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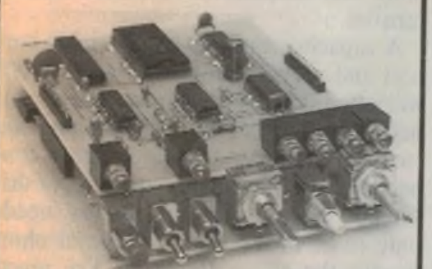
Electronics Australia

Volume 51, No.12

December 1989

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE – ESTABLISHED IN 1922

Digital storage adaptor for scopes



One of our FIVE construction projects this month is this low cost, easy to build unit which adapts almost any normal analog scope into a digital storage instrument. Everything fits on two small PCB's, which plug together. *See page 86*

Over-speed monitor

Another of this month's projects is a gadget which helps you avoid speeding, by giving you a visual and audible warning when you exceed the limit. Put fun back into your driving, and maybe live a little longer! *See page 122*

On the cover

EA staff design engineer Rob Evans checks the final performance figures for his outstanding new very high quality stereo power amplifier, the Playmaster 'Pro Series' No.1, whose description begins this month on page 76. (Photo by Leon Faivre)

Features

Entertainment Electronics

Projects and Technical

News and Comment

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Letters to the editor

Switch ratings

It has been a concern to me lately about the ratings of switches – ratings such as 250V/5A-125V/10A. This is the power rating.

People who do not know exactly how to work out proper ratings may resort to using the logic of doubling the voltage; "as long as the current is halved, it'll be OK..." This is not so, however.

The switch will work without heating up in the closed mode, but will probably arc in the open mode due to the potential being across the open 'ends'. This could be even more lethal in the case of someone trying to use it, say, to switch 4000V at 1/8 of an amp! Again, it would operate normally when closed, but will arc like mad when open.

The issue I am trying to bring up is to warn people that switches are rated in power dissipation in heat terms – NOT open voltage rating terms.

Just remember that the highest voltage rating actually written on the side or back of the switch is the maximum open voltage rating. But even then, it is still best to keep well below that rating in normal operation.

Matthew Straford,
Canterbury, Victoria.

Amateur radio

It seems to me that amateur radio has fallen victim to technological progress – simple equipment such as that described in your April 1939 issue is no longer acceptable.

The construction of state-of-the-art equipment requires a high level of expertise plus a lot of time and patience.

SSB for example is a mixed blessing. It has made the design and construction of both transmitters and receivers more complex, and the requirements of frequency stability more demanding. How many potential amateurs have a receiver fitted with this facility, to allow them to listen in on the amateur bands and thus become interested in amateur radio?

Other hobbies have suffered a similar fate. I used to develop, print and enlarge my own black and white photographs, but with the advent of colour I decided it was not worthwhile.

I count myself as fortunate in that I entered electronics in the days of the crystal set and grew up with it. Those who do so today must start where I am leaving off!

J. Emery,
Bull Creek, WA

Electro faults

The Serviceman in his August 1989 column seemed puzzled as to why two electrolytic capacitors, similar in capacitance and size, showed different characteristics.

A capacitor carrying a high ripple current and probably running warm (C430) will often develop a high resistance connection between the pigtails and the case, or the inner structure. These connections are often only a press fit of dissimilar metals. This resistance needs only to be in the order of several ohms to give the effect described. The reactance would normally be around .1 ohms.

The multimeter test, while showing the capacitor charging up, would not easily show a small but important unwanted series resistance.

W. Nichols,
Penguin, Tasmania.

Radar detectors

Might I complement you on an excellent magazine and its thorough coverage of many subjects.

There is one subject however, that you do not seem to have mentioned, and that is radar detectors. I am sure many representatives in the electronic and instrumental fields would be keen to see a radar detector project.

A sensitivity of 120dBm/cm^2 with image rejection of microwage 'noise' would be ideal.

Is there any chance you could cover this subject. I am sure your magazine's circulation would pleasantly respond.

John Moffitt,
Auburn, NSW

Comment: Perhaps you're right, John, but in principle I'm against the use of these devices – which seem basically designed to allow motorists to exceed the speed limit whenever possible, without getting caught. Since excessive speed causes so many deaths and horrendous injuries, I wouldn't want a project of ours to contribute to this problem.

Source of valves

In the May issue of your magazine, on page 125, there was a letter from a reader asking where he could get 807 beam power valves.

I have a quantity of these (and other valves) that I would like to dispose of. Could you please let me have the reader's name and address, or alternatively you could give him my address, so that we might come to some arrangement? You might also consider publishing this letter in your magazine, in case other readers are interested.

I would also like to say that I have been reading your magazine since 1950, and still find it one of the best. I particularly enjoy Neville Williams' 'When I think back', and the articles on 'Vintage Radio'. I also enjoyed the reprint of your first issue. Are you planning to reprint any more old issues?

Wal Watters, 14 Blackwood Ave.,
Beresfield NSW 2322.

Comment: Thanks for your advice, Wal. We'll see what we can do, regarding further reprints.

Fisk Radiolas

Having just read (and enjoyed) the second of Neville Williams' articles on Ernest Fisk, I was eagerly awaiting one vital piece of information which I was hoping would 'put me out of my misery.'

Not so however. It was glossed over very quickly so I'm still none the wiser.

It concerns the addition of Fisk's name to AWA Radiolas. Being a valve radio enthusiast for many years I have come across the odd 'Fisk Radiola', in numerous shapes and sizes from battery sets and bakelite mantels to large console radiograms, all carrying the Fisk badge. The question is, now and when did Fisk's own name actually become emblazoned on AWA radios in the form of the familiar blue enamelled badge?

I have asked many people and received many strange answers ranging from recognition after his knighthood to "dunno."

I would really like to know what the true story is behind it, (if there is a story at all) and over what period of time did Fisk's name appear on AWA Radios.

Any enlightenment would certainly satisfy my curiosity.

Brian J. Smart, Belgrave, Victoria.

Comment: We don't know either, Brian, but hopefully either Neville or one of our readers will be able to enlighten us all.

Editorial Viewpoint

Even more value than we were before...

I guess I'm biased, but this month's issue seems to me an especially good one, whichever way you care to judge it. Even in terms of old-fashioned value for money it's surely pretty good – with 148 pages of basic magazine, plus a free 16-page catalog from Geoff Wood Electronics in the centre, PLUS a bonus 36-page booklet on the front with (at last) an index of all main articles we've published over the last 10 years.

I'm sure you'll find that 10-year index of great value, in tracking down those useful articles you just *know* we published, but can't quite remember *when*. There have been many, many requests for us to produce one, and our production co-ordinator Milli Godden has spent hours and hours slaving away at the keyboard this month to bring it to you. She's done a great job, too.

In the magazine itself, you'll find the first appearance of yet another new department: *Computer News and New Products*. Computers, their components and peripherals are now such an established part of the electronics scene that they deserve more extensive coverage than we've been able to give them previously, and this new department will allow us to do so. I'm sure many of you will find it of interest, judging by the very high proportion of *EA* readers with their own personal computer.

You'll also find no less than *five* construction projects, including one about which we're especially proud: Rob Evans' outstanding new MOSFET stereo power amplifier design, which offers over 140 watts RMS per channel into 8 ohm loads with extremely low distortion figures – combined with a mechanical design which makes it really easy to build and get going. We've dubbed it the Playmaster 'Pro Series' No.1 amplifier, because in many ways it seems like a re-birth of John Moyle's original Playmaster concept: reliable, trouble-free designs which allow the home constructor to achieve the highest possible performance at a reasonable price.

And stay tuned folks, because there are further exciting Playmaster Pro Series designs already under development!

Among the other project designs inside you'll find a very elegant little Digital Storage Adaptor for scopes, which offers many features at a price much lower than previous designs. It's much easier to build, too. There's also an over-speed monitor for your car, to help you avoid speeding; the construction details for the fax card for PC's, introduced last month; and the concluding article on Peter Jensen's 'Maggie' replica. A project for almost everyone, surely!

All in all, I hope you find the issue as interesting to read as we found it to produce. And from all of us here at *EA*, our best wishes for a merry Christmas and a prosperous New Year, to all of our readers and advertisers.

Jim Rowe

What's New In Entertainment Electronics

Marantz improves CD-94 player

Marantz CD-94II has now been launched in Australia, replacing the CD-94 – already regarded as one of the finest audiophile quality compact disc players yet produced. It is a natural partner for Marantz's award-winning PM-94 amplifier, or the trend-setting new PM-95 digital amplifier.

In the CD-94II, Marantz has incorporated two digital-to-analog converters arranged in a unique push-pull arrangement to eliminate any last source of distortion.

One converter in the pair receives its information in inverted phase. Differential amplifiers used after signal construction use this feature to cancel out low frequency noise, hum and other forms of distortion, leaving the pure musical signal to pass unhindered.

The CD-94II also features a special servo system which can detect weight differences between a normal 12cm compact disc and the new 8cm (3") CD singles. The information is fed to the motor drive controls to ensure perfectly accurate rotation, despite the different inertia characteristics of the two disc types.

An ultra-compact signle-beam laser ensure accurate disc tracing and minimises acoustic feedback problems.

The CD-94II sells for a recommended $1699.

For information contact Marantz Australia, Australia Centre, Figtree Drive, Homebush 2140 or phone (02) 742 8480.

Ultra light and compact camcorder

An ultra lightweight (0.9kg) 8mm camcorder which is described as far more compact than any prevous model has been launched in Australia by Sanyo.

The major reason for the reduction in size with the VEM-S1P) is the utilisation of a newly developed ultra compact mechanism, which features a 4-head cylinder measuring only 27mm in diameter, an achievement made possible by increasing the drum tape loading angle from 180º to 270º.

In comparison, the conventional 2 head 8mm cylinder measures 40mm across and the 4-head VHS cylinder has a diameter of 4mm.

Picture quality has been improved through the use of a high pixel count image sensor which incorporate 470,000 separate picture elements. This extra high pixel count is said to significantly reduce picture noise and enhance colour differentiation for high image resolution and natural colours, even when shooting in low light conditions.

With a 1/1000 of a second high speed electronic sheet, the VEm-S1P allows you to capture fast sports shots and other split second action and the fade in, fade out capability provides a professional image for your video recording.

Recommended retail price is $2699.

For further information contact Sanyo Australia, 7 Figtree Drive, Homebush 2140 or phone (02) 763 3822.

VCR records three times as long

Engineers working at the Nokia laboratories in West Germany have found a low-cost way to record acceptable video on a VHS cassette running at only 0.78cm/s, one third of the normal speed.

The technique involves electronic reversal of the phase of the recorded signal for each track, to cancel out crosstalk between the narrower and more closely spaced tracks.

Because the recordings are not compatible with existing VHS recorders, VHS inventor JVC is not happy with the technique and may prevent it from being exploited.

JVC is also reported to be unhappy with the recent development by Germany's BASF of an 'E300' VHS tape with a polyester base only 9um thick, and capable of recording for up to 5 hours at normal speed. However BASF has apparently released the new tape in Europe, claiming that it is at least as reliable as current 12um 'E240' tape.

Philips releases details of DAT copy protection

Philips has released further details regarding the Serial Copy Management System (SCMS) recently agreed upon by leading international recording and consumer electronics companies, to limit the copying of pre-recorded music on digital audio tape (DAT) machines.

It appears that SCMS will allow original recordings from CD, LP or cassettes to be copied onto blank DAT tapes without restriction; however the DAT recordings thus made from a CD cannot be copied again by direct digital means. This restriction only applies to source material which is protected by copyright, however. There is also no restriction on copies made via a DAT player's analog inputs, from any source.

Operation of the SCMS is fully automatic, with the DAT machine sensing and making use of copyright status and source ID codes already allowed for in the digital encoding process. The only hardware changes required to DAT machines are logic changes within the encoding/decoding and control circuitry, claimed to result in negligible cost increase.

As a result of the agreement regarding SCMS, DAT recorders will now be able to provide for direct digital dubbing from CDs, at 44.1kHz.

Companies who participated in the memorandum of understanding concerning SCMS include Philips, Grundig, Sony, NEC, Hitachi, Matsushita, Toshiba, JVC, Pioneer and Sanyo – along with the International Federation of the Phonographic Industry (IFPI) and the Recording Industry Association of America (RIAA).

CD player has 5-disc turntable

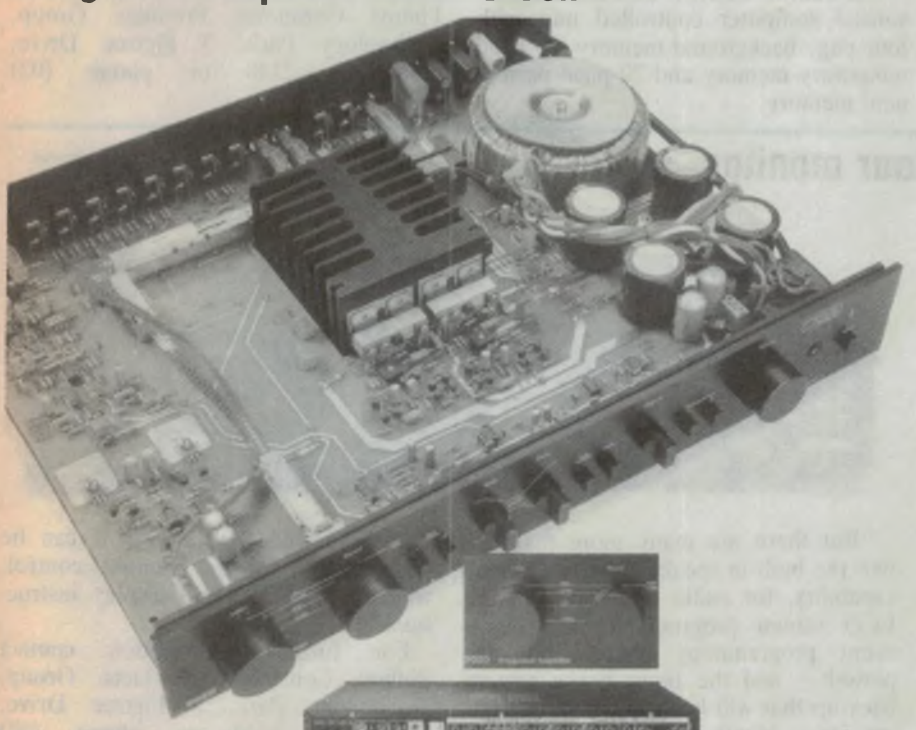
Sony Australia has announced the release of the CPD-C500 (430mm full size) and CDP-C500M (355mm midi size) compact disc players, featuring a rotary turntable holding 5 discs, enabling hours of continuous programmable CD entertainment.

Features of the CD-Roulette include four times over-sampling digital filter, dual D/A converters and wireless remote commander with five-key direct disc selection. There is also all disc shuffle play; RMS (Random Music Selection); four-way repeat and five-mode timekeeper functions.

The CDP-C500 and CDP-C500M are designed to suite 'programme and forgot' people who require uninterrupted music for parties, dinner functions, etc. Both players are available now from the Sony dealer network with a suggested retail price of $499.

Further information is available from Sony (Australia(, 33-39 Talavera Road, North Ryde 2113 or phone (02)

Integrated amplifier from Creek



Concept Audio, the importers of Creek Audio Systems, have announced the release of the long awaited 5050 integrated amplifier.

The 5050 is the result of over two years research, into the type and style of circuitry best suited for the reproduction of high quality music from today's many different sources.

Some of the features include:

- Over 50W per channel (200W mono)
- Switchable high performance moving coil input
- Optimised CP input
- Inputs for mono or stereo video machines
- Capability for splitting pre-amp and power amp stages with rear mounted switch

The introduction of the more sophisticated 5050 amplifier marks the way for Creek Audio to venture into the more esoteric area of hifi, yet still retain the company's philosophy of simple design and value for money.

Further details can be obtained from Concept Audio, 32 Roger Street, Brookvale 2100 or phone (02) 938 3700.

Multi-standard 117cm CTV

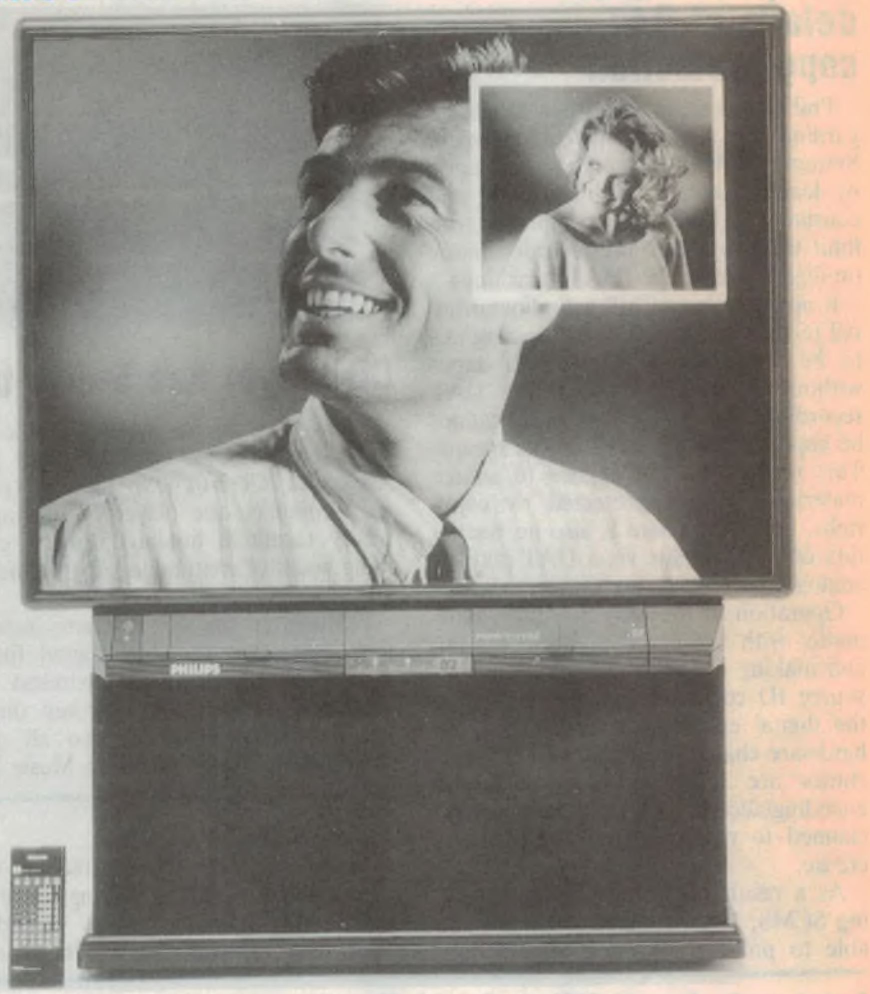
Claimed to lead a new generation of superscreen rear projection colour television is Philips 46CE8766 with a 117cm flat square picture. Naturally it has infra-red remote control, hi-fi stereo and digital enhancement, but it also has a wider angle of viewing.

This rear projection TV has a viewing angle of 120° – an increase on the previous standard, so that more people in a room have a full screen view. They can even view from less than three metres, for the 'big-screen' realism formerly associated only with the cinema.

The receiver has the capability to accept satellite and cable signals. Its multi-standard engineering system can accept signals in any of the three world standards – PAL, NTSC and SECAM – through either the tuner or the VCR input. It has Picture in Picture (PIP), including freeze shift, swap and change source. Because the PIP itself is about the same size as a 34cm (14") picture, it is easy to view.

Among its audio features this TV has hi-fi stereo of 80 watts PMPO (10W RMS per channel), a three speaker system for improved sound quality, and switchable sound depth enhancement of spatial stereo when needed.

The digital enhancement ensures that changes of program sources are instantaneous and without a flicker. Another technical refinement – a contour booster – allows the picture's contrast to be improved according to taste.



The built-in Teletext decoder is an advanced computer controlled unit with four page background memory, 20 page temporary memory and 20 page permanent memory.

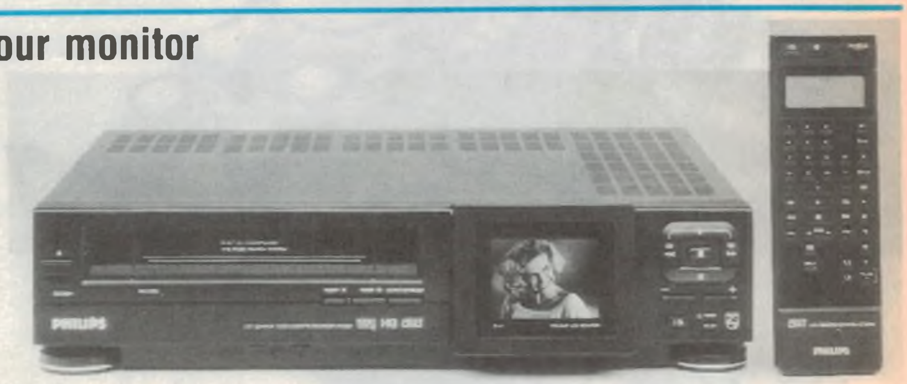
For further information, contact Philips Consumer Products Group, Technology Park, 3 Figtree Drive, Homebush 2140 or phone (02) 742 8374.

New VCR has in-built colour monitor

A video cassette recorder with its own built-in small (7.5cm) colour TV monitor has been developed by Philips design engineers in Europe. The novel built-in colour screen can show the pictures being recorded or played back by the VCR, or the picture from any TV channel – quite independently of any TV set.

This multi-feature VCR from Germany utilises the new "Active Matrix" LCD technology developed by Philips research laboratories. It is expected to appear in Australian shops early next year.

The VCR's screen makes programming easier to check. "Programming instructions as well as video pictures appear on the LCD screen", said Mark Leathan, video product manager for Philips Consumer Group.



"But there are many more features, like the built-in speaker and headphone capability, for audio monitoring of the LCD screen program. There's eight-event programming over a 31 day period – and the timer has a battery back-up that will keep the clock operating for a month of interrupted mains power."

Leathan said the new VCR can be programmed by the remote control, which has an LCD to display instructions.

For further information contact Philips Consumer Products Group, Technology Park, 3 Figtree Drive, Homebush 2140 or phone (02) 742 8374.

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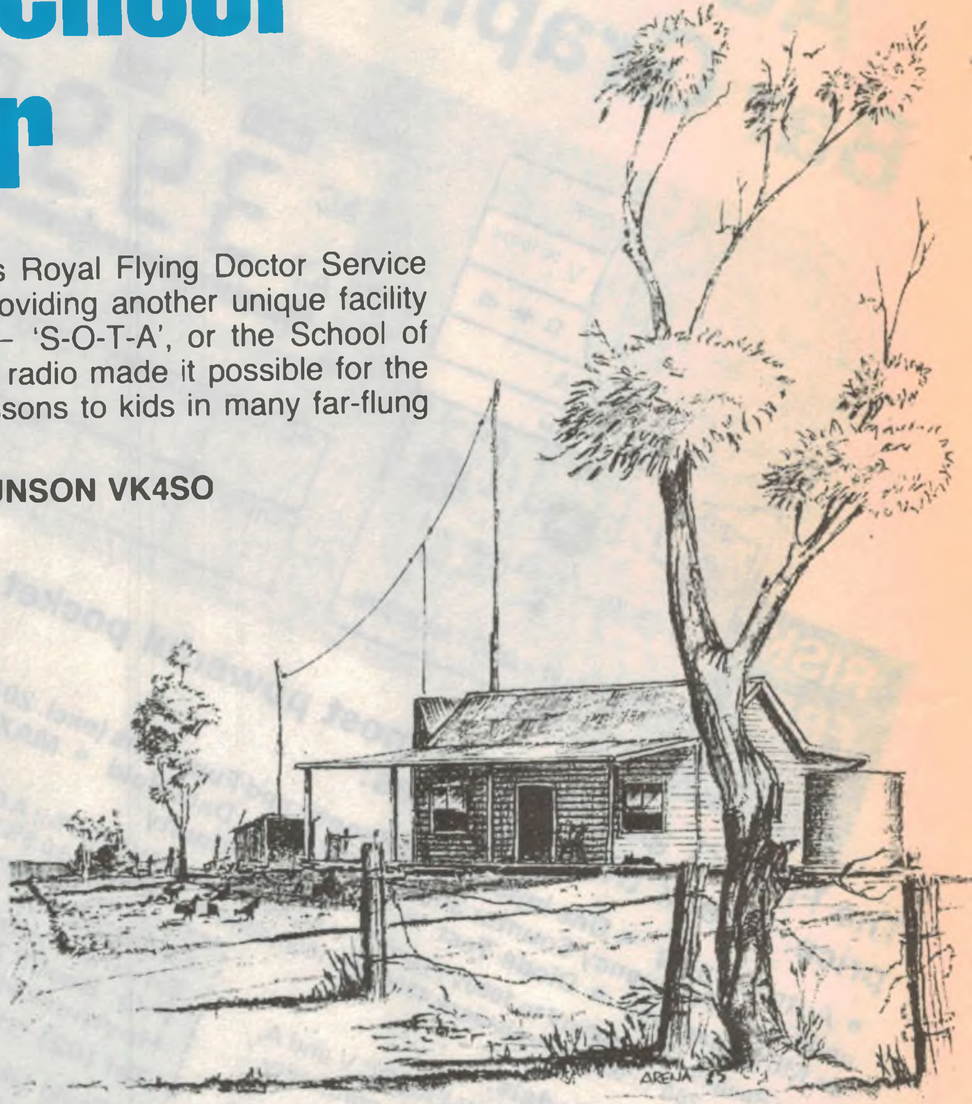
Australia's unique School of the Air

For almost 40 years, Australia's Royal Flying Doctor Service radio network has also been providing another unique facility for the people of the outback – 'S-O-T-A', or the School of the Air. Here's the story of how radio made it possible for the teacher to give personalised lessons to kids in many far-flung bush stations.

by MERVYN EUNSON VK4SO



You've maybe heard of this phenomenon, but don't comprehend. Yet, integral with our Royal Flying Doctor Service is another unique Australian institution, without parallel elsewhere in the world, doing a big job for a big country.

In the outback, without convenient schools, primary education once was chancy and limited to correspondence texts by infrequent mail service or maybe scanty lessons from itinerant schoolmasters on horseback. This was all part of the tyranny of isolation, which 'Flynn of the Inland' set out to alleviate. Flynn foresaw the concept of schooling by radio, and his technical cohort Alfred Traeger stated in 1934 that with later superior valves a radio-telephony set was possible for the purpose.

But time passed before the situation was altered by the efforts of Miss Adelaide Meithke, an officer and later President of the Flying Doctor Service. Aided by Graham Pitts, the Base Radio Officer, her experiments with education by two-way radio through Alice Springs Base and the homestead network led to our first official School-of-the Air in 1951.

Initially Miss Meithke prepared and conducted the lessons herself, before education authorities embraced the scheme. Radio-equipped bases formed with Flying Doctor bases providing technical means and Education Departments supplying teachers (it could happen only in Australia!).

Thus 'on-air' classes augmented correspondence lessons as extension of assistance to outlying areas. Here today will be found our youngest operators, proficient in two-way radio techniques at kindergarten age, though one difference not to be emulated is sparsely given call-signs without a prefix (such as 8MS or 9PT). Listening on the frequencies otherwise will afford a lesson in precise procedures, far more efficient and disciplined than on amateur bands.

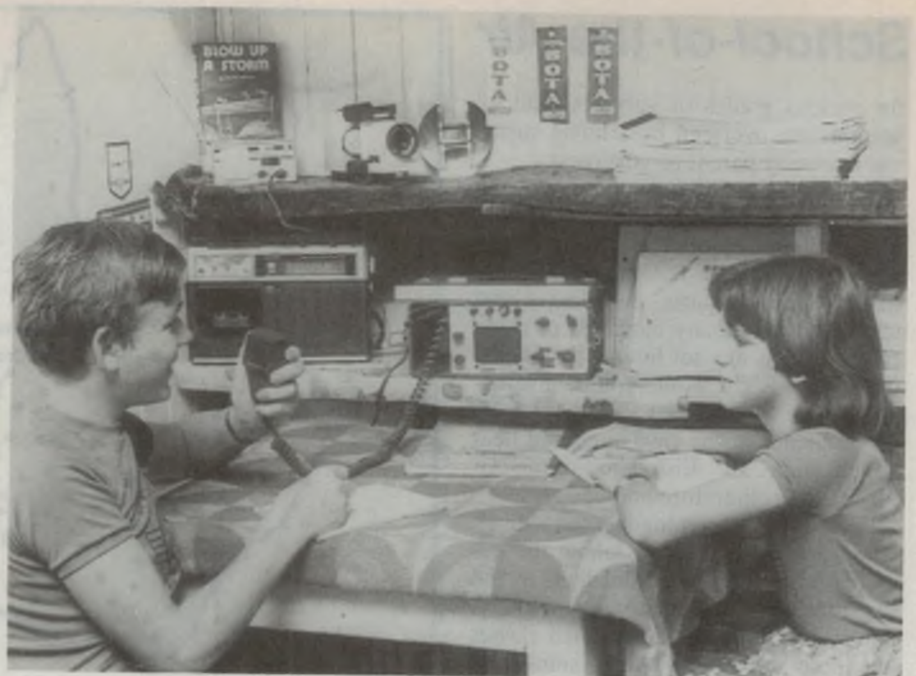
Every School-of-the-Air has its own story, with installations at Alice Springs, Broken Hill, Cairns, Carnarvon, Charleville, Derby, Kalgoorlie, Meekatharra, Mount Isa, Port Augusta and Port Hedland. Space limits us here to looking at one representative example from Queensland.

Cloncurry, birthplace of the Flying Doctor, commenced S-O-T-A operations at the start of the 1960 school year from the RFDS base VJI in Gregory Street. At the microphone was a capable teacher in Bid O'Sullivan, brought back from retirement with exceptional skills, and who was to remain until aged 70 years.

Skip and propagation were to be – still are – the main problem (amateurs have no monopoly on MUF and sunspot cycles). Shy bush kids mastered modern technology, though a slip could occur. Like the tot who softly confided to teacher "Mummy's having a baby and doesn't want anyone to know" – the big secret was broadcast to the listening outback!

The RFDS monitored the frequency for priority emergency calls, and could assume control before returning it to the teacher – classes thus learnt more about medical science than natural science! And this was to the advantage of one lad, who received immediate treatment advice when his puppy was bitten by a young crocodile.

Fourteen children at isolated properties from the Gulf to Birdsville and the Territory border answered the first roll-call from Cloncurry. This eventually was to reach nearly one thousand, with operation from other bases at Charters Towers and Charleville. Today sites are altered, for Charters Towers base VJN shifted to Cairns, and a change in aviation service facilities saw Cloncurry



A typical SOTA classroom at an outback station.

Base VJI transfer to the vast scattered municipality of Mount Isa – the biggest city in the world.

For S-O-T-A a special Traeger Transceiver, the basic Model 59SA, was produced. This was designed without frills, to overcome the complexity of large general-coverage homestead units. Simple controls were fitted for little fingers, merely a channel selector and AF gain adjustment. Sets were hired from the Department of Education for £12 per year with PMG licence fees the same as for amateurs, £1 a year.

This classic AM unit with 12V solid-state toroid inverter and crystal channels had 10-watts of output. Valve types were a 6M5 in the oscillator and modulator with 6CW5 power amplifier. The sensitive receiver employed 6N8's in AF and IF stages, 6AN7 mixer, 6AL5 detector and 6M5 audio output. These served faithfully for more than a decade, and on release through disposals many were modified for 80 metres by our first Novices (for whom crystal control was initially stipulated).

Children of the outback, those of stockmen, fencers, well-borers, railway workers, miners, graziers and others take classes through primary school years 1 to 7 in preparation for secondary boarding school. Pupils receive individual attention with up to nine teachers

The later model SSB-50 transceiver, made by Traeger Transceivers in Adelaide, SA.

The satellite dish at Mount Isa base VJI, set up for trial SHF operation with selected homesteads.

School-of-the-Air

for various grades or subjects, and all sessions are overseen by a home supervisor, usually parent or governess.

Ah, you have the picture now – a stop-gap sort of substitute with disembodied discourses via the air-waves? Far from it! Every S-O-T-A boasts far more than city counterparts, including a vast schoolyard and many hundreds of classrooms. Pupils are not limited to just the basic three R's – would you believe on-air lessons for recorder and guitar? Be on frequency at the right time and hear adjudication of Eisteddfod-of-the-Air for recorder, literature and verse!

Lessons have been highlighted with an important visitor at base taking the microphone – the Queen did that, as did the President of Ireland, Dr. Hillery. And Rolf Harris has entertained classes on three occasions. Also, sums and texts are supplemented by a Video Home Loan scheme through Ashgrove Studios, a branch of the Department of Education. A Library Loan scheme also flourishes.

Even Sports Days eventuate, with children congregating at Mount Isa from outlying areas. Somewhat in reverse are the 'Activity Days' when teachers visit in turn centres at Julia Creek, Sedan Dip, McKinlay, Camooweal, Cloncurry, Gregory Downs and Winton for craft classes with pupils and parents – an extension of early 'Flying Visits' started by teacher-cum-pilot Ann Woodward in an aero-club Cessna Skyhawk to meet her unseen charges.

Coverage of the Mount Isa SOTA network – from Bedourie to Mornington Island.

School Summer Camps are held at coastal locations during the holidays. An exchange also takes place annually with a number of students from Brisbane's Macgregor State School – the youngsters from the city, in distinctive tartan uniforms, spend a week on outback properties and the bush children are introduced to the capital's bustle.

Our inland kids neglected? – perhaps they more qualify as an elite group! Oh yes, 'Gumbuya' (meeting place) is the school magazine: there's a uniform and school motto 'Per Ardua ad Caelestia' (through difficulty to the heights). Strong support services come with a vigorous Isolated Childrens' Parents' Association in addition to P. and C. committees. Nothing is overlooked – Cubs-of-the-Air meet on S-O-T-A frequencies each Wednesday, as do Brownies-of-the-Air on Tuesdays.

There yet remains the itinerant teachers of yesteryear in today's Outback Mobile Teaching Service, though now travelling in pairs by 4WD from Longreach, Mount Isa, and Richmond. And to relieve the load on RFDS facilities, the Department has established it's own similar 'Schools of Distance Education' at Longreach and Charters Towers, reducing S-O-T-A enrolments by 300 pupils.

Technology is much improved since 1960. The classic 59SA set became outmoded with the adoption of single sideband transmissions in the seventies.

A shot of flying teacher Ann Woodward with the children of Punjaub Station – a welcome visitor.

Then the Traeger Model SSB50 became standard, capable of both DSB and SSB. This superb miniature rig had in-built antenna base loading, a stout QZ06/20 valve final, with all the one type BF195 transistors in oscillator and receiver. When Alf Traeger retired, after fifty years of service to the Flying Doctor, newer single-sideband units were supplied by EILCO. Today, other locally-made sets by Codan or Tracker are favoured.

Frequencies? Mount Isa S-O-T-A has exclusive channels on 5445 and 7803kHz, and shares 6965kHz with RFDS operations in times of difficult skip. Charleville uses 4045kHz, 5227, 6945 and shares 6845. Cairns has 5330kHz and 5865, with 7465 shared. Times of operation are weekdays 0800 hours to 1530 EAST.

But now the space age is upon us – 1985 saw the launch of Australia's first domestic satellites in geostationary orbit and the birth of AUSSAT. High and low power transponders on board are the means for relay of television programs and remote telephone services to the outback, which also allow clear two-way communication with isolated communities.

One priority experiment with the new

A Traeger model 59SA transceiver in expert hands, around 1960.

technology was a S-O-T-A satellite trial through earth stations installed at Mount Isa base and selected network homesteads. Established side-by-side with standard HF services was complementary SHF operation in the gigahertz range, to enable direct 'OUTER SITE' video broadcasts from the Department's studios in Brisbane. Results are being evaluated for widespread improvement in S-O-T-A services.

Strangely, only one author has lauded this epic of bush learning in book form – the detailed and lavishly illustrated 'Over to You' by bush writer Helen McKerrow, who escaped from Sydney to the peace of Oorindi with it's population of seven people, three dogs, and one cat (copies at $10-00 post-paid are available only from the Outback's magnificent monument of John Flynn Place at Box 67 Cloncurry 4824).

All this illustrates that our own amateur radio service, vitally concerned with technical education and having appropriate means at it's fingertips, has much to learn from the outback.

ACKNOWLEDGEMENT: The illustrations used in this article are reproduced from 'OVER TO YOU' by kind permission of the Royal Flying Doctor Service of Australia (Queensland Section) and Mount Isa base VJI, who also offered the author other invaluable assistance. EA

The US facing a semiconductor challenge

In the last year or so, there has been a philosophical revolution within the US semiconductor industry. Rather than continue with their tradition of private industry and fierce competition, many of the key players are pooling their resources and seeking Governmental support, to set up consortiums such as Sematech and US Memories. Here's the first of two articles discussing these very significant changes.

by JEANNE ALFORD and PAUL SWART

"The time is right for a collective memory manufacturing venture in the United States," were Sanford Kane's first words as president of US Memories.

With those few words, Kane was summing up a multi-facetted transformation that has been going on in the United States, particularly in Washington DC, which has created a climate in which a venture of this nature was able to be formed. Among other things:

Anti-dumping enforcement regulations have been put into place with the US-Japanese chip trade agreement. Japanese DRAM companies will not be able to 'dump' US Memories out of the market, the way they were able to get rid of all but one major US DRAM manufacturer in the 1970's and early 1980's.

Washington is getting increasingly nervous about the decline of the US position in technological leadership in many different areas. Both the Bush Administration and Democratic and Republican Congress members are eager to support efforts aimed at competing in major new emerging markets, such as HDTV.

The latter trend has led the US to loosen anti-trust regulations and allow companies to set up consortia to jointly develop new technologies and manufacturing techniques (MCC, SRC, Sematech, etc.)

Major transformation

During the past couple of years, both US industry and government has come to realise and appreciate that the electronics industry is on the verge of a transformation, spurred by the convergence of computer and telecommunication technologies.

Electronic products of all types will change dramatically during the next two decades. The key building blocks for this transformation will be VLSI memory chips such as DRAMs, custom VLSI microprocessors, flat-panel displays, and digital communications.

The new wave is being facilitated by the advent of advanced consumer products such as digital audio and High Definition Television (HDTV), but advances in electronics technologies being developed for the consumer segment will eventually ripple into every end-use electronics market as these markets become increasingly integrated.

The electronics industry is already the largest employer industry in the US. It generated nearly US$280 billion in sales and over 2.5 million jobs during 1988, in a worldwide market of over US$700 billion. The worldwide market for advanced electronics products will create millions of jobs and is expected to reach one million dollars in sales during the next couple of years.

Andrew Procassini, President of the US Semiconductor Industry Association.

According to Andy Procassini, president of the Semiconductor Industry Association in Cupertino, "For the US, catching the wave of new technologies will mean the difference between a boom in profits and job growth, and a decline to second-tier status among electronics-producing countries."

"Nations in Asia and Europe have been leveraging the consumer market to prepare for entry into the advanced electronics era. US-based systems manufacturers have largely abandoned the consumer electronics market to international competition, principally Japan, as a consequence of unfair trade practices such as dumping and closed international markets," Procassini added.

American semiconductor makers and other providers of key technologies, without a domestic customer base, have not been a major factor in the consumer market for well over a decade. US semiconductor sales to foreign-based consumer firms have often been restricted due to tariffs and non-tariff barriers that include cultural prejudices, industry collusion, and government guidance.

Falling worldwide market shares for American semiconductor firms has decreased their ability to pursue the research necessary to remain competitive. And, since semiconductors are one of the fundamental building blocks required for the development of advanced electronic products of all kinds, falling behind in semiconductor technology or production capability has serious consequences for the US economy.

Changes coming

The changes in semiconductor technology over the next 20 years can be broadly defined through three major trends which are already under way:

1. Digital technology will replace analog technology. Semiconductors are fast-

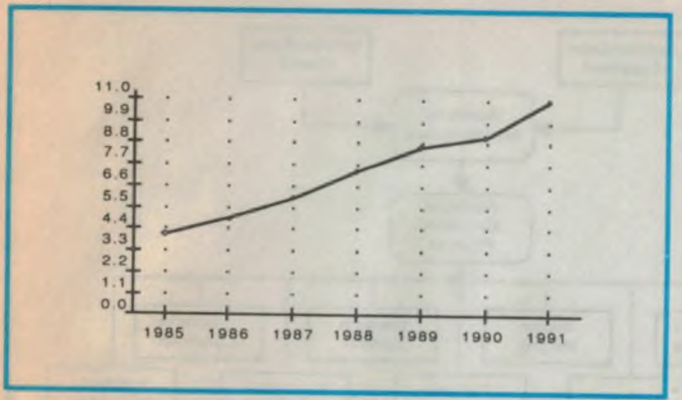


Fig.1: World ASIC market sales in billions of US dollars, as predicted by Dataquest.

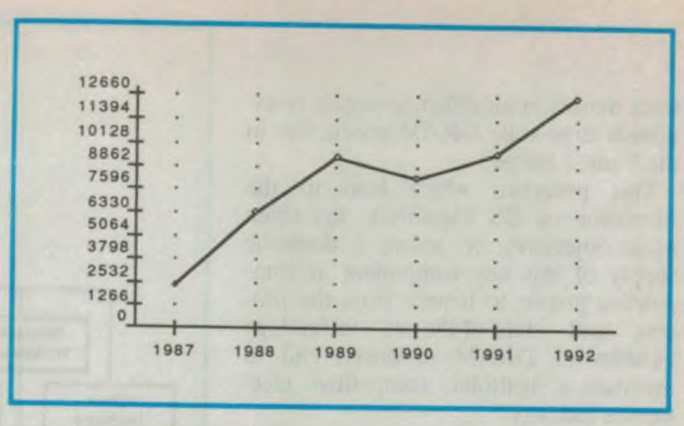


Fig.2: World DRAM market sales in millions of US dollars, as predicted by WSTS/SIA.

er, more accurate, and more uniform in most applications. This move from analog to digital circuitry has become obvious with the rising popularity of digital audio systems for consumers, and is now spreading into digital photography and animation, display systems, and telecommunications systems.

The 1988 Academy Award for an animated short subject went to a feature created entirely on a computer, for example. Regional telephone companies have begun trials of Integrated Services Digital Networks (ISDN) – the basic roadways that will enable faster, simpler and less costly communications of all types, including voice conversations, television broadcasts, facsimile transmissions, and access to computer information databases.

The opportunities for semiconductor companies with digital expertise will be high-intensity penetration of new applications such as HDTV, displacing conventional colour sets, fibre-optics terrestrial telecommunications, replacing twisted copper wire; desktop mainframes displacing conventional computer mainframes; and flat screen displays displacing cathode ray tubes.

2. Custom/ASIC components will replace multiple standard parts. In many electronics markets, designs based on single ASIC components are delivering lower manufacturing costs and higher performance than designs based on multiple standard components. ASICs' share of the semiconductor market has risen steadily over the past few years, and will continue to do so as semiconductor design and manufacturing skills improve (Fig.1).

3. DRAM usage will increase rapidly. To date, DRAMs have been used mostly in computers. The typical amount of RAM in a personal computer has risen from 16-kilobytes to 1-megabyte within ten years, and the newest personal computers and workstations require 4, 8 or 16-megabytes of RAM for optimum performance. By the mid-to-late 90s, high-end PCs will probably consume as much as 36-megabytes, and workstations up to 200-megabytes.

As manufacturers of television sets, appliances, automobiles, diagnostic equipment, and other products build more intelligence into them, increasing amounts of RAM will be needed to sustain that intelligence (Fig.2). While today's colour televisions use no RAM at all, for example, Dataquest estimates that advanced High Definition television (HDTV) receivers produced within the next 10 years will use as much as 32-megabits of video and other RAM.

Other major emerging markets for DRAMs include personal copiers, which will require up to 4-megabytes, fax machines with up to 2-megabytes, and printers with a 2-3 megabyte requirement.

DRAMs crucial

The stakes in the struggle for DRAM dominance are high. Already DRAMs are the largest single product in the semiconductor industry, accounting for nearly US$6 billion in sales in 1988 and 14% of worldwide consumption of semiconductors. By the end of the century DRAM sales of more than US$30 billion is not inconceivable.

DRAMs also provide crucial knowledge for the development of other, more complex semiconductors and for operationally stressing newly developed manufacturing systems. Thus, DRAMs continue to function as the 'technology driver' for the semiconductor industry.

"It logically follows that the industry that controls DRAM design and market share can exert significant influence over the development of advanced electronics systems," says Procassini.

Currently, Japan controls 80% of the overall DRAM market, and 90% of the 1-megabit DRAM market. Given a chance, few doubt that Japan would not hesitate to leverage its dominance of the DRAM business into the advanced systems areas.

It is with that frightening prospect in mind that the US Semiconductor Industry Association announced last year that it was trying to team major semiconductor companies with the computer sys-

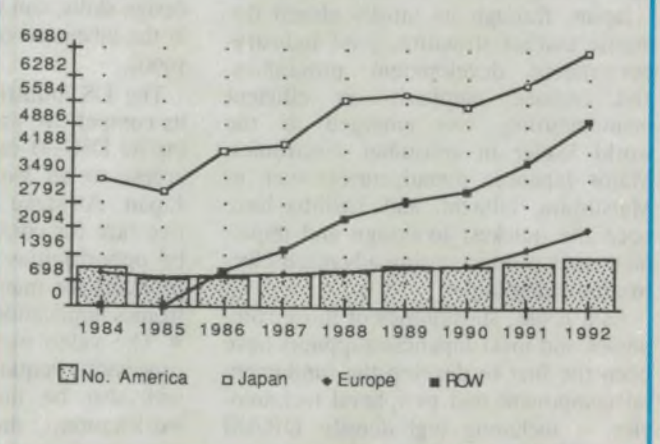


Fig.3: Consumer segment semiconductor sales by region, in millions of US dollars, as predicted by Dataquest.

tems houses in an effort to jointly re-establish large-scale DRAM production in the United States.

This program, which lead to the formation of US Memories, has three main objectives: to assure a domestic supply of this key component at competitive prices; to benefit from the process and state-of-the-art technology benefits of DRAM products; and to maintain a healthier, competitive electronics industry.

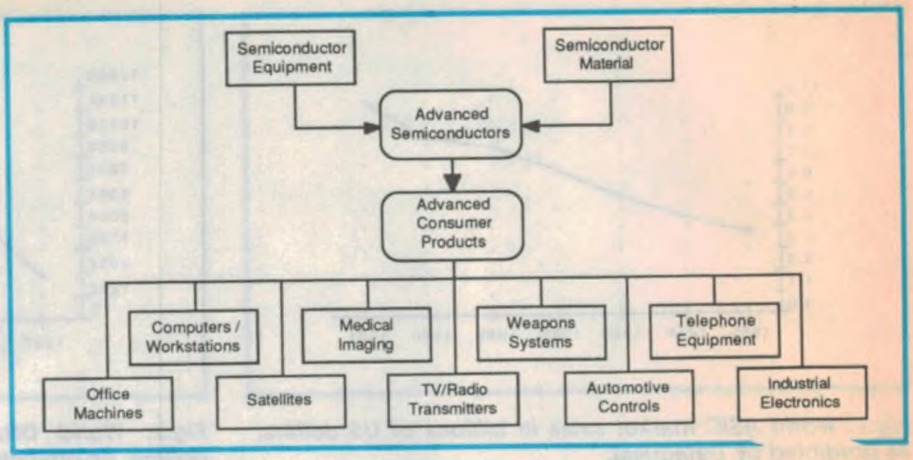


Fig.4: Spillover markets for advanced semiconductors. Total US electronics industry turnover in the 1990's is estimated at over $1 trillion.

Costs too high?

Enormous resources are required to develop technologies in line with the trends towards digital technology, ASICs, and increase DRAM usage. A key challenge that faces the American semiconductor industry is to develop a worldwide customer-base for advanced technology. By addressing this challenge, the US semiconductor industry will be able to constantly design and produce pace-setting, state-of-the-art devices, and thereby generate sufficient revenue to finance development of next-generation product and processes.

Because of the high R&d costs involved, fiscal prudence dictates that 4-megabit DRAMs and other semiconductor technologies be developed initially for markets that offer early potential returns on investment. Although the largest end-use market segment for semiconductors is computers, the earliest potential return on investment in semiconductor technology comes from the consumer market segment, because of the high commodity-level production numbers.

Unfortunately, US electronics manufacturers are last in the world in purchases of chips for the consumer segment of the semiconductor market, and have been for over five years (Fig.3).

Japan, through its mostly closed domestic market structure, joint industry-government development programes, and focused emphasis on efficient manufacturing, has emerged as the world leader in consumer electronics. Major Japanese manufacturers such as Matsushita, Hitachi, and Toshiba have been the quickest to design and implement new products using advanced electronics technologies.

As a result, subsidiaries of those companies and local Japanese suppliers have been the first to develop the fundamental component and peripheral technologies – including high-density DRAM chips, VLSI controllers and processors, and LCD (flat-panel) displays – that will be required in those finished product designs. It comes as no surprise that some Japanese firms have announced their intention to begin producing 4-megabit DRAMs by the end of 1989.

A fabrication plant capable of producing next generation 4-megabit DRAM chips will cost approximatley US$350 million. In order to justify funding advanced R&d, US semiconductor makers must secure a principal role as suppliers for forthcoming advanced electronics, including consumer product designs. This challenge includes restoration of a major consumer electronics market in the United States. Most are hoping the new generation of HDTVs will be that market.

HDTV the key

Japan may continue to lead the world in consumer electronics production for many years, despite increasing pressure from producers in South Korea and other newly-industrialising countries. However, the US semiconductor industry, with its basic technologies, its strength in digital technology, and its design skills, can be a competitive factor in the advanced consumer market of the 1990s.

The US industry's strategy to achieve its competitive position includes increasing its DRAM capacity and gaining fair access to all world markets, including Japan. At stake in the global competitive race for consumer preeminence will be opportunities to design in US-made products for many other advanced electronics applications, including:

- The video memory and video image processors required for HDTV, which will also be important to computer, workstation, medical imaging, and weapons systems displays.
- The digital signal processors and faster A/D converters required in CD audio systems and HDTV sets, which will influence telecommunications equipment from telephones to satellite, cable, and optical fibre transmitters.
- The basic VLSI semiconductor R&D required for the first wave of advanced consumer electronics, which will enable more powerful and reliable microprocessors, denser memory chips, and faster signal processors for a wide range of products in other end-use sectors.

Because of their ripple or spillover effects, technology advances will be used in other applications including information services, satellite/cable/fibre optic transmission systems, video telephones and teleconferencing, professional video and audio production equipment, home applicances, office equipment, laboratory equipment, and weapons systems (Fig.4).

US$1 Trillion Market

There are varying estimates of the total value represented by the range of products that will be developed or transformed by advanced electronics technologies over the next 20 years, but even the most conservative estimates project a total electronics market worth US$1 trillion in the 1990s, supporting millions of jobs.

"In order to continue to enjoy the economic benefits of strong participation in the electronics market, the United States must continue to participate in advanced technology research and development. And advanced technology begins with advanced semiconductors which serve state-of-the-art customers in the United States and the rest of the world," Procassini said.

To be continued

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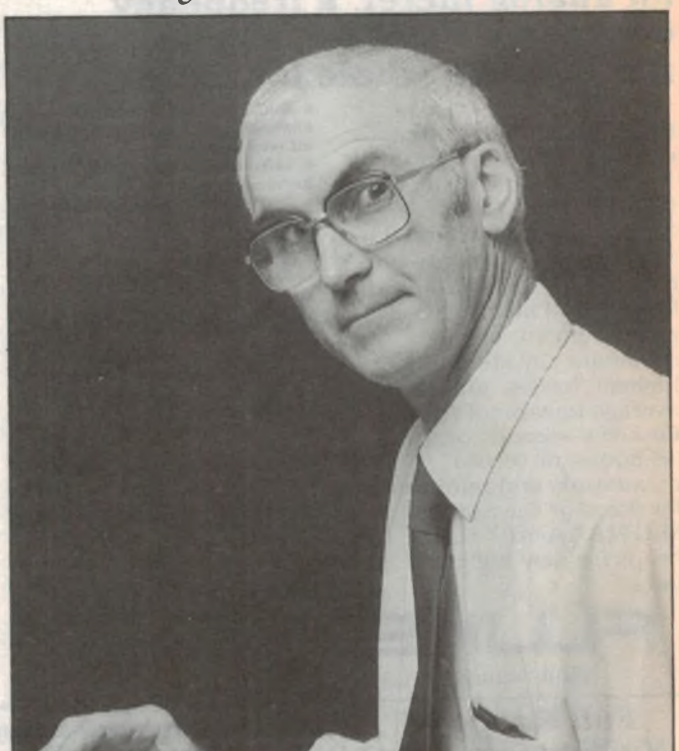

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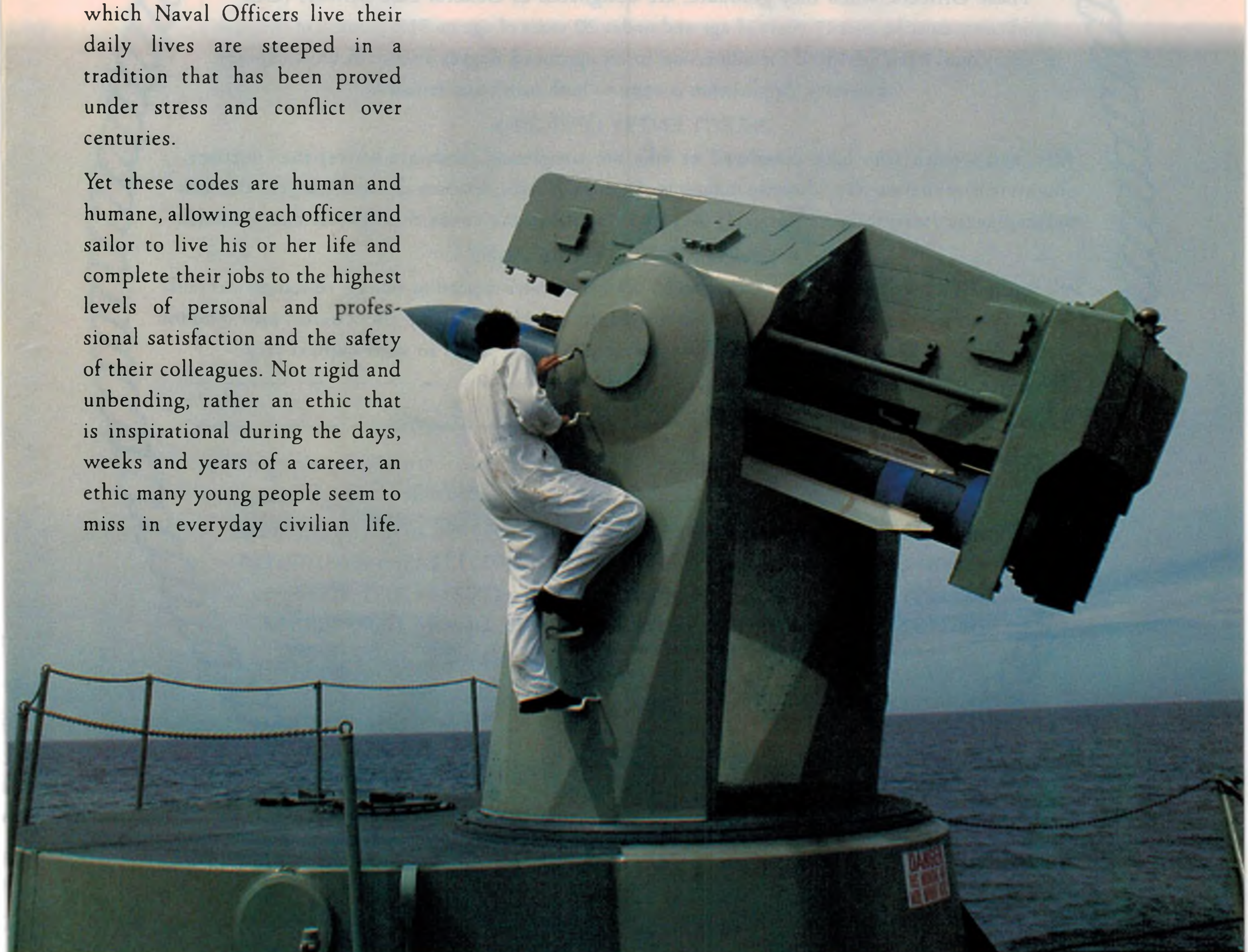

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NELO 37

Compact Disc Reviews

by RON COOPER

CLASSICAL

Mozart: Eine Kleine Nachmusik, Allegro from Oboe Concerto No.1, Allegro Assai and Andantino
Chopin: Nocturne Opus 37
Tchaikovsky: The Waltz of the Flowers
Beethoven: Largo from Piano Concerto
Deutsche Austrophone DC 74417 DDD
Playing time: 61mins

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

Eine Kleine Nachtmusik is one of Mozart's most popular compositions, as its simple and relaxed style is probably easy to relate to. Curiously as far as we know, it was rarely played during his lifetime.

The Chopin Nocturne whilst well played is one of his quite lesser known pieces, and I felt it a little out of place on this disc.

The Waltz of the Flowers from the Nutcracker Suite obviously is well known and the performance here is well played, with fairly normal tempos.

The Allegro from Mozart's Oboe Concerto is a good choice for this disc, but I feel it would have been more appealing to have the complete concerto and delete one or two of the shorter pieces.

Beethoven's first piano concerto was originally written for himself as a soloist and this movement shows a great deal of depth and feeling.

Two movements only from Mozart's Milan String Quartet also seems an unusual choice to have on a disc such as this which ends up having too many bits and pieces. As far as the players are concerned, they are all very capable and perform well, but the recording itself is rather middle heavy and bass light probably due to overbright acoustics. Nonetheless, it is a modern clean recording and no doubt worth the $10 price tag.

EDVARD GRIEG

Holberg Suite Opus 14
Piano Concerto in A Minor
Lyrische Stucke, Opus 43
Lyrische Stucke, Opus 57
Hall of the Mountain-King
VMK Globe
Playing time: 62mins

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

The Holberg Suite was written in 1884, celebrating the 200th Anniversary of the birth of the Norwegian-Danish writer Ludwig Holberg. Although originally intended for piano, it was revised in 1885 for string orchestra and this is the version recorded here. It is very appealing in character and well performed on this disc.

The A minor Concerto needs no introduction and the artist, Dubravka Tomsic is obviously very capable although I would have preferred an increase in tempo in the first movement. But it is nonetheless, an excellent recording.

The piano solo pieces here are also very well played, with enough reverberation to give a well rounded sound.

The final piece on the disc from Peer Gynt I feel is somewhat out of place. (They could have continued with more of his piano works (maybe they wanted a big finish)!

Overall, a good disc, though a little light on deep bass – but excellent value.

TCHAIKOVSKY

Violin Concerto Opus 35
Serenade, Opus 48
Eugene Schaeffer,
Orchestre du Festival Belgique,
VMK Globe 100.41823
Playing time: 60mins

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

Listening to this wonderful work some 110 years after it was written, it is difficult to understand the scathing criticism it received on its first performance. The well known critic of the time – Hanslick – wrote a most devastating critique of the composition, with descriptions like "Tchaikovsky's violin concerto confronts us for the first time with the ghastly idea that there might be pieces of music which can be heard to stink!"

Nowadays of course this work is standard repertoire among the great violin virtuosos.

This new all-digital recording is masterly performed by Eugene Schaeffer. The tempi appear to be 'just right' and the recording quality very good, in line with other recordings I have previously reviewed on this label.

The second work on this disc also has fairly wide appeal and although it indicates an analog recording, there is no real noise intrusion during the softer passages.

All up – an excellent value disc for $9.99. ▶

THE YOUNG BACH

Michael Murray
Gabriel Kney Organ,
College of St. Thomas,
St. Paul, Minnesota
Telarc: CD-80179 DDD
Playing time: 58:17

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

Here is a somewhat different recording of organ works of Bach in that it doesn't contain the D minor Toccata and Fugue. Rather, it contains some of the lesser known (or lesser performed) works of this great composer. They are as follows:

Prelude and Fugue in C major ('Fanfare')
Prelude and Fugue in G minor
Concerto No I in G major
Prelude and Fugue in D minor ('Fiddle')
Fantasia in G major
Prelude in C major
Fugue in G minor ('Little')
Canzona in D minor
In Dulci Jubilo

Bach was more involved in his late teens with singing and the violin rather than the organ, but this changed with his appointment to the new church in Arnstadt from 1703 to 1707. During this time, he devoted himself to fantasias, preludes, fugues and toccatas etc., no doubt spurred on by the church's new organ of two manuals and 23 stops. Also, he was influenced by Buxtehude, as shown by the fact that he made a somewhat famous journey of 400 miles round trip on foot to hear his mentor play.

This new 1989 Telarc recording is, as usual with this label, merely brilliant! The acoustics, balance and reverberation put you 'right there'. It should be played fairly loudly to create this atmosphere – a big organ in a big church.

Michael Murray does a splendid job, although I would have preferred a little more 'spirit' in the little G minor Fugue.

This disc I feel is more for devotees of this music rather than the casual listener. There are excellent programme notes and details of the instrument.

MOZART

Symphonies No 29, 35 "Haffner" & 40
Academy of St.Martin-in-the-Fields
Sir Neville Marriner
Philips 420 486-2 ADD
Playing time: 67mins 11sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

Here is a digitally re-mastered release of some of the finest symphonies Mozart ever wrote. The recordings themselves are quite early (almost ancient by modern standards), dating back to 1970 – yet the overall sound is better than many modern recordings.

I have vinyl copies of the 35 and 40, from which the original masters of this disc were taken and the playing and recording quality of those vinyl copies were quite stunning – with their clarity and detail of the myriad of parts that make up these delightful symphonies.

Also included are excellent program notes. Even if you already own copies of these works I feel this revision would be a very worthwhile addition to any collection and now at a reduced price, a real must.

Of course on CD virtually all traces of background noise have disappeared, revealing the true musical and acoustic environment of the original performance. The snappy soft grace notes in the Haffner finale are a good example of the exquisite playing of this fine ensemble.

Here's how you can try your hand at:

High-speed photography with a home video camera

Wondering what else you could do with that fancy new video camera or camcorder? Providing it's fitted with one of those new high speed electronic shutters, you can use it to look at what really happens when a light globe smashes, a balloon bursts, or a mandarine explodes!

by TOM MOFFAT

Television viewers a couple of years ago were horrified to see an American space shuttle explode during its launch. Were shown first a movie film, and later on some still frames of the spacecraft being engulfed in flames. Examination of the still pictures revealed the cause of the disaster.

One frame showed a small fire jetting from the O-ring seal on one of the engines. Further frames revealed the spread of the fire over a matter of milliseconds, followed by the explosion and disintegration of the spacecraft. They were grim pictures, but they provided the information necessary to change the design of the space shuttle's engines – hopefully to prevent any more explosions.

Whenever any new aircraft or missile or spacecraft is being tested, all conceivable electronic and optical means are used to collect as much data as possible, as quickly as possible. Sensors are embedded inside and outside the object being tested. Information they collect is either recorded onboard the device, or relayed to the ground via radio – a procedure known as 'telemetry'.

As well, every test is filmed from several different angles. The cameras usually have gigantic telescopic lenses, and race through film at a frightening rate. There's a good reason for this: if something goes wrong – if something goes boom – there will be plenty of records available to work out what happened.

This article will show you ways to record your own high-speed 'events' with a home video camera. With a little imagination in planning your experiments, you can gain some new insights into forces and effects that you'd never see any other way. But first let's look at some of the professional methods of optical data collection.

How the pros do it

There are two general methods of capturing experimental data on film. Which one is used depends on how fast the desired 'event' takes place. The slower type of event is something like the launch of a spacecraft, where photographic coverage is required for several minutes. The fast event may be an explosion, or a violent impact which lasts a few milliseconds at most.

A typical camera for recording 'slow' events looks much like an astronomical telescope. It may be around five metres long and half a metre or more in diameter. The camera is fixed onto an azimuth/elevation mount so that it can be raised, lowered, or spun around electronically.

A camera operator sits in a seat which is part of the mount, so when the camera spins or moves up and down, he goes with it. The operator looks through a smaller telescopic viewfinder, and steers the camera with fingertip control through a very sophisticated joystick arrangement.

There is usually a large dome surrounding the camera, with a slot that can be opened up when the telescope is being used. The dome rotates with the camera, driven by electronically controlled servo-motors. So the dome, the telescopic lens, the camera and its operator - many tonnes of equipment – can all be moved in synchronism with the touch of the operator's fingers.

A typical telescopic lens will have a focal length of 200 inches (they're specified in inches, not millimetres) and an f-stop rating of f/8. This type of lens isn't particularly sensitive to light, so it's necessary to use high-speed film to get reasonable performance.

The 35mm cine cameras used with these telescopes are frequently made by the Mitchell company, the same company that makes the Hollywood models. The cameras run at 96 frames a second, about four times the normal rate. So the films they shoot are 'slow motion'.

Recording of a 'fast' event is much more involved, since so much has to happen so quickly. The entire procedure is carefully planned in advance, and orchestrated by a multi-channel precision timer. The timer is really a fancy digital clock, with lots of 'alarms'.

The clock is of the countdown variety, meaning it starts at 'T-10' seconds or whatever, counts down through zero seconds, and then starts counting upwards from zero.

There may be 30 or 40 or more 'alarms', or channels. Each can be programmed so that it delivers an electronic pulse at a 'T-n' or 'T+n' count, specified to the nearest millisecond, or in some cases, the nearest microsecond.

A typical 'fast' test could be based on the firing of a large cannon, such as a 105mm Howitzer. Within the barrel of the cannon is a scale model missile, complete with tail fins and other protuberances.

Obviously pressures built up during firing of the gun would blow right past a missile with tail fins, so the object is enclosed in a balsa-wood shroud called a 'sabot'. This encases the missile and its tail fins into a cylindrical object shaped more like a cannon shell, so the gun's gasses have something to push against. As the unit emerges from the muzzle, the sabot disintegrates, leaving the missile to fly on its own.

Several metres from the cannon's muzzle may be a large block of concrete. The object of the test would to see what happens to the high-speed missile when it smashes into the concrete. If you imagine the missile to be full-sized, and the concrete to be an underground missile silo, you can see why researchers would be interested in such an experiment.

Off to one side, and about midway between the cannon and the concrete, will be a high-speed cine camera. There may be another one directly above the missile's flight path, looking down.

Back in my own test range days when I was involved in experiments like this, the only really high-speed camera around was the Wollensak 'Fastax'. From the outside this camera looked much like any other 16mm movie camera, except for the enormous motor attached to the film's takeup spool.

The Fastax was capable of frame rates of up to 18,000 per second, compared with a 'normal speed' rate of 24 or 25 frames per second. This speed would have been impossible with a normal camera mechanism, which pulls each frame into position, stops it for the exposure, and then moves to the next.

Everything in the Fastax was in continuous motion, with the film's sprocket holes turning a drum, which in turn spun a glass prism. The prism kept the image stationary in relation to the film, although both were moving very rapidly.

The film was pulled – no, jerked would be a better word – by the big takeup motor. When the camera was going flat out it could rip through a 400 foot roll of film in about four seconds, compared to ten minutes or so for a normal movie camera.

The Wollensak's frame rate could be controlled over a wide range by varying the voltage fed to the motor. This was done by a large variable-voltage transformer, mounted in a sturdy case along with an AC voltmeter. For some strange reason this control box was known all over the world as a 'goose'.

Since the film was pulled brute-force fashion by the motor, the frame rate increased as speed built up, eventually peaking about two-thirds of the way through the roll of film. Every goose was supplied with a calibration chart, showing the maximum frame rate for each voltage setting, and the time required from switch-on to reach the maximum. So for a frame rate of say 6000 per second, you would set the goose for something like 200 volts and program the timer to fire the camera perhaps 2-1/2 seconds before the cannon was fired.

Photo 1A: A common lamp globe, before being hit with a hammer...

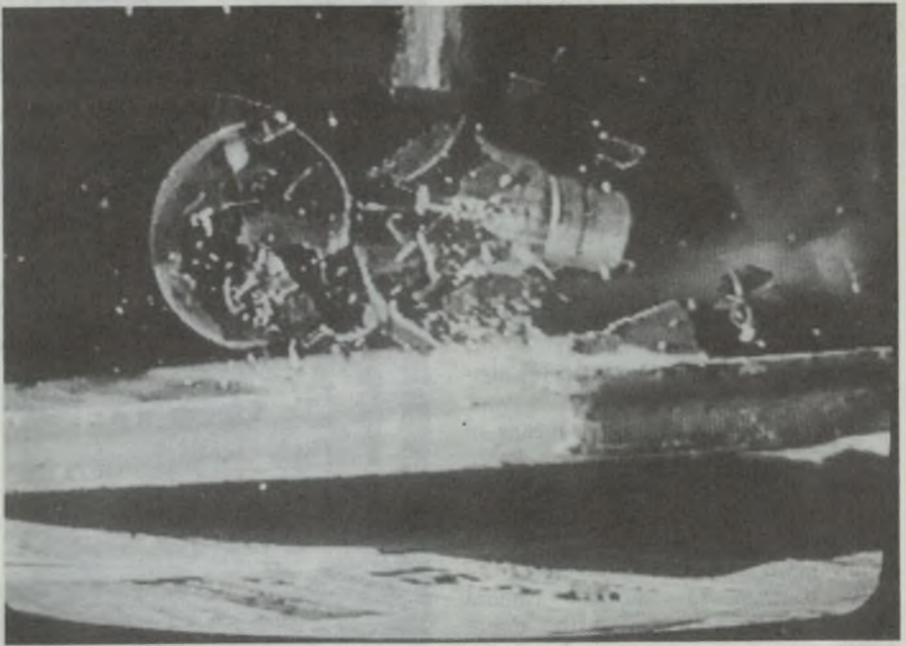


Photo 1B: ...And afterwards, in the process of collapsing.

All this activity put pretty stringent requirements on the electronic timing system. At T-20 seconds a data tape recorder would start. At T-2.5 seconds the timer would start the 6000 frame camera. There might be another camera set for say 15,000 frames a second; this would have to be fired a bit later, like T-1.2 seconds. The event itself would be fired at zero seconds, while there might be a still camera set to take a single photograph at T+200 milliseconds.

Some events were more complicated than a single cannon firing. Sometimes up to 20 underground charges would have to be let off in sequence, spaced a precise number of microseconds apart. All this had to be controlled by the programmable timer.

These experiments were usually conducted in the desert, far from any population, and in somewhat primitive conditions. A much used facility might have a blockhouse or bunker, to protect the experimental personnel from any mishaps. If there was no bunker, it was common practice to start the timer and then run like hell!

There was plenty that could go wrong. In the cannon experiments the aim was to launch the missile model at the highest possible speed, and this meant putting truly enormous charges of explosive into the breech of the gun.

In a successful experiment the entire cannon would jump a metre off the ground from the force of the recoil. In less successful experiments, the cannon's barrel would explode. It was good to be far away when this happened.

Sometimes, when there was a small fault in the film sprocket holes, the Fastax cameras would make a good attempt at self-destruction. If the film broke while going through the camera at thirty metres a second, it would keep flying off the supply spool and get ground into tiny chips. When you opened the camera you would be greeted with a mess of monumental proportions, and a cleaning job that could last the rest of the week.

Despite all the hassles, these experiments produced some startling results. For instance, if the model missile was going fast enough, it could bore through the concrete block as if it were made of butter. The missile's exact speed could be determined by measuring how far it travelled between each frame of the movie film.

These days the Fastax camera could well be kaput, replaced by a more modern video system. But it would take some pretty flashy engineering to duplicate the performance provided by that whizzing film. However the video idea has to start somewhere; why not with your own home video camera?

Doing it yourself

You can use your home video camera to capture explosions and other high-speed events. The only catch is that the camera must have the fairly recent feature called a 'high-speed shutter'.

This option is really intended for analyzing sporting activities, such as your golf swing. It uses electronic means to sensitise the camera's pickup device (usually a 'CCD' or charge-coupled device) for only 1/1000th second or so for each frame. This effectively freezes the action into a series of still pictures.

By contrast, a 'normal' camera records information during the entire 1/25th second time for each frame. So fast-moving objects look blurred in each individual frame.

This blurring is generally beneficial, making fast action look smooth and flowing. If you view action shot with 'high speed shutter' at normal speeds, the motion looks quite jerky. Material shot in high-speed shutter mode is usually intended for viewing frame-by-frame, studying each frame before moving on to the next. So the mode is ideal for studying extremely brief events such as explosions, as well as golf swings.

Before filming explosions or other violent action, it's a good idea to protect your camera's lens from damage. This is easily accomplished by fitting a clear glass filter, such as a skylight filter, in front of the lens. These filters only cost a few dollars and just screw on. Anything that would have damaged the lens will break the filter instead, and the filter's a lot cheaper! In fact it's not a bad idea to leave a skylight filter in place all the time.

In most cases you should set up your

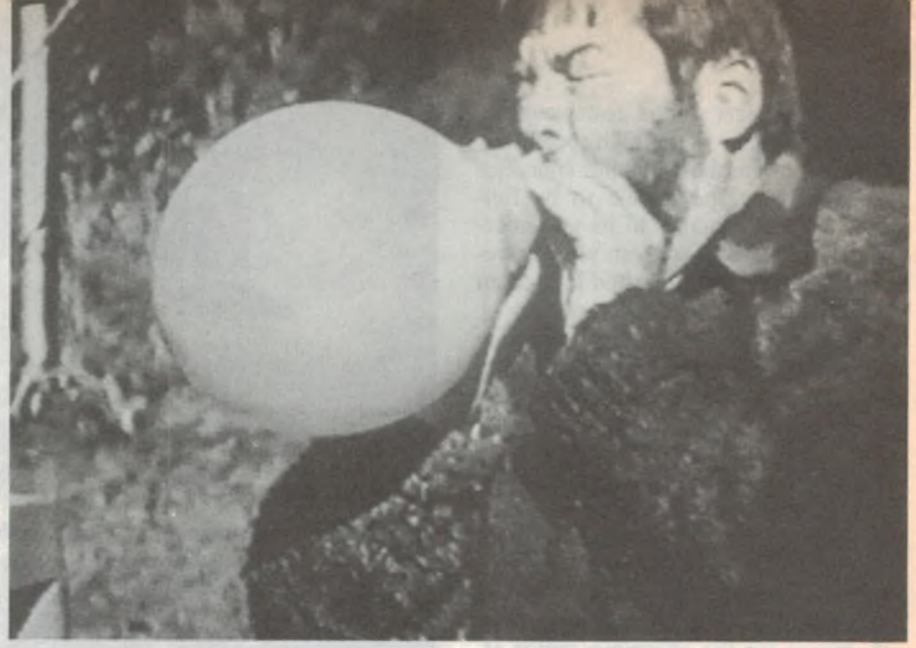


Photo 2A (above): The author blowing up a balloon, until...

Photo's 2B (above), 2C (below): ...It finally bursts.

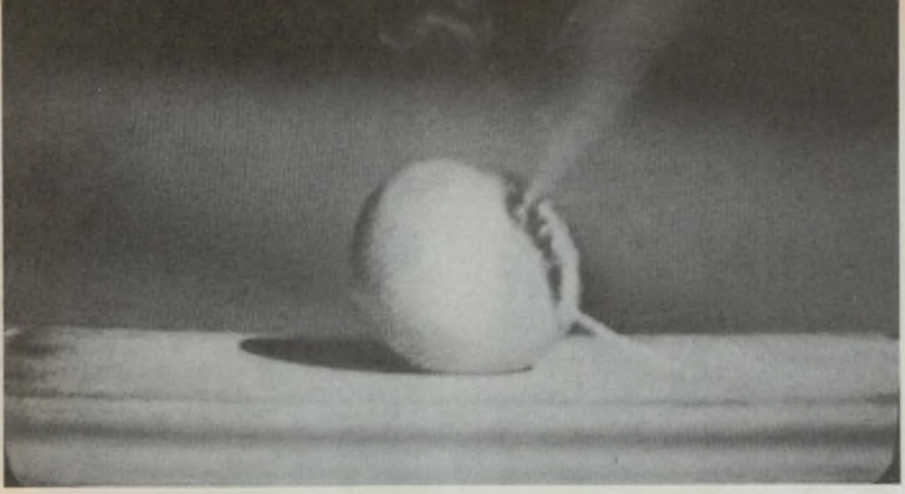


Photo 3A: A firecracker beginning to explode inside a mandarine.

Photo 3B: One frame later (1/25 second), it has turned inside out.

test range outdoors, where there is plenty of light. As in the professional test range photography described above, the camera is much less sensitive to light in the high speed mode. An exception is in an experiment such as that in photos 4A and 4B, in which the the subject of interest is the light produced by the explosion itself.

Before beginning any noisy experiments, such as those involving firecrackers, it might be a good idea to word up your neighbours, pointing out that their distress will only be short lived and will help contribute to the furthering of scientific study. They might even be interested in acting as your assistant, lighting a cracker or wielding the hammer for a light globe experiment.

Once the coast is clear you can begin. Set the camera on a tripod, and stay as far back from the action as possible while allowing sufficient detail to be shown. Have your assistant ready to light, or smash, or blow up your object. Then start the camera and switch to high-speed shutter mode.

On my Sanyo Video-8 camera, the switch is a button which must be held down for the entire time the camera is running. When the picture looks satisfactory in the viewfinder, your assistant can start the action. Try not to flinch when the bang comes!

Although this technique produces interesting and useful results, there is one weak link: you are only taking 25 pictures every second, instead of many thousands, so there's a relatively long blank period between each one. So the really interesting bits might happen during the interval between pictures. It's good insurance to repeat each experiment at least twice if possible. Sorry about that, neighbours!

Once your experiments are safely on tape, you can take it inside and copy it onto a full-sized VHS videocassette. Most home videos these days are capable of playing back tapes frame by frame, either continuously or by waiting for you to press a button for each one.

You can also take conventional photographs of the most interesting frames. The method I use is straight out of a book called *The Nikon Way*. Set the shutter speed for 1/8th second and then let the camera's through-the-lens metering suggest an appropriate exposure for the image on the screen.

You'll find you spend a lot of time staring at your pictures, trying to work out what they mean. Why did something move that particular way? What is that blur? These questions will prompt you to try even more experiments. This whole business is terribly addictive. Perhaps it could even turn into a hobby in its own right!

A few examples

Photos 1A and 1B are of the classic 'light globe smash' – before and after. As I remember, this was the subject of the first ever demonstration of high-speed photography around fifty years ago. A company called something like 'Edgerton Greer and Greer' used it to promote its new development, the electronic flash.

I told my assistant (my daughter) to make sure the globe smashed properly on the first try. We only had one 'blown' globe, and to repeat the experiment would have required the destruction of a globe that still worked. In Photo 1A, the globe lies at rest on a wooden cutting board, unaware that a hammer is coming down at considerable speed.

Photo 1B was taken several frames after the first impact. My daughter had given the globe a decent old belt and the hammer head, in the top centre of the picture, is actually rebounding from the blow. The cutting board has also jumped up from the table, and the light globe is in the process of making a dreadful mess.

The ugly mug in photo 2A is me, trying to burst a balloon with sheer lung power. This time my daughter is in charge of the camera. In photo 2B the balloon lets go, turning into a flap of contracting rubber. In photo 2C, a few frames further along, the remains of the balloon have flown above the frame and are now falling back into it. I have recoiled from the explosion, and seem to be pushing it away with my hands.

There is an unexpected effect in these last two pictures, which I hope shows up in the magazine reproduction. In the area the balloon occupied before it burst, there is either a mist or some optical distortion. This is a zone of violently expanding air.

The laws of physics say it must be cooling as it expands, which would explain the sudden appearance of mist. But you can see through it, although the background on the other side appears distorted. Why?

This question could be further studied by readers. Why not draw a black grid on a piece of white card, and place it behind another balloon. What will happen to the grid when the balloon explodes? Will the lines become distorted? As you can see, every question answered raises further questions.

Photos 3A and 3B show what happens when you put a firecracker inside a mandarine. (That's just what happened to be in the fridge at the time.) I expected the mandarine, being mushy inside, to absorb most of the force of the blast, with little more than a gentle 'plop'. I was very wrong.

Photo 3A shows the very beginning of the explosion, with a jet of smoke and fire shooting up and to the right from the mandarine. This looks remarkably like that shot of the doomed space shuttle with fire jetting from the O-ring. A split is forming downwards from the jet of flame. The white line is a section of unburnt fuse.

Photo 3B is of the very next frame on the video, 1/25th of a second later. There is a furious explosion; the orange mandarine skin is now white – it has been turned inside out. The object leaving the upper right of the frame is the remains of the firecracker, more or less intact. It landed on the ground in one piece, smoking, with only a few holes blown in it. It appears the force that should have blown the cracker apart was transferred to the mandarine instead. Why? How?

Photos 4A and 4B were made in subdued light, to emphasise the light produced by an explosion. The object was a metal lid about 70mm in diameter, placed upon a firecracker lying on its side.

It's interesting to note that in photo 4A the main part of the explosion, instead of spreading out evenly, followed the path of the rising lid as if sucked along behind it. Is this what happened? Why? What prevented the explosion spreading outwards?

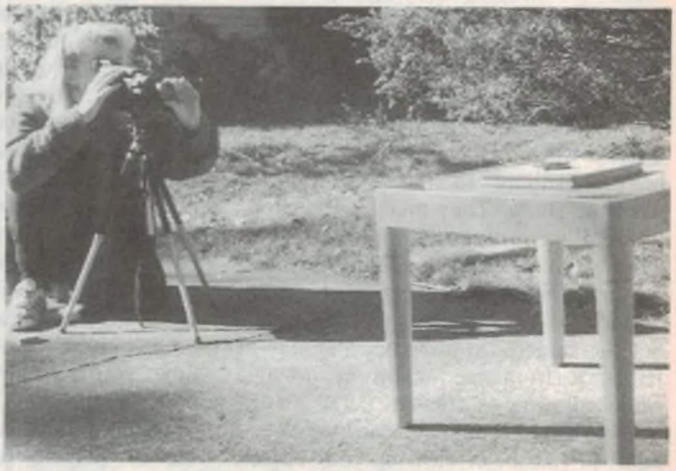
Photo 4B is again the very next frame on the video. The lid with its following jet of fire has just risen out of the picture, leaving a bright cloud of white smoke behind it. There are also some glowing flecks of something or other.

Photo 4A: A firecracker exploding in darkness, under a metal lid.

Photo 4B: The same event as above, only one frame later.

Are they gunpowder granules? And, just above where the explosion occurred, there is some lingering fire, mixed with the smoke. Why didn't it follow the lid like the rest of the fire?

Questions, questions, and more questions. If I were a science student, I'd be considering experiments like these as the basis for a term project. The careful study of objects too fast to see is really a fascinating activity; a marriage of electronics and optics that could conceivably lead to some interesting discoveries. Will YOU be the one to make them?



The author's daughter and accomplice, operating the video camera for a test run.

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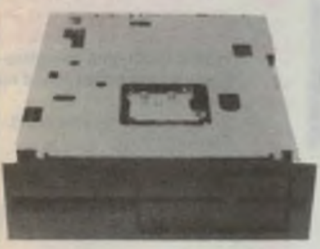

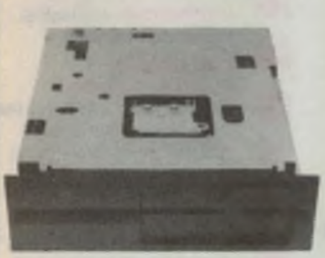

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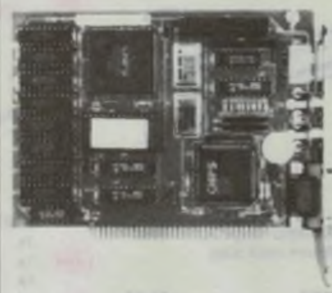

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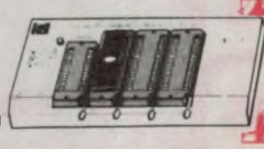
- Model LP-A1
- SRAM TEST 6116-62256
- Capable of programming EPROM 8-bit IC's (2716-27512, 2716A-27512A, 27010-27012, 27C16-27C512, 2804-58064, 28256-52B13), EPROM 16-bit IC.s (271024, 27102, 27210), MCS-48 series (8741-8750, 8748-8748H, 8749-8749H), MCS-51 series (8751-8752) & PAL series
- Compiles HEX Format for Textronix, Intel, etc.
- Can handle 2MBits buffer, EDIT HEX & ASCII Data, search HEX & ASCII data, and functions e.g. Micro command, delete, Change, Memory Lock-On-Off are also available
- Comprised of strong hardware to support future requirements by changing option module
- Allows selection of Parameter, Vcc, Vpp, Tpw and Mode



ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS

VERBATIM DISKS

(ALL PRICES PER BOX OF 10 DISKS)

DESCRIPTION	1-9 BOXES	10+ BOXES
3 1/2" 2S/2D	$37.95	$34.95
3 1/2" 2S/HD	$78.95	$74.95
5 1/4" 1S/2D	$21.95	$19.95
5 1/4" 2S/2D	$25.95	$23.95
5 1/4" 2S/4D	$33.95	$31.95
5 1/4" 2S/HD	$33.95	$31.95

COLOURED VERBATIM DISKS

(Each pack of 10 consists of 2 Red, Blue, Yellow, Green & Orange Disks)

3 1/2" 2S/2D	$41.95	$39.95
5 1/4" 2S/2D	$28.95	$26.95
5 1/4" 2S/HD	$37.50	$35.50

VERBATIM DATALIFE PLUS

Teflon* Coated

(ALL PRICES PER BOX OF 10 DISKS)

	1-9	10+
5 1/4" DS/DD	$29.95	$27.95
5 1/4" DS/DD	$38.95	$35.95

"NO BRAND" DISKS

Now you can buy absolute top quality disks that are also the cheapest in Australia! They even come with a lifetime warranty, which indicates the quality of these disks. So why pay 2-3 times the price for the same quality?

Packs of 10, D/S D/D without boxes, or brand name, just their whitepaper jacket, and index label. (5 1/4" disks includes write protects)

(ALL PRICES PER 10 DISKS)

5 1/4" 2S/2D "NO BRAND" DISKS

10+ DISKS	100+ DISKS	1,000+ DISKS
$6.00	$5.75	$5.50

5 1/4" HIGH DENSITY DISKS

(DOUBLE SIDED)

10+ DISKS	100+ DISKS	1,000+ DISKS
$23	$22	$21

3 1/2" 2S/2D "NO BRAND" DISKS

$21

3 1/2" 2S/HD "NO BRAND" DISKS

10+ DISKS	100+ DISKS	1,000+ DISKS
$65	$59	$53

Suitable for IBM, PS/2, Macintosh, Atari, etc.

GENDER CHANGERS

9 PIN TO 25 PIN CONNECTOR ADAPTORS

The perfect solution!
Features gold plated pins

- DB9 Plug to DB25 Socket

X15668..................$10.95

- DB9 Socket to DB25 Plug

X15669..................$10.95

RS232 MINI PATCH BOX

- Interface RS232 divices
- With male to female 25 pin inputs
- 25 leads with tinned end supplied

X15653 Male to Male
X15654 Male to Female
X15655 Female to Female
..............................$12.95

DISK BOXES

DISK STORAGE UNITS

- 80 x 3 1/2" - Lockable

C16038..................$16.95

- 40 x 3 1/2 "- Lockable

C16035..................$14.95

- 40 x 3 1/2 " "Eclipse"

C16040..................$8.99

- 120 x 3 1/2 "- Lockable

C16039..................$21.95

- 50 x 5 1/4 "- Lockable

C16025..................$14.95

- 100 x 5 1/4 ""Eclipse"

C16042..................$9.95

- 100 x 5 1/4 "- Lockable

C16020..................$15.95

- 120 x 5 1/4 "- Lockable

C16028..................$19.95

HARD DISK

REMOVABLE CARTRIDGE HARD DISK

Ricoh R260 20 M/Byte Removable Hard Disk is a sub-system for AT or 386 systems. Extra 20 M/Byte cartridges are available. To enable the end user to build a library that can be safely locked away. Or taken to another site that is using the same sub-system. It's the ultimate in hard disk back up systems or for transport ability of data.

Includes a cartridge

X20022..................$1,150

Extra 5 1/4" 20 M/Byte cartridge for disk (Ricoh RH5260)

X20024..................$220

DB9 GENDER CHANGERS

- Saves modifying or replacing non-mating DB9 connections
- All 9 pins wired straight through

X15640 Male to Male
X15641 Male to Female
X15642 Female to Female
..............................$14.95

RS232 NULL MODEM ADAPTORS

- Pins 2 and 3 reversed
- All 25 pins connected

X15657 Male to Male
X15658 Male to Female
X15659 Female to Female
..............................$11.95

CENTRONICS GENDER CHANGERS

- Saves modifying or replacing non- mating centronics cables.
- All 36 pins wired straight through.

X15663 Male to Male
X15661 Male to Female
X15664 Female to Female
..............................$29.95

RS232 GENDER CHANGERS

- Saves modifying or replacing non-mating RS232 cables
- All 25 pins wired straight through

X15650 Male to Male
X15651 Male to Female
X15652 Female to Female
.....................$11.95 each

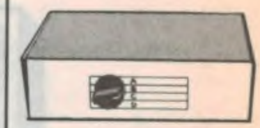
DB15 GENDER CHANGERS

Saves modifying or replacing non-mating DB15 connenctions

- All 15 pins wired straight through

X15645 Male to Male
X15646 Male to Female
X15647 Female to Female
..............................$14.95

I/O ACCESSORIES

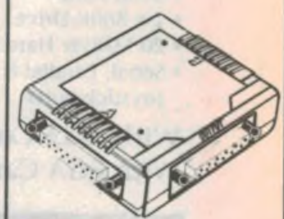


DATA TRANSFER SWITCHES

If you have two or four compatible devices that need to share a third or fifth, then these inexpensive data transfer switches will save you the time and hassle of constantly changing cables and leads around.

- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel
- Three/Five interface connections on rear panel
- Switch comes standard with female connector

2 Way RS232
X19120.....................$59
4 Way RS232
X19125.....................$79
2 Way Centronics
X19130.....................$69
4 Way Centronics
X19135.....................$79
RS232 2 X 2 Switch
X19140.....................$79
Centronics 2 x 2 Switch
X19145.....................$79



POCKET AUTO AB SWITCHES

- Pocket size, auto-scanning
- Allows 2 PCs to share one Printer

Serial model:
MS-201 - Host-powered
X19150..................$79.95
Parellel model: MP-201
Protocol transparent
X19155..................$89.95

CL21 COMPUTER LEAD

- 25 pin D Plug to 25 pin D plug
- All pins wired straight through (removable terminals)
- Length 1.5metres.

P19007..................$36.95

CL23 COMPUTER LEAD

- 25 pin "D"plug to 25 'D'socket
- All pins wired straight through (removable terminals)
- Length 3 metres

P19012..................$49.95

CENTRONICS CABLE

- 36 Way Centronics Plug to 36 Way Centronics Plug
- Shielded cable
- Length: 6 metre

P19013..................$29.95

IBM* CARDS

386SX 16MHz MOTHERBOARD

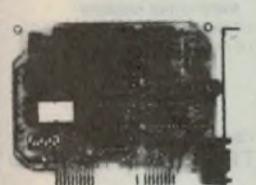
- Processor: 80386SX-16MHz (0/1 wait state)
- Co-processor: 80387SX-16 (optional)
- CHIPS & TECH NEAT chipsets
- (SMT) Surface Mount Technology for chipsets & CPU
- Supports up to 2MB on board, (Sixteen 44256 and Eight 41256 sockets)
- Three 8 BIT slots
- Five 16 BIT slots
- Memory Expansion Slot
- Optional 2-8MB memory card
- Supports LOTUS-INTEL-MICROSOFT (LIM) Expanded Memory Spec. (EMS) version 4.0
- Supports Page Interleave Mode using 100NS DRAM
- BIOS: AMI or PHOENIX
- Turbo Light and Hardware Reset connector
- Keyboard or Hardware Reset connector
- Power Good Signal on board
- Baby size main board
- Without Ram

X18094....................$900

286 NEAT MOTHERBOARD

- Processor: 80286-12, -16MHz or -20MHz (0/1 wait state)
- Co-processor: 80287 (optional)
- CHIPS & TECH NEAT chipsets
- 1-4MB dual RAM socket
- 1-4MB module RAM socket on board
- 640KB-384KB memory relocation
- Three 8 BIT expansion slots
- Five 16 BIT expansion slots
- Memory expansion to 8MB
- Supports EMS 4.0
- Page Interleave Technology
- BIOS: AMI or PHOENIX
- Hardware and keyboard switchable Clock Speed
- LED speed display
- Power Good Signal on board
- Baby size main board

• 16MHz
X18090....................$700
• 20MHz
X18092....................$895



MIDI INTERFACE CARD - DS/401

The MIDI DS-401 Card is the PC standard MIDI interface that runs most popular PC music programs for sequencing, recording, composing, music printing, patch editing, music instruction and many other applications.

- Run all programs designed for the Roland MPU-401 architecture
- Socketed EPROM for easy user replacement
- 1/3 length (short) card will fit in any computer accepting standard expansion card, including laptops
- Including "Y" cable, external connector box to transport is unnecessary

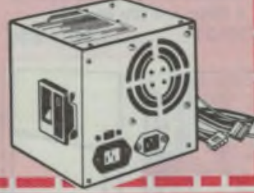
X18164....................$245

UNINTERRUPTABLE POWER SUPPLY

- Power MOSFET design
- Easy installation
- Zero transfer time
- Surge protection
- Built-in EMI/ RFI filter
- Ultra low output ripple
- Buzzer warning when blackout
- Compact size fits most PC/ XT*, AT* and compatible computer casing
- Maintenance-free and long life batteries
- New casing design facilitates battery replacement

180W for PC/ XT*
Dimensions:
222 x 141 x 118mm
X11108....................$449

230W for PC/ AT*
Dimensions:
165 x 150 x 150mm
X11110....................$499



IBM* CARDS

G7 MONOCHROME COLOUR CARD

Supports colour graphics, TTL and composite monitors with printer port
X18007....................$139

GRAPHICS CARD

TTL and Hercules compatible with printer port
X18003....................$99

ENHANCED GRAPHICS ADAPTOR CARD

Auto switch CGA, EGA and Hercules with 256K Video Ram
X18070....................$225

VGA CARD

PC*/ XT*/ AT* compatible 256K Ram works with OS/2
X18071....................$350

VGA 512K

PC*/ XT*/ AT* compatible 512K Ram. Hardware zoom, pan, window.
X18072....................$450

RS232 (SERIAL CARD)

WITHOUT CABLE
Supports 2 asynchronous communication ports. 50 baud to 9600 baud.
X18026....................$39

RS232 & CLOCK CARD

WITHOUT CABLE
Supports 1 asynchronous communication port. 50 to 9600 baud with Clock.
X18028....................$59

CLOCK CARD

X18024....................$49

PRINTER CARD

Parallel interface for Centronics printers.
X18017....................$29

GAMES I/O CARD

Features 2 joystick ports.(DB15)
X18019....................$29

I/O PLUS CARD

Provides a serial port, a parallel port and a joystick port, and even a clock/calendar with battery backup!
X18045....................$115

MULTI I/O & DISK CONTROLLER CARD

This card will control 2 x double sided, double density drives, and features a serial port, a parallel port, and a joystick port or games port. It also has a clock/calendar generator with battery backup
X18040....................$99

2 M/BYTE EXTENDED/ EXPANDED MEMORY RAM CARD

X18052....................$225

3.5 M/BYTE EXTENDED RAM AT* CARD

X18056....................$275

SERIAL/ PARALLEL/ GAMES CARD

XT*/ AT* compatible 1 parallel port, 2 Serial ports, 2 port games adaptor.
X18151....................$115

FLOPPY DISK DRIVE CONTROLLER CARD

These cards will control up to 2 sided 360K IBM* compatible disk drives
For 2 Disk Drives
X18005....................$52

4 WAY DISK CONTROLLER

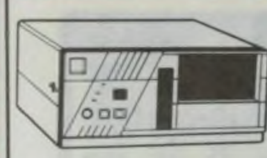
- PC*/ XT*/ AT* compatible
- 1.44 M/B, 1.2 M/B, 720K, 360K Drives
- Will Control up to 4 Drives

X18006....................$129

HARD DISK CONTROLLER CARDS

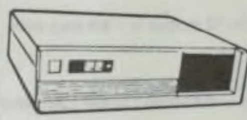
X18060 (XT*)..........$129
X18140 (AT*)..........$195

CASES



BABY AT* STYLE COMPUTER CASING

Small footprint. Features security key switch, 8 slots and mounting accessories
Size: 360(W) x175(H) x405(D)mm
X11093....................$99



IBM* XT COMPATIBLE CASE WITH AT* STYLING

Features security key switch, 8 slots, and mounting accessories
Size: 490(W) x 145(H) x 400(D)
X11091....................$99

TOWER COMPUTER CASING

Remount your computer to give it that professional look.

- Accepts XT, AT, Baby AT and 386 boards
- Horizontal full height hard disk drive mounting
- Room for 2 x3 1/2" and 2 x 5 1/4" floppy drives
- Full height HDD plus fan mount
- Size: 165(W) x 600(H) x 500(D)

X11105....................$325

DUST COVERS

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

MODEM

ALLEGRO 24.24 SA MODEM

- Auto Dial Commands
- Auto Answer CCITT V25 Compatible, Auto Disconnect timeout: Hayes compatible
- Auto Range Selector: 300/1200/2400
- Modem capability: V21, V22, V22bis, Bell 212, Bell 212A
- High Performance: Better than 95% for binary transfers at Signal to noise ratio of 21dB and Receive data level- 34dB
- Telecom Approval C88/37/37a
- 12 month warranty

X19082....................$459

JOYSTICKS

JOYSTICK FOR IBM*

Features selectable "spring centring" or "free floating". Electrical trim adjustments on both axis. 360 degree cursor control
C14205..............$49.95

APPLE* COMPATIBLE JOYSTICK

Ideal for games or word processing. Fits most 6502 "compatible" computers.
C14200..............$39.95

ROD IRVING ELECTRONICS

Please quote this advertisement for the prices listed for this month.

SYDNEY: 74 Parramatta Rd. Stanmore 2048
Phone: (02) 519 3134
Fax: (02) 519 3868

MELBOURNE: 48 A'Beckett St
Phone: (03) 663 6151

NORTHCOTE: 425 High St.
Phone: (03) 489 8866

BRISBANE:
(V.C.R Computer Services)
647 Lutwyche Rd. Lutwyche.
Phone: (07) 857 5617

MAIL ORDER & CORRESPONDENCE:
P.O. Box 620, CLAYTON 3168
Order Hotline: 008 33 5757
(Toll free, strictly orders only)
Inquiries: (03) 543 7877
Telex: AA 151938
Fax: (03) 543 2648

All sales tax exempt orders and wholesale inquiries to:
RITRONICS WHOLESALE -
56 Renver Road, Clayton.
Phone:(03) 543 2166 (3 lines)
Fax: (03) 543 2648

ORDER HOTLINE
008 33 5757
(TOLL FREE)
STRICTLY ORDERS ONLY

LOCAL ORDERS & INQUIRES
(03) 543 7877

POSTAGE RATES:

$1 - $9.99	$2.00
$10 - $24.99	$3.00
$25 - $49.99	$4.00
$50 - $99.99	$5.00
$100 +	$7.50

The above postage rates are for basic postage only. Road Freight, bulky and fragile items will be charged at different rates.

Errors and omissions excepted. Prices and specifications subject to change.

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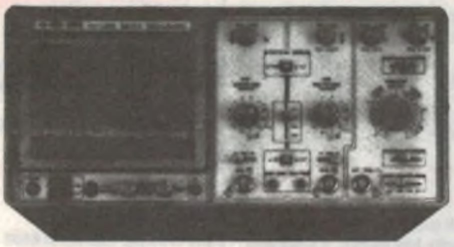
ROD IRVING ELECTRONICS

ROD IRVING ELECTRONIC

OSCILLOSCOPES



20MHZ DUAL TRACE OSCILLOSCOPE

CRT DISPLAY
- 150mm rectangular

VERTICAL DEFLECTION
- Deflection Factor: 5mV to 20V/ Div on 12 ranges in 1-2-5 step with fine control
- Bandwidth DC: DC to 20MHz (-3dB)
  AC: 10Hz to 20MHz (-3dB)
- Operating Modes: CH-A, CH-B, DUAL and ADD (ALT/CHOP L202 only)
- Chop Frequency: 200KHz Approx.
- Channel Separation: Better than 60dB at 1KHz

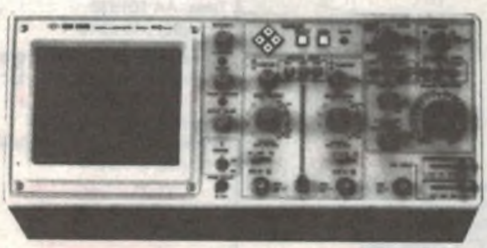
TIME BASE
- Type: Automatic and normal triggered in automatic mode, sweep is obtained without input signal
- Sweep Time: 0.2µ Sec to 0.5 Sec/ Div on 20 ranges in 1-2-5 step with fine control and X-Y
- Magnifier: X5 at all ranges

TRIGGERING
- Sensitivity Int: 1 Div or more
  Ext: 1Vp-p or more
- Source: INT, CH-B, LINE or EXT
- Triggering Level: Positive and Negative, continuously variable level; Pull for Auto
- Sync: AC, HF Rej, TV (each + or -) at TV Sync. TV-H (line) and TV-V (Frame) sync. are switched automatically by SWEEP TIME/Div switch.

HORIZONTAL DEFLECTION
- Deflection factor: 5mV to 20V/ Div on 12 ranges in 1-2-5 step with fine control
- Frequency Response: DC to MHz (-3dB)
- Max Input Voltage: 300V DC + AC Peak of 600Vp-p
- X-Y Operation: X-Y mode is selected by SWEEP TIME/ Div switch
- Intensity Modulation Z Axis: TTL Level (3Vp-p-50V) + bright, - dark

OTHER SPECIFICATIONS
- Weight: 7Kg Approx
- Dimensions: 162(H) x 294(W) x 352(D) mm

Q12105..$695



40MHZ READ-OUT OSCILLOSCOPE

CRT DISPLAY
- 150mm rectangular

VERTICAL AMPLIFIER (CH1 and CH2 identical)
- Operational Modes: CH1, CH2, ADD, DUAL, ALT, CHOP
- Sensitivity: 5mV-5V/ Div 3% in 1-2-5 steps
  1mV-1V/ Div x5% x5MAG
- Bandwidth DC: DC to 40MHz (-3dB)
  AC: 5Hz to 40MHz (-3dB)
- Rise Time: Less than 8.7nS

HORIZONTAL AMPLIFIER
- Operating Modes: X-Y operation CH1-X axis, CH2-Y axis
- Sensitivity: 5mV-5V/ Div± 3% in 1-2-5 steps
- Input Impedance: 1MΩ±2%, 25pF±3%
- Bandwidth DC: DC to 1MHz (-3dB)
  AC: 5Hz to 1MHz (-3dB)

TIME BASE
- Sweep Method: AUTO, NORM, SINGLE
- Sweep Time (A): 0.2µs-0.5S/ Div±3% in 1-2-5 steps (X1 only)
  (B): 0.2µS-0.5mS/ Div±3% in 1-2-5 steps (X1 only)
- Magnified Sweep: 10 times±5%, Max 20ns
- Linearity: ±3% or better

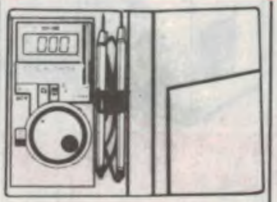
Q12107..$1,695

TEST EQUIPMENT

DIGITAL METER (YF-120)

- Autoranging operation
- Data-hold for easy readout
- Full range protection
- 0-500 volts AC-DC
- 0-20 MΩ
- Dimension & weight =133 x 29 x 17mm and 60g approx

Q11270...........ONLY $55



MULTIMETER (YF-100)

- Autoranging for DCV, ACV, OHM & continuity measurement
- AC DC 0 - 500 Volts
- 10mm thickness & 80g light weight for easy operation
- Dimension & weight = 108 x 54 x 8mm and 60g approx

Q11264.......................$69

MULTIMETER (YF-3000)

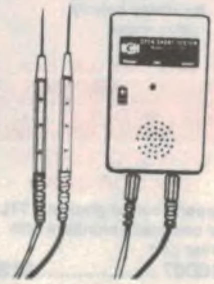
- Large display 3 1/2 digit 0.5" height LCD for easy readout
- AC DC 0 - 1000 Volts
- Auto/manual range select easy to operate
- Automatic low battery" - + " display for battery indication
- Memory-comparative function available for allowance within ±5% f.s
- Warning sound for overload and conductance
- Dimension & Weight = 170 x 80 x 33mm, 260gram approx
- Data hold function for easy readout

Q11268......................$110

MULTIMETER (YF-2100)

- Large display 4 1/2 dgt 0.5" height LCD with maximum reading of 19999
- AC DC 0 - 1000 Volts
- Automatic polarity."-" display for negative input
- High over-load protection for all ranges
- Over load display, the highest digit "1" or "-1" alone glows
- Power consumption 20mW approx.
- Dimension & weight = 162 x 86 x28mm and 200g approx

Q11266......................$199



SHORT TESTER

- Instantly shows the open/short position of PCB
- It can test whether PCB or solid wire open/short by Buzzer

Q11276................$22.95

LOGIC PROBE (LP-2800)

- Useful for TTL or CMOS has high and low indicator leds and also with pulse memory.
- This is a very handy tool for the hobbyist or serious technician for tracing those hard to find faults on logic boards.

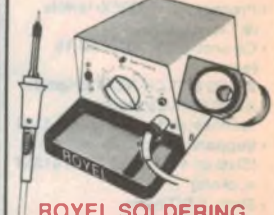
Q11272..............$34.95

LOGIC PULSER (LP-540H)

- Can be used directly to inject a signal into logic circuits without removing IC
- Compatible with TTL, DTL, RTL HTL, MOS and CMOS

Q11274...................$42.95

SOLDERING IRON



ROYEL SOLDERING STATION

The all solid-state heat sensor and control unit allows the selection of the appropriate soldering tip idling temperature. The very high-powered element (relative to the size of the tool) will replenish heat drained from the tip during each soldering operation and will recover the tip tempreture moments after the tip is lifted.

- Zero voltage switching
- Zero tip potential
- Aux ground connection
- For soldering irons-
  CT6 (3mm Tip), CT7 (5mm Tip)

T12570......................$225

ROYEL DUOTEMP SOLDERING IRONS

The DUOTEMP range are designed to idle with a normal tip temperature of 360°C, without its button depressed. In this mode they are ideal for delicate work such as printed circuit boards. With the button depressed, the power is doubled allowing much heavier work to be completed, or a rapid tempreture recovery from larger joins. (Note: This mode cannot be used continuously). A range of 6 long-life tips are available.

Features:
- 240V operation, no transformer required
- Safety Standards Approved
- 6 months warranty

ROYEL DR-30
(21 WATT)

- 3mm tip

T12640.................$47.50

ROYEL DR-50
(30 WATT)

- 5mm tip

T12645.................$49.50

ROYEL DR-60
(40 WATT)

- 6.5mm tip

T12650.................$54.50

ADCOLA SOLDERING IRON RS50
(16 WATT)

- 5mm tip
- 240V operation
- 3 months warranty
- Safety Standards Approved

T12630.................$36.50

When I Think Back...

by Neville Williams

Readers have their say: Organs, Langford-Smith, Popov and FM

In response to the historical articles that have been published during the past twelve-odd months, a number of readers have contacted me direct or through the magazine, offering further information and/or suggestions for future topics. What better time than the present to acknowledge their observations in lieu of the regular article.

While feedback is valuable, anyway, as a barometer of reader reaction, I've been able already to make good use of clippings, photostats and odd booklets that readers have passed on to me from time to time – the kind of thing that's not good enough to keep, but too good to throw away!

If you do want to comment or pass on information that might otherwise be lost, I suggest that you address it to me via Jim Rowe at the *EA* office so that, as Managing Editor, he can better gauge reader interest in the various subjects.

To date, the article that seems to have generated the most response was the one in the May issue: 'Organs – electronic and otherwise'. Once an organ enthusiast, it seems, always an organ enthusiast!

In that context, one interesting item came from the family of a lady who had been in the same age group as my own grandparents, and whose pride and joy had also been an Estey reed organ. Among the things she left behind was a small reed organ catalog from W.H. Paling & Co Ltd, 'established in 1853'.

The catalog is undated but it shows their Sydney centre which I well remember on the corner of George St and Angel Place, plus premises in Newcastle, Brisbane, Toowoomba and Rockhampton. My guess is that it was issued in the early to mid 1930s.

Eleven models are listed, with pictures and specifications, 'For Churches, Lodges and the Home'. Curiously, I had forgotten about the lodges, which were very much a part of the social scene around that time.

Typical reed organs

The folding portable organ mentioned in the May issue was, I discovered, the Estey model JJ, as pictured. It had four C-C octaves and no stops, the loudness depending on how many notes you played and how hard you pumped – a useful attribute of most cottage organs.

My own grandmother's organ could have been a de-luxe version of the 12-stop 1135 or the 13-stop R-38, while the 16-stop R-97 would have been the kind of reed instrument that most amateur organists of the day would have been content to own.

The Estey folding organ, mentioned in the May article. Supplied in a small oak console, it was described in the Estey catalog as 'a treasure for missionaries or for open-air services'.

The Estey T-61, pictured, was at the top of the range, intended for churches, convents, etc., which could not afford a pipe instrument. In a 'solid American oak' console, it had two 61-note CC-C4 manuals and a 30-note CCC-F concave radiating pedal clavier. With 15 stops and 10 sets of 'Philharmonic Scale' reeds (548 total), it was normally fitted with a rotary hand blower, with an electric blower available as an option.

I doubt that I ever saw an Estey T-61, much less played one, probably because the organs and churches with which I was familiar in my younger days were on a much humbler scale.

Two other instruments, which I had never seen or even heard about, are illustrated in the catalog. The Estey 'Modernistic', with a 61-note manual F-F manual, 11 stops, 'noiseless' electric blower and piano-like expression pedals clearly anticipated electronic instru-

Self-contained, the Estey T-61 was designed for use in situations where a pipe organ was not affordable or practicable. With two manuals, pedal board and balanced swell, it could equally serve as a useful practice instrument for professional organists.

ments in both concept and appearance. The 'Melodeon', with tabs rather than drawstops, was an apparently similar instrument but housed in an 1850-style solid walnut cabinet styled for parlours rather than parishes!

Pipe & pipeless organs

By why the focus on mechanical reed organs in a modern electronics magazine? Mainly because they created a receptive market and an army of amateur organists for electronic organs, which made their appearance around the time this catalog was issued. In fact, organs like the T-61 provided the basis for short-lived ventures into amplified reed – 'pipeless' – formal organs, of which the Everett Orgatron was probably the best known.

Still on the subject of organs, I received a letter from Aberdeen, Scotland, from a distant relative and a lover of grand organs, Will Sinclair – whom I met briefly during his recent visit to Australia. He took a copy of the May issue with him to read on the plane. Minus the personal references, his letter reads:

Dear Neville,

I found your article both excellent reading and absorbing in an historic sense. I can differentiate between degrees of musical merit, but do not share your overall knowledge of the subject.

Your reference to Marcel Dupre brought back pleasant memories of this fine organist, whom I heard twice in St Macher (?), one of three cathedrals with a Willis organ. M'lle Demessieux, his pupil, also played there and caused a stir by doing so in high-heeled shoes!

My late, great friend Dr John Dalby (Dr Mus) gave many broadcasts while he was organist at the same cathedral. I was privileged to have been a friend for 50 years and guested for him many times at recitals.

Your other reference to the old reed organ at Scatlands (Shetland Islands) awakened further nostalgia. I played a few hymn tunes on the very same organ, when we visited there some time ago, little knowing that you had made it possible.

Will Sinclair (Aberdeen)

One might well remark 'what a small world', but the indigenous families on the Shetlands, out there in the North Sea off Aberdeen, form a small, tightly knit community (no pun intended).

Playmasters & GEMs

From much closer to home came a letter from Doug Browne, formerly electronics buyer and departmental manager for Grace Bros, who was primarily responsible for introducing to Australia the Italian GEM organ pictured in the May issue.

I first got to know Doug about the time *EA* became involved in the Playmaster electronic organ (also pictured in the May issue), using components which became surplus when Stromberg Carlson Australia went into liquidation.

I finished up with a single manual Stromberg/Playmaster, but Doug upstaged me by buying the laboratory prototytpe of a new 2-manual transistor organ which Stromberg-Carlson engineer Neville Oates had been developing for Australian release. Doug persisted with it for a while, but finally sold it and consoled himself with a Hammond M-100.

In a phone conversation, I asked Doug why Grace Bros had not persisted with the GEM organ, which seemed so well suited to churches/chapels, and excellent value for money. I knew that there had been some difficulty in arranging showroom demonstrations and finding TV servicemen able to cope with organs.

Those were considerations, he said, but organs proved not to be a good showroom mix with TV and hifi. Organ enthusiasts were never in a hurry to make up their mind and sales staff tended to adopt the attitude that, in the time it took to sell one organ, they could write orders for several TV sets!

The truth of the matter probably is that the retail mark-up on organs has to be high enough to cover all of the above. But that's no longer Doug's worry. Now retired, he divides his spare time between his CB transceiver, fiddling with vintage radio equipment (valve, of course) and playing his M100 Hammond.

Australian organ

From Kotara, NSW, comes a letter (abbreviated) which reads as follows:

Dear Mr Williams,

I enjoyed your story in the May issue concerning the evolution of electronic organs. In a brief survey, it is obviously not possible to cover everything.

I wondered if you were aware of quite an impressive and innovative theatre organ developed and manufactured by Alan Bourne, in Newcastle, during thc immediate post-war years. He made 23 altogether.

Quite significant was its acceptance by top musicians. Wilbur Kentwell chose a Bourne organ to put down three of his albums, including 'Strolling down Broadway'. It's a pity that these and other elements of our music are not permanently preserved.

I'm enclosing a copy of a newspaper story on Alan Bourne. As you will see, *he has kept abreast of state-of-the-art electronics for more than 50 years.*

With every good wish,

Vic Moore.

Clipped from *The Newcastle Star*, the article recounts how, returning to Newcastle after wartime service in the RAAF, Alan Bourne set up in business as a radio mechanic. He later became involved in theatre sound systems and in the provision of sound amplification for major musical events in the Newcastle area.

For good measure, he established Newcastle's first sound recording studio (1948) and, from it, set up an all-day, every-day background music service for supermarkets, factories and telephone circuits in the Newcastle area.

An accomplished pianist and organist, his interest in music led him into the design and construction of electronic organs.

The first of these went into the New Lambton (Newcastle) Methodist Church. Another was installed in the Newcastle Baptist Tabernacle, where it remained for 30 years. Still another was installed in a Melbourne TV station.

Bourne organs with special sound effects were also built for hypnotist and entertainer Franquin. In fact, Alan toured with him for several years during the 1950s and '60s, throughout Australia and New Zealand, as organist in the three-man team.

While I had heard occasional reports of Alan's activities, I can't recall ever having had direct contact with him. I do remember having played a lone hymn in a small meeting in the Newcastle Tabernacle many years ago – without knowing anything about the organ. And I would almost certainly have reviewed the particular Wilbur Kentwell albums – again without being aware of how and where they were recorded.

As it turned out, Alan rang me following publication of the May article, and we managed to make up for some of the lost time – to the delight of Telecom! Still a very busy man, he looks after an assortment of electronic organs in the Newcastle area. But his main involvement is with Yamaha organs, including the big new computerised models.

They're about as far removed as is possible from the analog instruments that most of us are accustomed to. Listening to his account of obscure problems with microprocessor chips caused me mentally to 'dip me lid', to a pioneer who has indeed kept abreast of electronic organ technology.

Fritz Langford-Smith apparently contributed to the design of this low power CRMF radiotelephone transceiver, used by missionaries in the 1940's and 50's.(Courtesy CRMF)

Yet another letter comes from Victorian organ enthusiast R.B. Morrow, husband and manager of professional organist Nell Morrow. I simply can't do it justice here and will respond to it at the first available opportunity.

F. Langford-Smith

On a completely different subject, several readers contacted me following publication, in the August issue, of the article on Fritz Langford-Smith. One such was Dr Ernest Benson, a long-time mutual friend, and one of the enthusiastic group who pooled their resources to build their own Hammond style organs (May issue).

Sadly, Ern Benson himself died suddenly on August 2 at age 78, leaving a very large gap in the Sydney electronic engineering fraternity.

Among the other letters to hand was one from Robin Cole, Executive Director of CRMF (Christian Radio Missionary Fellowship Inc) now centred in Blackburn Sth, Vic. He adds a further dimension to the Langford-Smith story. I quote (with abbreviations):

Dear Mr Williams,

I write to express my appreciation for your article in the August issue.

Although I personally can lay no claim to knowing Mr Langford-Smith, I read the article with great interest because his name was recently brought to my attention. This, in the context of a history of CRMF which we are currently putting together.

Between the years 1946-56 CRMF designed and produced, amongst other items of equipment, an HF transceiver mainly for use by Missionary Societies

A shot taken inside a mission station at Rugli in New Guinea, around 1950. A CRMF transceiver is visible behind the operator's right hand; the large transmitter on the left is an ex-RAAF AT-13C. (Courtesy CRMF)

and Churches in Papua New Guinea, Borneo and other overseas countries. I understand that Mr Langford-Smith assisted the late Claude D'Evelynes (our then technician) in the basic design.

I joined the staff of CRMF in 1971 and, even at that time, we were still servicing a few of those same transceivers.

The receiver was notable for its stability, even though it was not crystal locked. It could be set on precisely the correct frequency without fear of drifting and you could confidently return to that frequency, even in the event of no signal being present.

Robin Cole (Executive Director)

In the 1940s and '50s, CRMF was centred in Sydney and, while I often talked to Claude D'Evelynes by phone and, of course, knew Fritz Langford-Smith personally, I was unaware of the latter's involvement in the design of the particular transceiver. As I indicated in the biography, FLS was a very private person and the chances are that many of his contributions to Australian-designed equipment will never be recorded. Thank you, Robin Cole.

By the same token, few would ever have known of Fritz Langford-Smith's influence on a very successful British technical writer – by coincidence, another Sinclair – whose letter appears in the accompanying panel, minus a couple of essentially private references.

I can certainly endorse the writer's observation about FLS's meticulous attitude to phrasing, and his insistence that the meaning of an explanation should be clear to any reader, not just to the technically qualified.

My own pet dislike, often stimulated by computer literature, is the kind of procedural instruction book which starts to make sense only after you've worked things out for yourself! Thanks also to Ian Sinclair.

More on Popov

When this was written, my article in the November issue on Aleksandr Popov was still in the printery and readers will not have had the opportunity to react to it. However I came across the letter reproduced in the accompanying panel, which indicates Marconi's personal reaction to apparently persistent argument in the early 1920s as to who really invented wireless telegraphy.

Popov was clearly just one of a number of names being thrown into the proverbial ring. I suggest you read it.

The Professor Braun mentioned in the letter was Professor Karl Ferdinand Braun (1850-1918), who shared the Nobel award with Marconi in 1909 –

F. Langford-Smith: 'Meticulous attitude'

Dear Sir,

My wife and I have just paid one of our regular visits to Dulcie Langford-Smith, who showed us your article in 'Electronics Australia'. It was the best biography of Fritz that we have seen, both in appreciation of his technical achievements and as a colleague.

I joined the English Electric Co in August 1956, and was overwhelmed to find that Fritz, the editor of the book that had been a continual source of information for me, was working as Technical Information Manager.

When we settled into a flat in Great Baddow, we found that Fritz and Dulcie were neighbours, and subsequently we moved to houses whose gardens were adjacent. Invariably we saw a lot of each other and my latent ambition was undoubtedly galvanised into action in those days.

Now, some 118 books later, I still remember his meticulous attitude to phrasing and his insistence that the meaning of an explanation should be clear to anyone who had read it, not only to the technically qualified.

Not all memories are pleasant, however, because we all witnessed the tragic disintegration in his later years. Dulcie returned to England in 1975 and has lived there ever since, though she is no longer able to keep house for herself.

Your article brought back many memories, not only of Fritz but of valve problems that we have all experienced. I am glad to find that a magazine of the status of 'Electronics Australia' can devote space to eminent names from the past and to technological problems that, at the time, seemed so formidable, but which are now only memories.

Yours sincerely,

Ian Sinclair (Felixstowe, Suffolk, England)

A letter to the editor from G. Marconi...

Marconi House,
Strand, London, WC2.
July 22, 1921

To the Editor of the 'Financial News':

Sir,

I fear that the recollections of 'Midas' in your issue of the 20th instant, regarding the invention of wireless telegraphy, would not be accepted by everyone as strictly accurate.

Few matters of fact seem to have excited so much diversity of opinion. In France, the majority of people are firmly convinced that wireless telegraphy is a production of French genius, as exemplified by Dr Branly.

In England, Midas thinks that the invention should be credited to Sir Oliver Lodge and Sir William Preece.

In Russia, I daresay, partisans of M. Popoff could be found.

In Italy, I believe that almost unanimously the decision would be in favour of my being the inventor, and I have reason to believe that in the United States there is what Midas may consider a regrettable tendency to follow Italian opinion.

In Sweden, however, which may be considered a neutral country, since no Swede has yet laid claim to be the inventor of wireless telegraphy, the Nobel Prize Committee, which gives its decisions on the strength of an international vote, unfortunately ignored the claims of Sir Oliver Lodge and many others and made their award in 1909 to me and Professor Braun of Strasbourg. Perhaps Midas has never heard of the latter gentleman.

Midas was also rather at sea when he states that the first instrument for despatching messages was exhibited by me at Dover Town Hall. This took place in August, 1899, and over a year before, in July 1898, I reported the Kingston regattas by wireless from Dublin Bay in the 'Dublin Express'.

And before that wireless messages were passed between Osborne and the Royal Yacht, and before that again between warships of the Italian Navy.

Yours, etc.,

(Signed) G. Marconi.

not Professor Werner von Braun of rocket fame, who lived much later. Mr (later Sir) William Preece, also mentioned, was chief of engineering of the British PMG's Dept and a man who warmly supported Marconi's early experiments.

FM broadcasting

Last but not least, I have to hand a long letter from Mr B.E. Cabena, of Mount Eliza, Vic. Commenting on the 'Special Anniversary Features' in the April 1989 issue, he notes that the articles are necessarily very brief. This, he says, often 'leads to a lack of accuracy and essential detail that is required to ensure justice to all the pioneers concerned'. He continues:

My impression is that the articles were written by a parochial Sydneysider, in that nothing ever happens in Australia unless it first happens in Sydney. I do appreciate the degree of reseach, effort and time put into compiling historical documents, but completeness is vital.

What he apparently has foremost in mind is the introduction of public broadcasting in Australia, particularly in the form of publicly supported music stations on the FM band. I am accused of 'glossing over' it.

Mr Cabena appears to have overlooked the fact, expressly stated on page 13 of the particular issue, that the articles in question were adapted from an invited Bicentennial paper I wrote for the *Journal of Electrical and Electronics Engineering, Australia* (Vol.8, No.2, June 1988).

With the permission of the author and the Institution, *EA* Managing Editor Jim Rowe simply broke the original paper into three sections, added separate headings and extra pictures for better display, and reprinted it in that form.

In presenting a personal overview of Australian consumer entertainment electronics in a single paper (as requested), it is simply not possible to include the kind of completeness that Mr Cabena appears to expect. If that was to be a pre-condition, there would be no 'overview' papers or articles in widely read magazines; just methodical, tightly-packed publications, containing lots of facts but rarely read.

No, I didn't refer specifically to the evolution of public broadcasting, as such, nor to the personalities in either Sydney or Melbourne whose efforts were finally rewarded by the inauguration of 2MBS and 3MBS and ultimately by the opening up of regular FM broadcasting in Australia. That's a story in itself.

In the space available, I simply outlined – accurately I hope – the commercial and political pressures which first denied FM broadcasting to Australia, only to see the position reversed, to produce what is now becoming a prosperous full-scale broadcast service.

But I'll tell you what: perhaps I could combine the content of Mr Cabena's letter with material from other sources and come up with a 'Think Back' article devoted specifically to the emergence of FM broadcasting in Australia.

I remember the frustration of Ray Allsop; the opposition, even scorn, of industry identities no longer with us; the intransigence of the PMG's Dept; the persistence of music lovers in Melbourne and Sydney (alphabetical order) and the efforts of still others whose dream was a network of broadcasting stations disseminating their particular ideology.

And, right now, the determination of broadcasters to be rid of TV stations in the FM band, so that they can grab a slice of the action! EA

Silicon Valley NEWSLETTER . . .

Credit card listens only to its owner

Secret user codes and personal signatures notwithstanding, credit cards, bank cards, and telephone debit cards have a long history of fraudulent misuse. But a team of researchers at Bell Communications Research has developed a card that could make card fraud a thing of the past.

Based on the premise that the speech of no two humans is exactly alike, a secret spoken password is digitally stored onto the card. When the user inserts the card into a bank teller, or credit-verification machine, the password must be spoken into a built-in microphone. The machine then compares the spoken password with the one stored onto the card, before allowing any transaction to be completed.

Bell Research said it has received a patent for its development and is seeking to license the technology to various potential users. The company does the bulk of the research for the seven regional Bell telephone companies.

Scott McNealy, president of well-known Mountain View computer and workstation maker Sun Microsystems. Since his company's inception seven years ago, its growth has been phenomenal – with annual sales rapidly approaching the $2 billion mark.

Sematech links with nuclear weapons lab

Sematech, the US chip industry's research consortium, announced it has established a joint research partnership with one of America's top defence science laboratories.

Sematech said it will provide financial grants and other support to the Sandia National Laboratory in New Mexico. Although owned by the Department of Engergy and operated by AT&T, the Sandia lab is one of America's premier centres for the development of new nuclear weapons. The centre has extensive state-of-the-art cleanroom facilities, where researchers manufacture highly advanced semiconductors for nuclear missile guidance systems.

Under the terms of the deal, Sandia will set up a new research centre to be known as the Semiconductor Equipment Technology Center (SETEC).

SETEC will assist Sematech in designing more advanced and efficient equipment to manufacture semiconductors.

One of the first projects that will be getting underway at SETEC will be the development of new chemical vapour deposition (CVD) technology and equipment.

"Sandia is recognised for its reliability programs in both nuclear weapons and nuclear power programs. This is the case where we can support these methods for use by private industry," commented Wayne Johnson, an engineering supervisor at the lab.

Applied plans big Japanese expansion

American semiconductor equipment companies, facing the reality of a Japanese market that is not only bigger than their domestic market, but also faster-growing, are increasing efforts to improve their operations in this key market.

Applied Materials has decided to invest US$58 million into the expansion of the firm's current facilities in Japan. With the expansion, Applied's Japanese operations will quadruple in size over the next four years. The company will also establish a new plant to serve the Southwestern region of Japan.

Applied officials said the program will further confirm to the Japanese semiconductor market that Applied is firmly committed to the Japanese market and to servicing its customers there. Such perception is critical to success in Japan, where most contracts are based on long-term business relationships built on mutual trust.

As part of the expansion, Applied will also build a testing facility where customers would be able to run local tests on Applied's chip production equipment. Currently, defective systems, which cost up to US$1 million apiece, have to be shipped back to Santa Clara to be tested. New research facilities will also allow Applied to custom tailor its systems to the specifications of its Japanese customers.

Toyota sends chip buyers to US

To date, Japanese automakers have purchased little more than a token number of US-made semiconductors for their various automobiles. But that is apparently about to change as a result of a new program developed by Japan's Minstry of International Trade & Industry, and supported by at least one major Japanese auto maker.

MITI, under pressure from the US has reportedly issued a directive to the country's automakers to buy more American components. Responding to the order, Toyota announced it has sent a number of its chip-purchasing agents to the United States on a two-week chip-buying spree.

Although US chip makers have been eager to meet with the Toyota representatives, many industry executives and observers remain skeptical, doubting if Japan's auto makers are really interested in opening their long-established domestic chip purchasing networks to foreign suppliers.

"They are being pressured by their government to increase the market share of US chip suppliers. It is unclear whether this is a genuine effort or not. But we want to get into the market, so we are accepting it as an opportunity and not questioning their motives," commented Marcus Wilson, manager of Intel's automotive components division.

Added Signetics' automotive business manager, Bob Filiault: "Today, there are definitely signs the market is opening up." But he added that less than six weeks ago, during a meeting with representatives from various Japanese automakers, one representative bluntly told him his company was attending the meeting only because "MITI made us come."

Turn-around expert new head to Wang

In a rapid succession of events and management changes at troubled Wang Laboratories, the Massachusetts company said it has appointed Robert Miller as its new president, replacing company founder An Wang who had taken back the reigns of his company only two weeks previously from his son Frederick.

Industry observers reacted with cautious optimism to the appointment. While Miller, 48, has been credited with turning around the Penn Central company and maintaining a record of being able to compete successfully with the Japanese in the area of consumer electronics, he has never worked for a computer company.

Still, An Wang said he has granted Miller a large degree of autonomy and independence in his efforts to pull Wang out of its seemingly desperate position. "I have great confidence in the ability of Rick Miller to assume total control of the operations of Wang laboratories."

During his 12 years at Penn Central, Miller was credited with pulling the railroad company out of bankruptcy. Miller has also been in charge of restructuring the consumer electronics operations of RCA and combining it with those of General Electric, before their sale to France's Thomson-CSF.

IBM demonstrates optical chips

IBM has demonstrated two gallium-arsenide-based optical semiconductor chips that hold 50 times more components than has ever been produced on such chips, which use tiny lasers to process electrical signals to and from beams of laser light.

IBM said the chips are capable of transmitting data over fibre-optic cables at the speed of one billion bits per second.

Congress report pessimistic on HDTV

A report released by the Budget Office of the US Congress forecasts much lower growth prospects for the US HDTV market than has been asserted in other reports. As a result, the report may put a damper on hopes for extensive governmental involvement in the effort to create a US HDTV industry.

In a preliminary draft of the report, the Budget Office says it has found that "even the most optimistic market growth would be unlikely to affect other electronics industries in the way that was suggested by proponents of HDTV."

According to the report, if the US HDTV market were to reach US$28.5 billion by 2010, as forecast by the American Electronics Association, those sales would still only represent less than 10% of overall US electronics sales. And the HDTV demand for semiconductors would amount to only about 1% of the total chip market.

The impact of HDTV on the overall electronics and semiconductor industries has been used as one of the key arguments to support government support for the still embryonic HDTV effort.

Critics of the Congressional report point out that while the US electronics market may indeed remain large compared to the size of the HDTV sector, the battle for HDTV is in actuality a battle for technological leadership. The futuristic television sets will force manufacturers to make tremendous advances in data processing, display and other technologies in a relatively short time.

If the Japanese are to achieve this level of integration and production efficiency in HDTV by the mid-to-late 1990's, US industry officials fear they could end up with an overpowering technological lead over any of their US competitors in markets such as personal and other computers, communications and semiconductors.

Cities bidding for US Memories

After losing the site-selection battle for Sematech and MCC to Austin in Texas, San Jose, the defacto 'capital' of Silicon Valley appears determined to lure the chip industry's latest consortium, DRAM start-up US Memories.

The city's council recently approved a package worth US$21 million in financial aid to US Memories, four times as much as the city offered in 1987 for Sematech.

Included in the package are $3 million in tax incentives, through the creation of a special 'industrial incentives zone' in the southern region of the city. Also, San Jose will provide $18 million in direct subsidies to the chip start-up.

The money San Jose is putting up would be in addition to any subsidies and other provisions the State of California is expected to put up.

Justifying the expense, San Jose mayor Tom McEnery said US Memories would create up to 3000 new jobs, generate some US$5 million in annual local taxes, and could spur the establishment of scores of related support businesses in the immediate vicinity of the chip plant.

Just days after San Jose announced its package, two of its neighbouring communities, Newark and Fremont also submitted bids to the state's Department of Commerce which will be presenting the various offers to US Memories.

While Newark and Fremont said they would not be able to offer the chip company much cash, the two cities said their communities offer key advantages over San Jose, including inexpensive land, lower housing costs, and better commuter access.

As a major incentive, both cities offered to cut all necessary red tape to get US Memories going. "We are ready to issue building permits – this afternoon. We have two sites, everything is ready. All we would need is a request for a building permit," boasted Fremont City Manager, Kent McClain.

San Jose officials reacted with skepticism to their new competitors, saying the offer to cut red tape amounts to little more than hype, considering the fact that US Memories hasn't even begun to design its chip facility.

Test instruments? NOTHING BUT THE BEST!

High Performance - Low Cost!

Digital Multimeter

The DSE Q-1440 Digital Multimeter proves that great performance doesn't have to cost the earth. With features and specifications worthy of many digitals costing much more. Latest IC technology is used to achieve the lowest possible component count - ensuring reliability, accuracy, and stability. It's durable and easy to handle. Includes fully shrouded probes for maximum safety. Requires only one 9V battery.

- DCV: 2, 20, 200, 1000 V
- ACV: 200, 500 V
- Current: 2, 20, 200mA (AC or DC)
- Res: 2k, 20k, 200k, 2Mohms
- Diode & Transistor check

Cat Q-1440

Bargain!

$49.95

Temperature To Voltage

Converter

It's ideal for service people, industrial electricians, schools, labs.....anyone who works with heat, heat exchange, etc! Used in conjunction with a voltmeter (multimeter) accurate temperature readings can be taken from -50°C to 1300°C or -58°F to 2372°F. Unit is powered by a 9V battery, fits easily in one hand and comes with bead type thermocouple on 4ft lead and banana plug connectors.

Specification:
Measures: -50°C to 1300°C
-58°F to 2372°F
Resolution: 0.1°C/F at 200V range
1°C/F at 2V range
Maximum Voltage at Thermocouple
Input: 60VDC or 24VAC
Cat Q-1430

$59.95

Superb Performance!

6.5MHz CRO

Here's a great one for the workbench at home, etc! We all know a good oscilloscope is probably the most useful piece of test gear you can own. Not only is it good value, but it offers some surprising features as well. Including retrace blanking for a clearer display, internal or external sync and usable response to beyond 6.5MHz. Low drift and quick warm-up make it perfect for service work, around the shack, in the class room, etc.

Specifications:
Vertical bandwidth: DC to 6.5MHz (-3dB)
Attenuator: 1/1, 1/10, 1/100 and ground
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Timebase: 10Hz to 100kHz
Sync: External or internal
Input Impedance: 1 Meg/35pF
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All the features an electrician needs. With a huge 21mm LCD display, pushbutton switches for mode and function selection, full range of measurements including AC/DC volts & Amps, resistance, diode, continuity and frequency. Features audible continuity test, auto ranging on DC, over range indicator, data hold, etc, etc. Plus it's shock resistant and fully sealed against water and dust.

3999 COUNT!

Ranges -
DCV: 400mV, 4, 40, 400 (9M ohm Imp)
ACV: 400, 700
Current (AC/DC): 4mA, 40mA, 400mA, 2A, 20A
Resistance: 4K, 40K, 400K, 4M (ohm)
Frequency Counter: 4KHz, 20KHz (>1%)
Max volt. for freq.: 250V AC
Continuity: Buzzer
(threshold approx 1.7K ohm)
Cat Q-1524

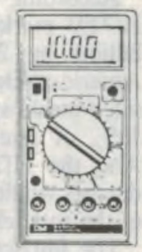
$129

Digital & Bargraph!

3.5 Digit Multimeter

A fantastic all rounder for hobbyists, technician and service people alike. Both digital and bargraph displays gives you the best of both worlds. Large 30 position rotary dial for function and range selection makes it quick and easy to use. Superb features include automatic overload indication, high surge voltage protection (1.5KV -3KV), capacitance measurement, diode and continuity, transistor hFE test and frequency measurement.

Ranges -
DCV: 200mV, 2V, 20V, 200V, 1000V
ACV: 200mV, 2V, 20V, 200V, 750V
DC Current: 200uA, 2mA, 200mA, 20A
AC Current: 2mA, 200mA, 20A
Resist: 200, 2K, 20K, 2M, 20M (ohm)
Diode Check: 2.8V @ 1mA
Frequ. Count: 20KHz, 200Khz
Capacitance: 2000pF, 200nF, 20uF
Cat Q-1526



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Invaluable!

AC Voltage Finder

A essential piece of test equipment for anyone working with AC current. It senses magnetic field so it's the safest way to work - there's no connection to the cable under test. Senses any current above 60 volts (approx.) and gives visual and audible indication. It can detect the difference between active and neutral/earth. Fits neatly in the pocket and comes with pocket clip. Powered by 2 x G13 batteries. Also fantastic for finding breaks in cables.
Cat Q-1530

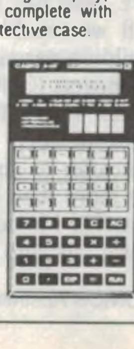
$13.95

Essential Equipment!

Electronics/Electrical Formula Calculator

The incredible Casio fx-61f is, without doubt, one of the most useful tools anyone working with electronics could have. Makes electrical/electronics calculations a breeze with 27 of the most used electronics formulas built-in: resonance frequency, impedance, voltage/current gain...everything!

Includes 74 scientific functions, 10 digit display, programming functions and comes complete with comprehensive manual and soft protective case.
Cat V-3828

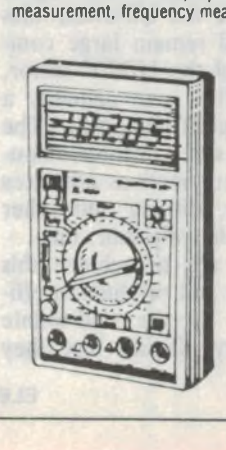


Just $79.95

It's Got The Lot!

4.5 Digit Multimeter

Superb features, high accuracy and rugged reliability make this the pick of the bunch. A beautiful piece of equipment, it's ideal for the serious minded hobbyist or technician. The easy to read 15mm high contrast LCD display and data hold function makes service, repair and test work quick and easy. With capacitance measurement, diode testing, transistor measurement, frequency measurement, data hold, 4.5 digit accuracy plus rugged construction for a trouble free life.



$199

Ranges:
DCV: 200mV, 2V, 20, 200, 1000
ACV: 200mV, 2V, 20, 200, 750
DC Current: 200uA, 2mA, 200mA, 20A
AC Current: 2mA, 200mA, 20A
Resistance: 200, 2K, 20K, 200K, 2M, 20M (ohm)
Frequency Counter: 20KHz, 200KHz
Capacitance: 2000pF, 200nF, 20uF
Cat Q-1528

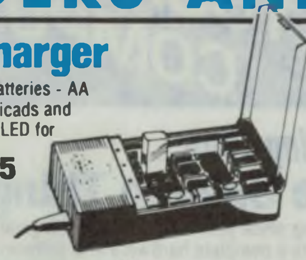
DICK SMITH ELECTRONICS

CHARGERS AND POWER SUPPLIES

Slimline Battery Charger

Designed to change the two most popular batteries - AA and 9 volt. Can charge up 6 penlight (AA) Nicads and IX Volt batteries at once. Includes indicator LED for each cell. Cat M-9508

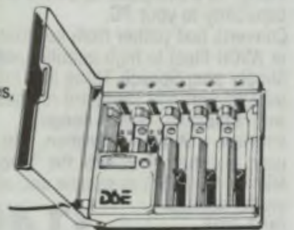
$22.95



Bargain Nicad Charger

A great way to save money on batteries and make sure you've always got power when you need it! The DSE Changing Cabinet charges all the most common batteries, up to 8 at once, in any combination - AAA, AA, C, D & 9 Volt. It is mains operated and comes with built-in test meter.
Cat M-9505

Only $39.95



High Capacity Nicad Charger

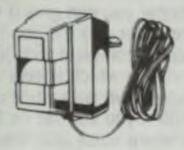
Same great features as the charging cabinet above, except this one is for high capacity NiCads - 600mAh AA, 1.8 & 2Ah C and 4Ah D cells. Does not have test meter. Cat M-9506

$39.95

Nicad Charger

Most chargers these days allows for an external charger to be plugged into charge Nicads (usually a 2.5mm socket). This charger is ideal for all Nicad packs from 6 to 10 cells (i.e. 7.2 to 12 Volts).
Cat M-9517

$17.95



Nicad Batteries

You won't be short on battery power when you need it with these great value NiCads. Just think about the money and waste you'll save.

Type		Cat No.	Price
AAA	180mAh	S-3305	$3.95
AA	0.5Ah	S-3300	$3.95
C	1.2Ah	S-3301	$9.95
D	1.2Ah	S-3303	$9.95
9V	Full Output!	S-3308	$19.95

12V @ 1 Amp Convertor

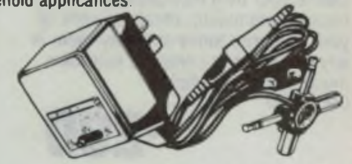
Perfect around the workshop or home. Simply plugs into the AC socket and gives 12V @ 1 amp. Comes complete with battery nap connector and 4-way connector. Cat M-9570

$24.95

Versatile Power Supply

The ideal power supply to have around the house. Select any one of six voltages - 3, 4.5, 6, 7.5, 9 & 12V (@300mA) covers most household applicances.
Cat M-9526

$18.95



3,6,9, 12V DC @ 1 Amp

This one is not only good for the home, but also perfect for the workbench. With DC connections via screw terminals on front of unit of easy connection and disconnection. Ideal for alarm systems, intercoms etc.
Cat M-9530

Only $29.95

3,6,9V @ 200mA

Here's a great way to save money on batteries. Three of the most used voltages makes it ideal for a huge range of battery powered equipment.
Cat M-9525

Just $17.95

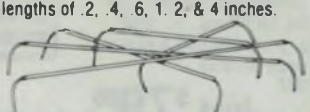
SOCKETED BREADBOARDS

Ideal for designing/tesing your own circuits ideas, etc. High quality breadboards which can be paralleled for larger circuits. Laid our in alpha-numeric format for easy track identification.

Jumpwire Pack

The fast, easy way to make your breadboard connections. Handy pack with 100 pieces of colour coded, insulated wire. Ends are bent for convenient installation. Wire is 22AWG and in lengths of .2, .4, .6, 1. 2, & 4 inches.
Cat H-4014

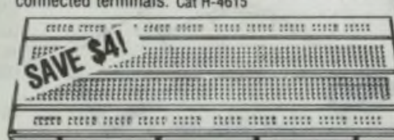
$5.95



Large 178 x 67mm Board

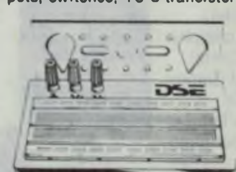
With 128 groups of terminal points, 8 bus lines and 25 connected terminals. Cat H-4615

$15.95



With Panel!

Same size as above but with panel which allows mounting of pots, switches, TO-3 transistors, etc. Cat H-4617



SAVE $6

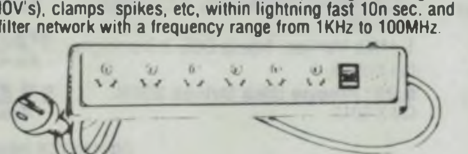
Just $19.95 ea

MAINS POWER ADAPTORS

Protect Your Equipment! 6-Way Power Safe

The best and most economical way to protect your valuable computer, hi-fi, video equipment, etc from dangerous power spikes and surges! 'Power Safe' could save you a fortune in repair or replacement costs. With built-in circuit breaker, master switch with pilot light, voltage surge/spike protection (uses MOV's), clamps spikes, etc, within lightning fast 10n sec. and incorporates a noise rejection filter network with a frequency range from 1KHz to 100MHz.
Cat P-5618

$59.95



Super Convertor

240 volt to 110 volt (1650W) convertor for operating foreign equipment from Australian mains. Suitable for hair dryers, shavers...anything with an electric motor. Not suitable for hi-fi, computers (solid state) equipment. Cat P-5653

Only 500 Available

$69.95

Aussie Reverse Adaptor

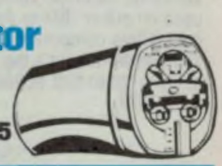
For use in Australia. Adapts 3-pin Australian mains sockets to accept plugs form Europe, America, Japan, etc. Does not adapt voltage so rating must be compatible. With multiple earth pins for new overseas systems.
Cat P-5655

$8.95

International Mains Adaptor

Adapts just about any mains plug to our 3-pin plug and vice-versa! Uses active/neutral pins only— does not connect earth. An essential piece of equipment for anyone who's travelling. (Does not adapt voltage). Cat P-5652

$24.95



DICK SMITH ELECTRONICS

LOOK WHAT YOUR COMPUTER CAN DO!

Play Music!

Creative Music System

The Creative Music Synthesizer card simply plugs into your IBM compatible and allows you create your own stereo sounds. With 12 channels (Voices), stereo output, 32 preset instruments and a stereo amplifier to drive speakers, headphones, etc.

Define your own instruments, play background music, create albums of your favourite tunes and play them in any sequence or compose your own music...it's fantastic!

Cat X-2020

$299

Talking With...

The Speech Thing

How long since your computer's had a good conversation? "Speech Thing" is a complete hardware and software package which adds sound capability to your PC.

Converts text (either from keyboard or ASCII files) to high quality speech. Simply plug Speech Thing into the parallel port and keyboard (comes with adaptors) - and it doesn't interfere with their operation. Can be used in conjunction with the 'Voice Master' (X-2038) to sample and edit digital sounds.

Cat X-2036

$149

IBM AT Compatible 80286 Motherboard

Building your own computer or upgrading the old one? Our new 12MHz motherboard is the way to go for the ultimate computing power. DRAM not included.

Look....

• Expandable to 1Mb using 256K chips • Expandable to 4Mb using 1Mb DRAM chips • Keyboard or hardware selectable 8/12MHz operation • Six 16-Bit and Two 8-Bit expansion slots. • Selectable for RAM speed - 80 or 100 nanosecond • Selectable from 0 wait states on read operations (with 80 nanosecond RAM) • Socketed for 80287 Co-processor • Performance - 13.7 using Norton S.I. • Battery backed real time clock on board • AMI Bios ROM's included • 0K RAM supplied

Cat X-1002

$499

Tell It What to do!

Voice Master

How often have you wanted to tell your computer what to do? With Voice Master you can give it verbal commands. You want DOS? Just TELL the computer and it'll get it for you.

Comes complete with headset and software which allows you to experiment with voice recognition. With it you can set up to 256 different voice activated keyboard macros. Installation requires an 8-bit expansion slot. The perfect match for "Speech Thing"!

Cat X-2038

$199

RS-232 Multilink Adaptor

A complete in-line tester/ adaptor which makes complex and time consuming Serial connections a breeze! Comes fitted with 25 pin male connector and 25 pin female connector. With jumper pads and wires, 24 in-line switches and 8 bicolour LED's which monitor the lines and tell you at a glance when you've got it right.

Cat X-2654

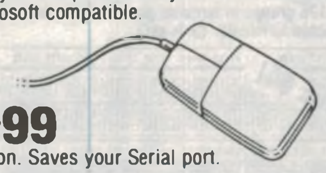
$49.95

With Dr Halo!

Bargain Super Mouse

Outstanding quality at a bargain price! Plugs into any serial port and comes with 9-25 pin adaptor. Complete with set-up disk, drivers, manual, Dr Halo paint program, mouse Pad and 'mouse house' so you can pack it away when not in use. Fully Microsoft compatible.

Cat X-3805



Only $99

Bus Version. Saves your Serial port.

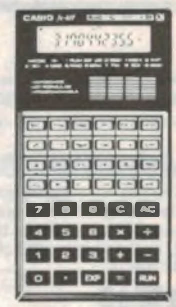
Cat X-3806 **$129**

With Electronics/ Electrical Formula!

Casio fx-61f Calculator

It's one of the most useful tools anyone working with electronics could have. With 27 of the most used electronics formulas built-in! Resonance frequency, impedance, voltage/current gain...everything! Includes 74 scientific functions, 10 digit display, programming functions ....it's unbelievable.

Cat V-3828



Just $79.95

Arcade Quality!

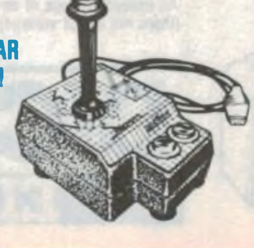
Commodore/Atari Joystick

It's almost indestructible! Uses microswitches for the ultimate in speed and reliability. With twin fire buttons.

It uses the same mechanism they use in arcade machines...so you can be sure it's built to last...and last..and....!

Cat X-3831

WITH 3 YEAR WARRANTY!



$54.95

Quality Disk Drives

Easy to install in any IBM compatible! Great value half height floppy disk drives in all of the available configurations. Can be installed as an internal drive or externally (with optional case.)

3.5" Disk Drives

720K Version. Needs DOS 3.2 or higher. **$249**

Cat X-2220

1.44Mb Version. Needs DOS 3.3 or higher. **$299**

Cat X-2221

5.25" Floppy Disk Drives 360K **$199**

Cat X-8012

IBM/Apple Joystick

Versatile, fantastic value and it can be used on either IBM or Apple II compatible computers. Lightweight and comfortable it's the best way to get into those fast action games.

Cat X-3570

Just $39.95

COMPUTER PROBLEMS? Call our exclusive **COMPUTER HOTLINE** on (02) 888 2002 for the solution!

DICK SMITH ELECTRONICS

COMMUNICATIONS MADE EASY!

Bargain AM CB

An exceptional value AM CB that's now even better value -you get a FREE mobile antenna! Quality construction and reliability are built in. Intended for mobile use it comes with mounting hardware and microphone. With optional power supply it can even be used as a base station.

Features:
- Compact (Only 160 X 44 X 122mm)
- All 40 channels
- Maximum legal power
- Built-in noise limiter
- Digital channel readout & power/strength indicators
- Easy to operate

Cat D-1450

Just **$89**

Bargain Marine Transceiver

The incredible 'Sea Simba' 12 AM marine transceiver is perfect for coastal boating. Superb quality and reliability are built in with features you'd only expect on models costing $$$ more.

With 12 channels (10 fitted) in the 27MHz marine band, automatic noise limiter, PA and extension speaker jacks, LED level indicators and channel readout plus RF and Mic gain controls. Comes complete with mounting hardware and microphone.
Cat D-1718

Just **$139**

Extra Range With SSB!
Super Tomcat SSB CB

The sensation Super Tomcat AM SSB mobile CB comes at an incredible low price yet sports some astounding features! With maximum legal power on both AM and SSB, all 40 channels, the extra range and performance SSB offers.... and, with optional power supply, it can even double as a base station! It's easy to operate with LED power/strength meter, RF gain control, clarifier, PA facility, automatic noise limiter and more. Comes complete with mounting hardware, microphone and full instructions.
Cat D-1713

Now Just **$199!**

Latest 1990 Edition!
WIA Radio Amateur Callbook

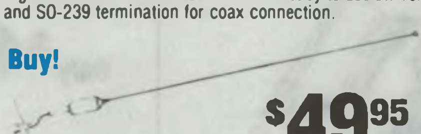
The lastest and most complete listing from all around Australia. In easy to follow, state by state order. Covers call sign suffixes, shortwave and Department of Transport & Communications information.
Cat B-2331

$9.90

Marine Antenna

Our most popular 27MHz marine antenna! It's ground independent so it doesn't require a ground plane for proper operation which makes it ideal for wood, fibreglass and cement boats. Features an easy to use swivel deck mount and SO-239 termination for coax connection.
Cat D-4069

A great Buy!



$49.95

With direction finder!
Quality Multiband radio

A great one for the keen radio listener, or the boat owner who wants to know where he is! A superb radio with 6 bands including all 40 CB channels, shortwave and VHF. Plus there's a built-in direction finder to help plot your position against AM radio stations. A variable BFO also allows reception of SSB marine signals. AC/DC operation and, with on optional mic, it doubles as a PA amplifier. Comes with manual and SW listening guide.
Cat D-2832

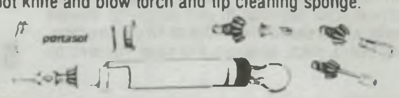
Only **$149**

MORE GREAT TOOLS!

Gas Powered!
Professional 'Pocket' Soldering System

Perfect for when you're out in the field or for those spot repair jobs. The complete portable soldering kit from Portasol. Comes in handy plastic carry case, you get butane powered soldering iron giving the equivalent of 10-60 watts and temperature adjustment up to 400 degrees Celsius, 4 tips including hot knife and blow torch and tip cleaning sponge.
Cat T-1374

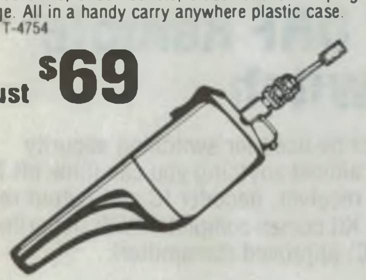
$99



Perfect For PCB Work!
Arlec Supertool

Working with PCB's can be incredibly frustrating and time consuming. The Arlec Supertool takes car of just about everything. It sands, it polishes, it drills, it engraves, it mills.... you name it. Comes complete with wire brush, milling cutters, grinding wheel, high speed drills, chuck collets, eraser sticks and plug page. All in a handy carry anywhere plastic case.
Cat T-4754

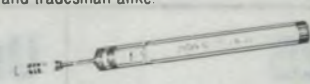
Just **$69**



Economy Pencil Blowtorch

Great for heatsink work, silver soldering, gold, brazing, glass work, etc. Fits in the pocket and it's powered by butane gas. Amazing value it's the ideal tool for handyman and tradesman alike.
Cat T-1380

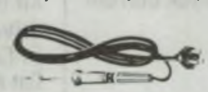
$14.95



15 Watt Hobby Iron

Mains powered, general purpose iron that ideal for project building, service and other low heat applications. Rated at 15 watts it saves cooking components in PCB work. It's well balanced to help make work easier and made by Weller so you can rely on the quality.
Cat T-1310

$29.95

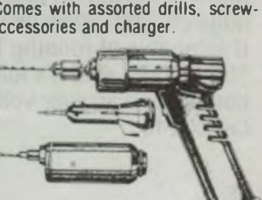


Incredibly Versatile!
3-In-1 Modular Tool System

- **IT'S A DRILL**
- **IT'S A SOLDERING IRON**
- **IT'S A SCREWDRIVER**
- **IT'S RECHARGEABLE**

You won't find a more useful tool for the home or workshop. The incredible 3-in-1 does it all. Modular components snap onto the rechargeable battery pack (pistol grip handle) and in seconds it converts to the tool you need. Comes with assorted drills, screwdrivers, solder accessories and charger.
Cat T-5712

$99



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ALL MAJOR CREDIT CARDS ACCEPTED. O/NITE COURIER AVAILABLE.
24 HOUR DESPATCH OF ALL ORDERS

DICK SMITH ELECTRONICS

ALL NEW KITS NOW AVAILABLE

Simple FM Transmitter For The 2M Band

The first in a great new series of easy to build projects for the amateur radio enthusiast. It's designed to make setting up and construction easier so the novice can more readily follow the operation and therefore gain more confidence in its use.

The solid state NBFM transmitter module produces over 1 Watt at 144MHz. The operation is simple where the signal from a microphone is amplified to form a modulation input of a variable-frequency crystal oscillator. The oscillator frequency, around 24MHz, is multiplied in two stages, first a tripler... then a doubler to 144MHz. The resulting signal is amplified through several stages before being fed to an antenna. Short form kit contains components and PCB.
Cat K-6010

$59.50

Short Form Kit: Contains PCB & Components

Improved Light Chaser

It's miles ahead of previous models! Our new Light Chaser is low in cost, easy to build, incredibly flexible and it's designed with safety in mind.

Providing 6 different chasing patterns, 8 speeds, an enhanced front-panel monitor display and the ability to run lamps to a total of 2400 watts. When the design was first conceived by the our R & D Department safety was considered paramount, so it was decided the best way to achieve this was to build a 'dedicated' chaser. This also allows many more functions to be incorporated without getting into complex construction techniques. Comes complete (full form), right down to the last bolt!
Cat K-3161

$99

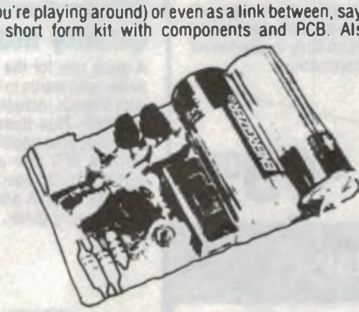
Incredibly Small!

FM Wireless Microphone

This one is great! The FM Wireless Microphone is small enough to be inserted into a matchbox, can be tuned to operate at around 90MHz (On your FM receiver), incredibly stable, extremely sensitive circuitry and relatively easy to build. It's fantastic!

You can use it as a bug (when you're playing around) or even as a link between, say, workshop and house, etc. Comes as a short form kit with components and PCB. Also includes batteries.
Cat K-5006

$16.95

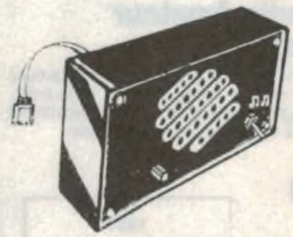


With BONUS Christmas Chip!

Melody Door Bell

Put an end to that boring old doorbell and build yourself the incredible Melody Door Bell. You can select between 3 instruments and any one of 16 melodies... or even a different melody each time the bell is rung. Kit comes complete including housing and pre-punched, silk-screened panel. It's easy to assemble and runs on 2 x AA batteries that will last for ages.
Cat K-2726

Only $49.95



CHRISTMAS BONUS: Buy this month and you'll get an extra chip just brimming with great Christmas tunes! Just send us proof of purchase and we'll post it to you... FREE!

Communications On & Between Bikes!

FM Radio Intercom For Motor Bikes

This has to be the best device for motorcycles since they replaced horseshoes with wheels! A true FM intercom which allows communication between passenger and rider as well as between bikes. Not only that, but it also doubles as an FM receiver for your favourite radio station.

The transmitter and receiver are housed in a small case which fits in the jacket pocket. The speakers and microphones are fitted in the helmet. As well, the microphone is voice activated to save switching. Beware though, it is not easy to build and is best tackled by someone with a sound knowledge of kit construction. Comes complete - ready to assemble with all components, board, mics, speakers and case. Powered by three penlight batteries (not included).
Cat K-6020

$79.95

NEW KITS SOON TO BE RELEASED

VK Powermate 25

The perfect kit for amateurs with all the grunt you need the get the most out of your shack. A high power 13.8DC supply giving a huge 25 amp continuous current rating with a peak of 35 amps. It's capable of running transmitters and amplifiers in the 100-150W class. And it's fully protected with both foldback current limiting and an over voltage crowbar circuit.
Cat K-3210

Short Form Only: Includes PCB and Components

Universal UHF Remote Control Switch

It's easy to build and can be used for switching security systems, lights, doors... almost anything you can think of! The kit consists of a 30mHz receiver, decoder IC and output relay driver on a single board. Kit comes complete. With Department Of Communications (DOC) approved transmitter!
Cat K-3258

DICK SMITH ELECTRONICS

The Widest Range And Best Prices On....

SHORTFORM Kits & kit BiTS

Here's a great way to get that project you've thinking about. . . up and running. Shortform kits which can easily be adapted to fit that special application you've had in mind, or you can build them as they were intended. All come with instructions and PCB's, some have complete hardware including cases, heatsinks, etc. But there are no components. Hurry stocks are limited!

HF Transceiver

A great one for the amateur! Comes complete with....

- Counter PCB
- Main PCB
- Front and Rear Panel
- Heatsink and plate
- Instructions

Cat K-9528

$49.95

200W HF Linear Amplifier

Comes complete with...

- Booster PCB
- Filter PCB
- Front and Rear panels
- Heatsink and cover
- Instructions

Cat K-9529

ONLY $99

Series 200 Amplifier

It was one of our most popular kits and now you've got the opportunity to build it the way you wanted. Comes with...

- Main PCB
- Control PCB
- Front and Rear panels
- Top and Bottom plates
- Brackets to hold Caps and power supply
- Instructions

Cat K-9500

Bargain! $129

Transmitter And Receiver!
8 Channel Infrared Remote Controller

A remote control for the TV, CD, VCR, mains powered appliances, etc, etc. Can control up to 8 functions. You get....

- Receiver PCB's (part A & B)
- Receiver front panel
- Transmitter front panel
- Transmitter PCB's (Part A & B)
- Instructions

Cat K-9532

Value Plus! $39.95

It's A Bargain!
PCB Pack

Here's a fantastic buy that makes great sense for the bits box. Pack come with 10 or more assorted PCB's. there are all sorts and sizes from small to large. There are no instructions with these but you'll find plenty of useful and time saving applications. At this great low price you'd pay for them is you only used one!

Cat K-9553

Extra Value! $12.95

Available through Mail Orders or, order through your nearest Dick Smith Electronics Store.

AND THERE ARE PLENTY MORE!

Description	Cat No.	Price
Fluro Starter	K-9501	$0.99
Musicolour Mk4	K-9502	$19.95
Deluxe Car Alarm	K-9503	$9.95
Car Alarm Mk2	K-9504	$4.99
Negative Ion Generator	K-9505	$5.99
Home Alarm	K-9506	$19.95
Infrared Red Controller	K-9507	$9.95
Infrared Red Remote Switch	K-9508	$9.95
60 Watt Mosfet Amp Module	K-9509	$19.95
RLC Bridge	K-9510	$2.99
Audio Oscillator	K-9511	$2.99
Graphic Equaliser	K-9514	$19.95
Low Cost Amp	K-9512	$19.95
I/R Stereo Head Phones	K-9516	$9.95
UHF FM Power Amplifier	K-9519	$12.50

Description	Cat No.	Price
VHF Gasfet Pre-amp	K-9523	$9.95
UHF Wattmeter	K-9524	$5.99
VHF Power Supply	K-9525	$39.95
RF Attenuator Box	K-9527	$29.95
6 Mtr Booster Amplifer	K-9530	$29.95
Radio Direction Finder	K-9531	$19.95
Signal Tracer/Bench Amp	K-9536	$8.95
Mega Fast Charger	K-9538	$5.95
Morse RTTY Decoder	K-9541	$19.95
Meter 200uA (No Panel)	K-9550	$12.95
Pre-punched extruded case	K-9552	$9.95
Heatsink & Cover Suit	K-9554	$39.95
Assorted Heatsinks & Brackets	K-9555	$19.95
Heatsinks suit 2 x To-3	K-9557	$5.95
Plastic cases suit V2 200 Decodes	K-9558	$2.99

Some components for these kits may not be available from Dick Smith Electronics stores. So you may have to source them elsewhere. . . or who knows(?), they may be hanging around in your workshop right now!

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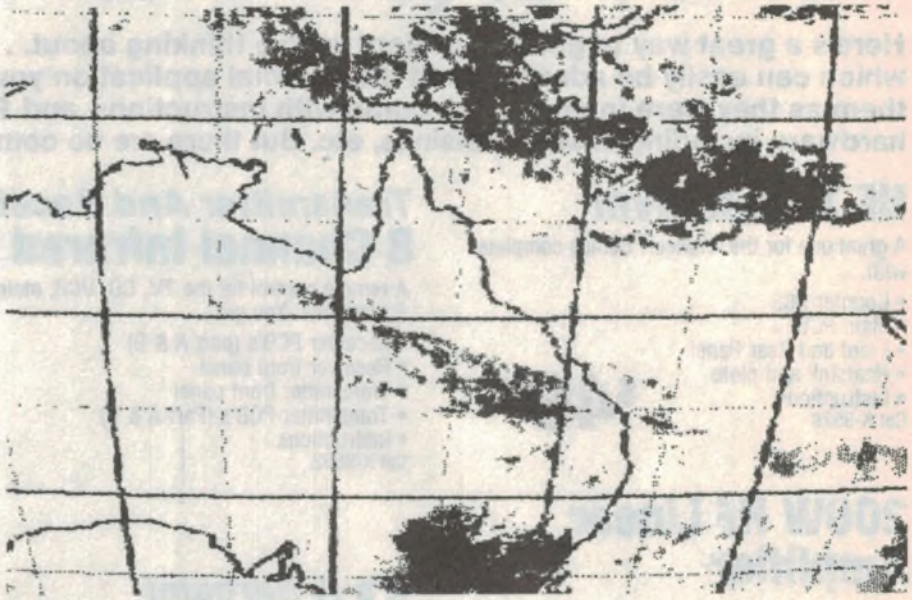
'Dick Smith Electronics - Still Full of Surprises'

News Highlights

System receives weather images



A low cost system to receive weather images from both geostationary and orbiting satellites, based on a PC/AT compatible personal computer, has been developed locally by long-established Australian firm Paris Radio Electronics, of Sydney.

The system has been designed for use in flight planning by airlines, for military authorities in planning exercises, sailing clubs preparing for ocean races, for hazard prediction by offshore oil exploration platforms, educational institutions and any other users who need accurate weather information.

The full system consists of a 1.8m satellite receiving dish, a high gain GaAsFET preamp/downconverter, a 137.5MHz receiver, a microcomputer-based scan converter/interface unit and the PC/AT computer system complete with colour ink-jet printer. The software which processes the image data has been fully designed and written locally by Paris Radio, using a combination of C and assembly languages to achieve high speed.

High-resolution images from the satellites are processed automatically, and can be stored on disk and printed out in colour as well as being displayed on the VGA (or EGA) screen. The images can also be transmitted to similar systems over land lines, using appropriate modems.

Special features of the system include high resolution 1024 x 768 pixel images with 16 gradations, a choice of 8 different colour palettes, area zooming capability, animated time-lapse display capability (requires 4Mb memory), entire hemisphere coverage, temperature/colour interpretation and the ability to overlay flight routes to airline specifications.

The Metsat system is available not only in complete turn-key form, but also as modules for users with an existing PC/AT computer and/or satellite or aircraft band receiving system. The most basic module consists of the scan converter/interface unit plus PC software package, and sells for around $2000.

Further information is available from Paris Radio Electronics, 161 Bunnerong Road, Kingsford 2032, or phone (02) 344 9111.

British Telecom opens R&D facility in Parramatta

British Telecom Australia has opened a research and development facility at Parramatta, in NSW.

The new $2 million centre boasts the latest in development systems and tools and has intellectual access to core research already undertaken in British Telecom research laboratories in England and Canada.

General Manager of British Telecom Australia, Peter Hutton, said British Telecom had planned to establish a research and development facility in NSW at the appropriate time.

"Our organic approach to the commercial environment and underlying financial strength has allowed us to bring forward our plans to meet the rules of the New Industry Development Arrangements (NIDA)," he said.

Sharp develops wallet-sized ECG

Many people are growing more aware of and concerned about their heart conditions.

In the past, it was necessary to visit a hospital to closely monitor one's heart condition. But things are changing rapidly, and Sharp Corporation of Japan soon plans to release a wallet-size personal electrocardiograph.

Sharp has been actively developing this system in cooperation with Osaka University's Department of Medicine. The system is compact and easy for heart patients to carry for continuous long-term monitoring of abnormal heart conditions. In addition, a large liquid crystal display makes it easy to access information quickly.

Sharp's personal electrocardiograph is claimed to be highly reliable and its data provides accurate indepth diagnosis. An IC card system even enables easy integration with analog electrocardiographs for printouts and with personal computers for storage and processing of data.

The personal electrocardiogram is still undergoing clinical testing. Once it is approved by the Japanese Ministry of Health and Welfare, production and marketing will immediately begin in the Japanese market.

New colour copier interfaces with video, computers

The new Canon CLD-500 colour laser copier not only produces better copies than its predecessor, the CLC-1, but has the ability to interface with video equipment and computers.

For example, it can lift an image from a video clip and reproduce it as a colour copy or as part of other artwork.

The ability to interface has major implications for the future of desktop publishing. Canon is to offer an option that will enable the CLC-500 to produce colour separations for offset printing.

Much will depend on software under development. For the present, the machine will appeal to a variety of businesses for the range of new features it introduces, like overlaying text on colour images, varying colours, creating mirror images, adding contours for font outlines and adding texture to images.

Like the CLC-1, the CLC-500 is a computerised design system with a scanner and central processing unit that converts images to digital information allowing image manipulation.

It will edit, zoom, change shapes or colours, print from a transparency, and

even blow up an image by 400% to make a poster for display purposes – all at the rate of five full-colour copies a minute.

As image quality is a high priority in the colour market, the CLC-500 offers improved imaging with 256 colour gradations compared with the 64 gradations of the CLC-1, resulting in copies which are virtually indistinguishable from the original.

It will reproduce crisp black text, using black tones even when combined with colour images – a feature which Canon says is offered by no other colour copier.

News Briefs

- Melbourne-based communications equipment specialist ***Vicom Australia*** has been appointed an Australia-wide distributor for Bird Electronics of the USA. Bird's RF test instruments are well known, especially the model 43 'Thruline' coaxial directional wattmeter.
- The electroluminescent flat-panel displays made by Planar Systems are now being distributed nationally by electronics distributor ***Amtex Electronics***.
- Jeremy Smith, previously NSW wholesale manager for Dick Smith Electronics, and later a buyer for the same company, has launched his own company: ***Board Solutions***. Specialising in add-on boards for PC's, the new firm's address is PO Box 1120, Lane Cove 2066 or phone (02) 906 5696.
- Electronic and electrical test equipment supplier ***Parameters*** has been acquired by ***Nilsen Instruments***. For the time being, Parameters will continue to operate from its existing locations.
- Recently-formed equipment renter ***Instrumentation and Computer Rentals*** (ICR) has established an office in Perth. The new office is at Unit 7, 290 McDonald Street, Yokine 6060, phone (09) 242 4181.
- Scada Corporation of the USA has appointed Brisbane-based ***Energy Control International*** as its sole agent for Australia. Scada specialises in the design and development of real-time data acquisition and control systems based on the PC AT 286/386 running PolyForth.
- North American telecomms manufacturer ***Northern Telecom*** has become the 17th corporation to join the Federal Government's Partnerships for Development Program. As part of the agreement, NT is to establish a centre in Australia, to provide technical, marketing, training, documentation and specialised business support for the Asia/Pacific region.
- ***CIMA Electronics***, of Oakleigh Victoria has been registered by the Industry Research and Development Board as a registered Research Agency. Contract R&D performed by CIMA may therefore be eligible for the 150% tax concession.

AUSSAT demonstrates MOBILESAT

AUSSAT has demonstrated MOBILESAT, which it claims is the world's most advanced mobile satellite technology, to Australia's communication consultants.

MOBILESAT is planned to be fully operational after the launch of AUSSAT's next generation of satellites in 1991 and 1992, although the two-way data remote monitoring service will be available in 1990 using the INMARSAT satellites.

Using L band frequency, the fully operational service will enable the provision of voice and data services, such as mobile phone and paging services direct via satellite with moving cars, aircraft, ships and trucks – across the entire Australian continent and neighbouring waters. Mobile satellite terminals for vehicles will consist of a 'frisbee' shaped antenna on the roof, with in-vehicle equipment similar to current cellular phones.

Philips videophone demonstrated at Auscom

Philips demonstrated its German-developed videophone at Auscom'89, at the National Convention Centre, Canberra, in late September.

The Philips ISDN videophone is part of the latest generation of colour videophones which include a graphics and text accessory.

The videophone allows for obvious gains in productivity and is able ot transmit a quality colour visual of each caller. The additional connection of a graphics camera and monitor also makes it possible to send pictures of sketches and three-dimensional objects to another party in order to supplement visual impact and enhance understanding of the message to be communicated.

A printer can also be connected, to provide a fast copy of the screen's display so that each end receives a copy of the documents from the discussion.

News Highlights

New Philips mobile uses SMT

Philips has released its latest mobile radio – the first designed in Australia for construction by computer controlled surface mount assembly (SMA) techniques.

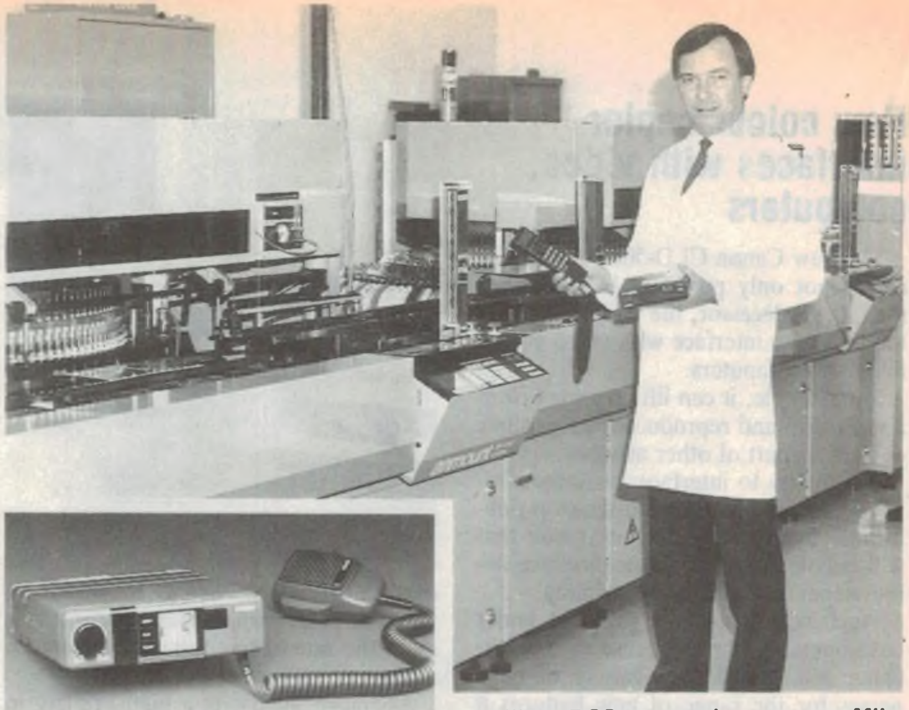
This new radio, the PRM80, is almost 'wire less' – 98% of its components are placed into its circuit board by a $2 million SMA assembly line at Philips Radio Communication Systems, in Clayton, Victoria.

The advantage of SMA is the extreme accuracy of the placement of each component into the circuit, with outstanding reliability. No other Australian company in radio communications has made such an enormous investment in this latest manufacturing method, according to Philips.

The SMA line, which can position and affix 15,000 components per hour is now working two full shifts a day, reports Clayton manufacturing manager, Geoff Syms.

A small scale SMA operation began at Clayton 18 months ago, for the placement of a limited range of components. At one placement every three seconds, this equipment was thought to be outstandingly fast – until the new 15-metre long Avimount SMA assembly line began operating.

Tim Conboy, engineering manager, who is responsible for the work of more than 70 software and hardware engineers in Philips RCS Research & Development Department, says that the PRM80 already had 40 man-years of engineering behind it when its first circuit boards were automatically lifted into the SMA line.



Philips RCS general manager Mike Tester alongside the SMA line.

A second $1 million computer controlled line, complete with a reflow oven for soldering, has just been installed and is about to commence operation in the same clean air production room. This brings the total SMA capacity to over 60 million component placements per year. Additional new radio communication products are moving into this SMA area, which is believed to be the only SMA facility of its size in Australia.

AWAM/Quest develop ASIC Designers Kit

A joint development project undertaken by AWA MicroElectronics (AWAM) and QUEST International Computers, now makes it possible for customers wishing to use AWAM's Application Specific Integrated Circuit (ASIC) facility in Sydney to complete the schematic design and basic logic simulation using the P-CAD PC-based CAE system.

Until now only the more expensive workstation systems were able to cope with the demands of ASIC design and simulation. The new 'ASIC Designers Kit,' to be makreted by Quest as a part of their range of P-CAD electronics design software, brings standard cell ASIC design within the reach of companies who choose to carry out their circuit development projects on the more cost-effective IBM type personal computers.

The kit consists of Master Schematic, the schematic capture module from P-CAD, a Standard Cell Component Library and a Netlist Translater. Together these can provide the input information for AWAM's new $35 million 1.5 micron ASIC design and manufacturing facility in Sydney. The ASIC designers kit can also be supplied with the optional P-CAD logic simulator, PC-LOGS for users wishing to retain control of the total design stage in house.

A typical ASIC design project including, say, 10,000 gates would involve designing the circuit on Master Schematic using the full range of AWAM's 1.5 micron standard cells, performing functional and timing simulations using PC-LOGS, fine tuning the design and resimulating the results until the design criteria are fully satisfied. The design database created by P-CAD can then be passed through the Netlist Translator and transmitted to AWAM for ASIC preparation and manufacture.

If required AWAM can accept this information via modem, thus minimising the turnaround time for a project – often critical when getting a new product to market.

The ASIC Designers Kit will sell for under $8000, including the ASIC logic simulator, PC-LOGS. Even if the cost of PC hardware is added, this represents remarkable value for money.

Quest can be contacted by phoning Melbourne on (03) 807 7444 or Sydney on (02) 809 7499.

Siemens to supply TWT's to Aussat

After lengthy negotiations, Siemens has become a supplier to Aussat of high power travelling wave tubes.

The first order for two TWT's (type YH1421) has been received. Aussat's expected requirement of approximately 20 tubes per year would mean a business volume of about $1 million.

The TWT's produce an output power of 700 watts in the 14GHz frequency range. Very few companies in the world are capable of producing these high power tubes.

A sample tube was supplied to Aussat in November last year and has been in service since, logging some 6000 hours of operation.

Keck telescope on target

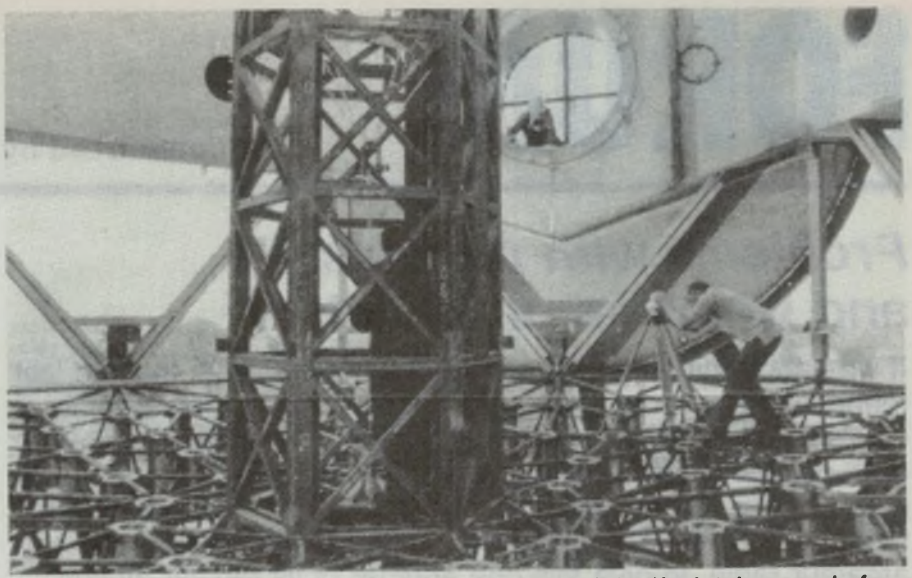
The W.M Keck Observatory, a joint effort of the University of California and the California Institute of Technology to build the world's largest telescope, is on schedule for completion in 1991.

With contracts scattered around the globe, the project comes to a focus atop Mauna Kea, in Hawaii, where the 270-ton eight story telescope is currently being assembled inside the observatory's completed dome.

The telescope's most complicated structural component is the mirror cell, a space frame structure onto which the 36 hexagonal mirror segments will be mounted. The mirror cell consists of over 1100 individual members connected together end to end.

The surface of the three-layer mirror cell presents a pattern of 'nodes,' forming the connection points to which the individual mirror segments are attached.

Each mirror segment will be attached to a 'sub-cell' assembly. The sub-cell is a structural component that connects to the mirror cell and onto which are attached the mirror, its supports, and the actuators that adjust the mirror segment. The sub-cell can be machined to much higher precision than can the larger telescope structure.



Surveying the 10m-diameter mirror cell structure of the Keck telescope before it was disassembled for shipping to Hawaii.

Over the 10-metre wide mirror cell, the node points are located to an accuracy of a few millimetres. The sub-cell allows for still finer adjustment of the position of each segment as it is nestled into the mirror array.

More importantly, the mirror must maintain its overall shape to within a millimetre as the telescope points to different areas of the sky, changing the gravitational load felt by the mirror cell.

The actuators can travel only a little more than a millimetre in total range, and would be unable to maintain the alignment of the mirror segments if the gross shape of the mirror cell changed by more than that amount as the telescope moved.

Before the shipping from Spain where it was fabricated, the telescope structure was tested to measure the geometry and stiffness of the cell under a simulated mirror load. The cell was surveyed unloaded and then with a 12-ton load. The survey results were compared with predictions from a computer model of the structure.

The test results indicated that the telescope stiffness was exactly as predicted and that only minor rework will be required on site to adjust the geometry so the mirrors can be properly located.

TI signs Hivision HDTV agreement with NHK

Texas Instruments intends to capture a major world-wide share of the emerging high definition television (HDTV) market, following the signing in Japan of a technology transfer agreement between Nippon Hoso Kyokai (NHK) and Texas Instruments.

Based on the agreement, TI stands to acquire the Japanese broadcasting company's 'Muse' or 'Hivision' advanced television receiver technology.

TI intends to use this HDTV system knowledge to provide leading-edge integrated circuits to major television manufacturers, thereby increasing its penetration of the semiconductor market. In addition TI will work with customers to adapt TI's HDTV semiconductor technology to meet different HDTV standards world-wide.

Announcing the agreement, Mr. Stuart McNair, Managing Director of Texas Instruments Australia said, "the consumer electronics world is moving away from analog and into more digital technology, which relates directly to TI's strengths. We have an excellent market opportunity to engage with customers around the world and support their transition to new digital advanced vision system products."

Australian consortium to install network centre for NZ's TV3

Australian joint-venture consortium Pacific Communications and LSE Technology, won the contract to install the network centre for TV3 – New Zealand's first independent commercial television channel, which began operation last month.

The Pacific-LSE contract included the provision of technical and training assistance during the run-up to on-air, as well as setting up TV3's Auckland Centre.

The contract is managed on TV3's Eden Terrace site, by TV3 Studio Project Manager Gerry Smith, with LSE's Bill Young as on-site Project Manager, and Syd Griffith from Pacific, acting as Project Director.

Syd Griffith (Pacific), Bill Young (LSE) and Jeff Bennett of TV3 (L-R).

As part of a separate contract, but under the same design and installation guidelines, Pacific are in the process of completing an eight camera Outside Broadcast Van for TV3. Under the guidance of TV3 Project Manager, Eddie Pooley, the vehicle was for delivery before the on-air date.

FORUM

Conducted by Jim Rowe

Problems with projects, and whiskers on kit bits...

It was about nine months ago, in the March issue, that we last found ourselves discussing the thorny and perennial topic of who's to blame when a magazine project – whether built from a kit or otherwise – doesn't work. Further letters on this topic have arrived during the intervening months, so this month I thought we'd take a break from things like hifi exotica and amateur radio, to give this one another of its regular airings.

But just before we draw our metaphorical swords and get stuck into each other again, I note that this month's column actually marks the beginning of my third year as Forum's conductor (battle steward?). How time flies when one is having such a good time!

As it happens I would still have a long, long way to go, if I were to try matching Neville Williams' record of starting and running the column for over 37 years (whew!). It's doubtful whether anyone ever could, of course, but at least two years is a start. And judging from the letters that still keep on rolling in, at least a reasonable number of you still find the column of interest and relevance. I'll try to keep it that way.

And so to battle once more, on the subject of project and kit problems. Incidentally, after this was raised last time, in the March issue, I was told by the principal of one of the main kit suppliers that I was 'an idiot' for even trying to discuss the subject in print, because it was one of those arguments where no-one can win, and even discussing it not only makes us look bad, but makes the readers more unhappy. Perhaps he's right.

You may recall that the reason for discussing the subject back in the March issue was the arrival of a letter from Mr Len Spyker, of Karrinyup, in Western Australia. Mr Spyker's letter was fairly critical, particularly of the magazine, but his criticisms were of a strongly constructive nature and as a result deserved careful discussion.

As it happens I was forced to conclude that some of Mr Spyker's suggestions were not nearly as easy nor as practical to implement as he appeared to think, and I tried to explain why. But his motives in making them were entirely laudable, and this alone justified their being published in these columns.

In his cartoon that same month, BeeJay chose to include not only the usual pointy-nosed caricature of yours truly – hiding under the secretary's desk, in this case – but also another somewhat grim-faced character, which might perhaps have been based on BeeJay's impression of Mr Spyker.

Mr Spyker himself seems to have taken it all in good part, and in fact sent me a brief note a few weeks later, thanking me for supporting the french liberal philosophical idea 'I could not disagree more with what you say, but would defend to the death your right to say it'. He's obviously a good sport, as well as being a man of considerable erudition.

But I *did* get a letter some months later, from another reader altogether, castigating us for having belittled Mr Spyker in the cartoon. Ah well – can't win 'em all!

Perhaps I should make it clear that as editor, I have virtually no say in what goes into the cartoon each month. BeeJay himself decides what he will put in it – we simply fax him the entire text of each month's column, and it's entirely up to him what he elects to use. A week or so later we get the results of his work, and unless there's anything which I judge likely to attract legal action (which has never happened yet, I might add), it goes straight off to the production scanners.

Even though I might wince a bit sometimes, when I see what he *has* done to me in his latest opus, I firmly believe this is the right approach. A cartoonist should have as much freedom as possible, or their work will inevitably suffer – even that of someone with as much obvious talent as BeeJay. And the whole idea of having a cartoon in Forum each month is to deflate egos, bring us all down to earth and stop all this technical argy-bargy from becoming too turgid and boring!

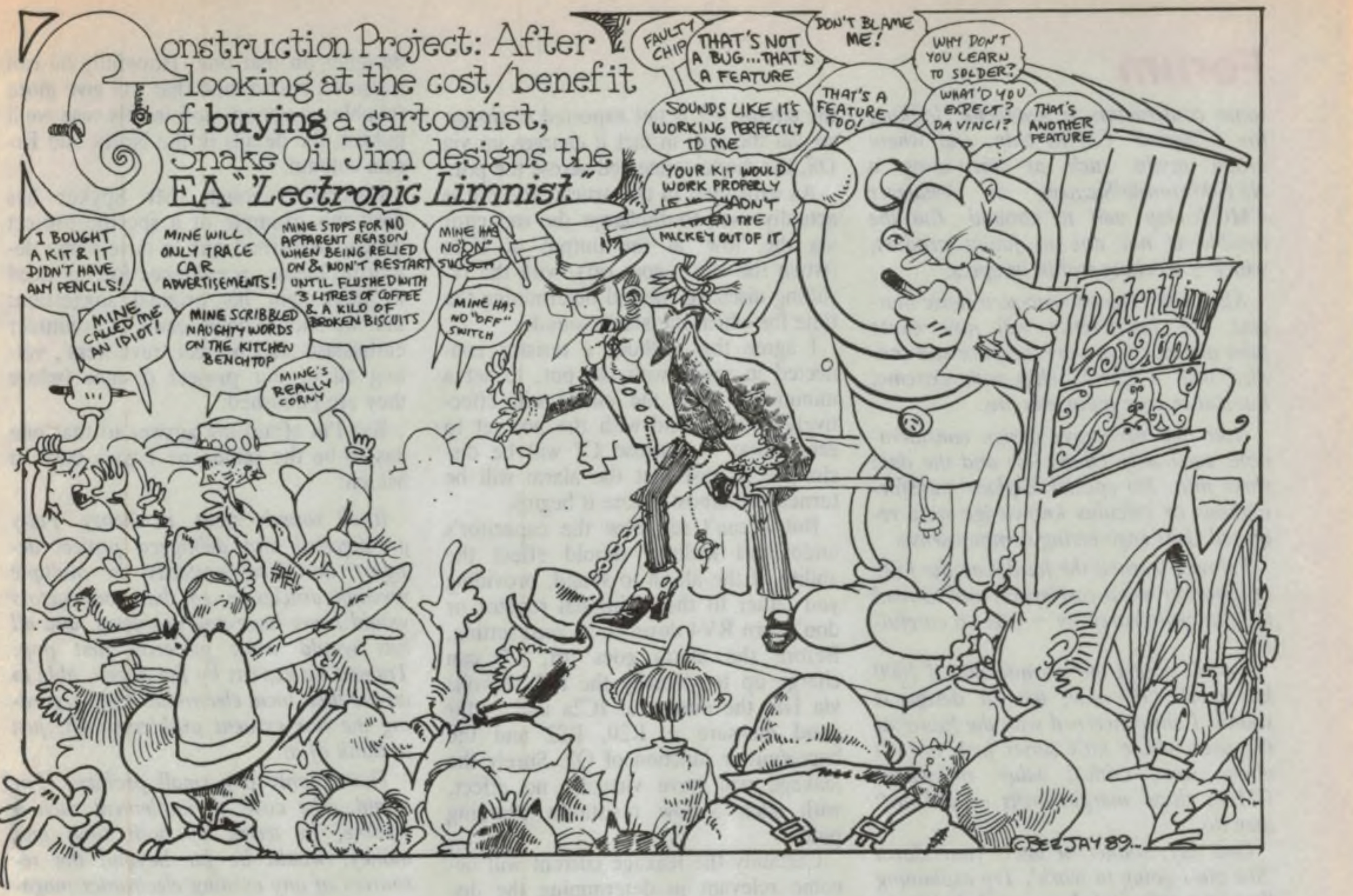
So if YOU write in, and do end up like Len Spyker in one of BeeJay's cartoons, with some of the mickey taken out of you, please try to look at it philosophically like Mr Spyker. At the very least you can console yourself that it will probably only happen to *you* the once, whereas it tends to happen to *me* almost every time – and often with bells, tu-tu and spiky hair on...

That said, I have to admit that Mr Spyker himself is really tempting BeeJay and fate, because he's written in again on the same subject as before. I can only hope that BeeJay puts Mr S safely under the desk this time, and takes the mickey mainly out of me!

Not that there's any real reason why Len Spyker shouldn't write again, of course. If he wasn't happy with the response to his first letter, and wanted to make some further points, that's the logical thing to do. And that is exactly what he's done.

By the way, it turns out that Mr Spyker is in fact an electronics designer himself, and of no mean talent or experience. With his recent letter he sent me details of a project for which he had prime responsibility, on the electronics and electrical side: a remotely-controlled underwater cleaning vehicle called 'Scimitar', developed at a cost of $4 million to clean the marine growth from Woodside Petroleum's 'North Rankin A' offshore drilling platform. Apparently Scimitar took only 8 months from concept through to manufactured completion – very impressive.

Mr Spyker's letter itself is fairly long, so I'll have to condense it. I'm also deleting the specific references to one of our advertisers, on the grounds that these could possibly result in legal action. But the main thrust is still quite clear:



I have run into some interesting problems with the Low Cost 2-sector House Alarm project described in EA of April 1989, and designed by one of your advertisers. I helped a friend of mine, a qualified marine radio officer, who had built up this project from a kit and couldn't get it to work satisfactorily.

He had passed the kit builder's test with flying colours. He rapidly found the mistakes: wrong diode orientation on the layout diagram, electro on board not shown in circuit schematic, no reference in the parts list to the 4093 IC, and C1-4 and C14 with a value of 1uF rather than 0.1uF as shown. Kid's stuff.

However he was stumped when the circuit failed under two conditions. One was that no alarm occurs when RV4 is at zero.

I was called in, to wave my magic wand over it. After much probing, a few mods and a few cuppas (or was it glasses), it was persuaded to work.

Fitting a 10k resistor in series with RV4, to set a minimum resistance, fixed the first problem.

For the second problem, I refer to the dubious design practice of using electrolytic capacitors in conjunction with high resistance value circuits. Most reputable capacitor manufacturers quote the internal leakage of electrolytic capacitors as $I_{leak} = 0.01CV + 3$, where C is in microfarads, V is applied volts and the leakage current is in microamps.

This means that with a 220uF cap across a logic pin to ground, as in this design, a reputable capacitor's leakage at the +8V input threshold of a CMOS logic input will be 21uA. With a +12V CMOS output source signal, this leakage will allow a maximum series resistance of only 190k before the signal will be unable to turn on the following CMOS gate. So a slight turn of the series 1M pot and the alarm may not alarm anyone, ever.

And guess which poor frustrated reader (as I was described in your March 'Forum' column) has a marine friend, who had received in his kit an ever-so-slightly-leaky electro? Sorry, no prizes given on that one.

But yet more potential failures loom: the lights dim, etc.

The installation wiring instructions given with the kit are incomplete. If a normally open sensor switch is assumed, and this is not shown in drawings or explained in the text, then you must wire a 47k resistor across the sensor switch RIGHT NEAR THE SWITCH, otherwise deliberate cutting of the alarm switch wires one by one will not cause an alarm. Think about it...

A normally closed sensor switch (preferred I believe) would need the resistor in series right next to the switch also, so that opening or bridging of the wires during any attempted tampering could be detected. This is also not explained.

The text does say something about the input being terminated in 47k, but some confusion arises as there is a 47k resistor in the input circuit. The article and kit refer to connection examples for terminals 17-20, but they are not included. Only by some comments in the testing section, mentioning an external 47k resistor on the terminal strip, it implies this is necessary at all.

Good one, Boris! By now I was getting fairly 'teed off' with the 'designer' of this project. So I did a more detailed design review.

I was amazed that this project was using CMOS inputs and level detectors. The designer has obviously never looked closely at any CMOS data book. These state categorically that with a 12V supply, the WORST CASE input threshold is 2.2V maximum for a logic low and 8.15V minimum for a logic high.

The alarm design uses 4 and 8 volts as its levels – 1.8V too high in the first case and 0.15V too low in the second.

This is the kind of situation where component tolerance spreads will give *some constructors a headache, looking for a 'typical' CMOS chip, and where urban myths such as not using a NEC/Motorola/Siemens or whatever CMOS chip start to abound. But the trouble is not due to faulty product, which is working within its specs.*

Also with zero or near-zero noise margins, RF interference will now cause false alarms, if you are the poor sod saddled with a CMOS chip with extreme, but still in-spec input margins.

Note that the above design considerations used only Ohms law and the data sheet info. No special Z-plane transformations or calculus knowledge were required. Just engineering commonsense.

I slowly learned the hard way the folly of ignoring worst case specs, and to read the fine print carefully – ever so carefully.

I don't accept the premise that if 1000 kits work OK now, the kit design is sound. I am concerned with the future of the user whose kit's series pots are set above some critical value, or whose CMOS chips' margin drifts – and drift they do.

One day, sooner or later, your alarm 'She ain't going to work'. Try explaining that little technical design and design review oversight to your own distraught family members...

So please reconsider your position, and give an in-house tech and 6 assorted readers these kits to build up and get the bugs out of the submitted or internally generated kits, before you publish and be damned.

I have to admit that there's a lot of truth in what Mr Spyker says. The Two-Sector Alarm design has turned out to have a few problems, including some of the silly circuit and wiring diagram mistakes which crept through our checking system. We were pretty snowed under that month, trying to get out our largest-ever 50th birthday issue. And judging by some of those design oversights, the designer responsible might have been a bit rushed too – although ideally *we* should have spotted these too before publication, as Mr Spyker suggests.

However I must confess to some puzzlement over his reference to the effects of leakage in the 220uF capacitor. I assume he means C7, as this is the only 220uF capacitor in the design and is certainly connected from a logic gate input to ground – although the series pot is marked as 2M, not 1M.

But from my own quick analysis of the circuit, C7 is not expected to *charge up* via the pot; in fact it charges up via D8, the diode connected across the pot.

As explained in the article, the pot is actually used to *discharge* the capacitor via the 'low' at the output of IC2a (when the alarm goes off), with the resulting discharge period determining the time for which the alarm sounds.

I agree that without a resistor connected in series with the pot, to set a minimum value, the alarm will effectively never sound with the pot set to zero value – because C7 will be discharged so fast that the alarm will be turned off almost before it begins.

But I can't see how the capacitor's undoubted leakage should effect the ability of the alarm to sound, providing you either fit the additional resistor or don't turn RV4 down to its zero setting. Before the alarm goes off, C7 can charge up to virtually the full 12 volts via D8, the output of IC2a and – for good measure – R20, R22 and the base-emitter junction of Q3. Surely the leakage will have virtually no effect, with such a low resistance charging path.

Certainly the leakage current will become relevant in determining the discharge time-constant, when the alarm goes off. I imagine this may well ensure that the maximum alarm time is determined more by C7's own leakage than by the maximum value of RV4. But this is surely a rather less serious criticism than that suggested by Mr Spyker. The alarm would not be prevented from sounding, but simply sound for a shorter period than one might have predicted.

If we assume that the capacitor has worst-case leakage of say 30 microamps of leakage, at 12V, this would correspond to an effective shunt resistor of about 400k. Taking the value of RV4 into account, this would bring the maximum discharge time down to about 70 seconds – rather than the 440 seconds expected. A shortcoming, certainly, but I suggest not nearly as drastic as suggested.

I'm more concerned about Mr Spyker's other point, regarding the apparent lack of consideration of worst-case CMOS input thresholds. That one is a worry, I agree. It suggests that at the very least, the resistor networks at the sensor inputs should have been given rather different values – assuming there are values that will give reliable operation, with the CMOS thresholds.

We've had to confer with the original designer on that one. Hopefully he can suggest a circuit mod that will give more reliable operation, and in this case we'll publish the details in the Notes and Errata column.

Naturally enough, Mr Spyker has used this example of a specific project which *has* turned out to have some design problems, as evidence for the need to implement his original suggestion: that we should have teams of volunteer enthusiasts and project 'reviewers', vetting all of our project designs before they are published.

But I'm afraid my answer to that one has to be the same one I gave back in March:

It all sounds great, in theory. Fully pre-digested and debugged project designs, described perfectly in multiple revision articles – so that constructors would never have any problems, and all kits would work perfectly first pop. Trained kit experts by the dozen, able to advise their local electronics shop regarding the non-existent problems. Ah, just to think of it!

There's only one small problem, I'm afraid. The costs to implement such a scheme, in terms of both time and money, would be far beyond the resources of any existing electronics magazine. If EA or any of our competitors were forced to implement such a testing, evaluation and revision scheme before we published any construction project, it would almost certainly send us broke.

I know it sounds unhelpful, Mr Spyker, and you might have difficulty accepting it, but I can assure you that it's the truth. Wonderful though it sounds, and as much as I might like to be able to do it, to avoid the embarassment of readers having problems with our designs from time to time, the fact is that we simply couldn't afford to do it.

In an ideal world, we would probably have implemented your scheme years ago, and have umpteen readers perpetually delighted with our trouble-free project designs. But we live in the real world, where everything costs money and any business enterprise – including a magazine – must recoup its costs if it is to remain in business.

As I said back in March, I'm afraid that the cost to do what you suggest would result in either no electronics magazines at all, or none prepared to describe project designs for home construction. I suspect that most readers would prefer not to have either of those scenarios, and would rather put up with the present system – imperfect though it may be. Most of the time I believe a majority of readers would say it's quite acceptable, despite the occasional slip-ups.

Different views

One of the other letters which turned up in response to the March discussion came from Mr Eli Montebello, who runs EEM Electronics, down in Epping, Victoria. Among his activities, Mr Montebello carries out repairs on equipment built from kits, and is therefore well qualified to comment on the causes of trouble. Again his letter is rather long, and I've had to condense it. But as you'll see, he takes a rather different tack:

On the points raised in Mr Spyker's letter, as you've already stated most of these points are great, if you had the means to enforce them.

The kits that cross my bench for repair each month all have a wide variety of faults. These include poorly substituted components and component values, poor construction and poor construction techniques, and last but certainly not least, poor soldering by the constructor.

Now it seems to me that the retailer or kit supplier should take all responsibility when it comes to providing parts for the kit. These parts should be the ones that are originally specified, and should of course be of the highest quality as far as specifications go.

Poor construction techniques and poor soldering practices are obviously the responsibility of the constructor. As you so rightly point out, the quality of workmanship supplied by the constructor is totally beyond the control of your magazine or the kit sellers.

The responsibility of the magazine, I believe, is to ensure that high quality construction techniques are used in all kits. I believe that this is so because it is impossible for the constructor to get the job right if the original article is full of poor construction techniques and inadequate mechanical rigidity.

I would further extend the responsibility of the magazine to cover faultfinding hints. On many occasions, I have found that it was only a simple fault that stopped a kit from working correctly – a transistor in backwards, or indeed a faulty chip that was either supplied faulty (yes, it does happen), or one that the constructor has blown up themselves.

I have noticed that transistor orientation diagrams are nearly always supplied with the project as a kit, but only rarely in the original article. And I am not necessarily talking about component overlay diagrams, which may suffice in most instances.

Consider the inexperienced constructor, if the transistors supplied are of the metal can type instead of the plastic type specified, or have a type number commencing with 'PN' instead of '2N'.

In the case of faulty components, detailed debugging guides and oscilloscope waveforms can be an invaluable tool to quick and relatively easy faultfinding, like the ones supplied with the Beat Me project – also described in the March issue.

In conclusion, I would like to add that the question of whether or not to build a kit rests with the would-be constructor. If he/she feels that there is inadequate information in the original article, or with a kit, then further information should be sought before commencing construction. The constructors might also wish to assess their own abilities in the field of kit construction.

If I might fly my own flag for just a minute, EEM Electronics is more than happy to provide any form of information possible, to enable a would-be constructor to get the job done right the first time. We are also happy to construct the whole project.

Thanks for your comments too, Mr Montebello. I note that your emphasis seems to be on the component quality and constructional side, rather than on the actual circuit design. Hopefully this is because you haven't found too many shortcomings in the latter area, compared with problems caused by the former...

I take your point about the need for us to provide as much information as possible regarding device connections, and on troubleshooting. We do indeed try to do this, although I have to admit that we could still do better from time to time.

While Mr Montebello is obviously also correct with his point about the kit supplier having a responsibility to supply components of high quality, I feel I must at the same time make a qualifying comment regarding realism and practicality. And in many ways it's very similar to the reply to Mr Spyker.

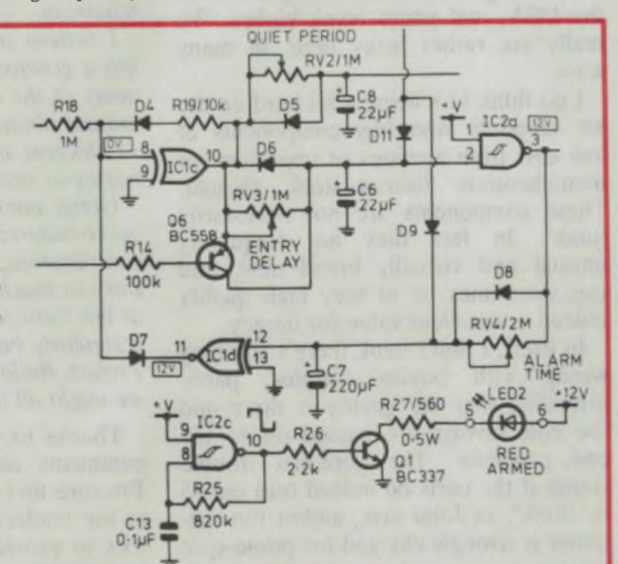
Whether we all like it or not, the fact is that electronic components are like everything else: you get what you pay for. So if you want high quality parts, I'm afraid you have to be prepared to pay for them. The trouble is that many kit buyers want 'Rolls-Royce' quality parts, but they expect to pay only 'Volkswagen' prices.

A number of kit suppliers have told me that they would like to put higher quality parts into their kits, but when they do so and inevitably have to charge a higher price, they lose business to competitors. In other words, many customers seem to go for the cheapest possible kits, forgetting that this inevitably leads to the use of less-than-top-grade parts. And then they'll compain bitterly when that's exactly what they get!

Luckily not all customers think this way, and this has allowed some kit suppliers to concentrate on quality rather than shaving the last cent off their prices. But the fact remains that if you want high quality parts, you must expect to pay for them.

Kits and parts

The next letter I'd like to quote from on this subject, and also on the subject of component quality, comes from a familiar source: John Day, VK3ZJF, who as you may recall is the Technical Director of Stewart Electronic Components in Melbourne, and a notable



The 'alarm time' section of the Two-Sector House Alarm project of April 1989, referred to in Mr Spyker's letter.

equipment designer. You may also recall that I quoted from John last month, concerning fancy audio cables and allied subjects.

Here's some of John's comments on the subject of project and kit reliability, and the influence of component quality problems:

Where do kit designers and producers get their parts? Well, as you know, I have designed the odd project or two. On one occasion a major outlet produced a kit for my project, and unfortunately the project as assembled from those kits almost invariably didn't work.

Why? Simple because the kit packager wouldn't even use the parts specified in the parts list published in the magazine! In fact some of our big kit packagers are the largest consumers of 'surplus' components in the country. Their philosophy seems to be to buy the cheapest junk they can, and unleash it on an unsuspecting public.

Unfortunately neither you as a magazine, nor myself as a designer has the possibility of influencing some of these operators to use the correct parts, as your correspondent Mr Spyker suggests.

Perhaps we should refer in a little more detail to the American situation you alluded to earlier. How often do you see a kit project in an American magazine? Not very often, nowadays.

We are fortunate in Australia, that we have a kit building heritage. We still have proudly independant magazines, that design and publish projects for their readers. In the US, the UK and Europe many of the magazines publishing projects are beholden to, or in some cases owned by, the very companies who sell the kits – or in some cases the PCB's, as you can't buy kits!

In the US the situation is even worse. For some reason the Americans don't seem to buy kits at all. Some of my friends who offer kits for magazine projects tell me that most of the time they only sell one or two kits – but lots of assembled and tested models. Their customers are scared of trying to assemble even the most basic kits.

Whilst on the subject of the US, maybe I could squash one runour that has been doing the rounds for some years. Many people have suggested to me that components are easier to get, and cheaper in the USA, with a greater range more readily available. The simple response to this is 'rubbish'!

In those parts of the USA that I have seen, including major centres such as Los Angeles and the inimitable Silicon Valley area of the South Bay region of San Francisco, components are more difficult to find and much more expensive than in Australia. Believe it or not as you please, but I can assure you it is true.

Several years ago, a friend and former neighbour went to live in Kentucky. After finding out what parts were like to get, and the prices in the US, he went out and purchased stocks of common bits to last him five years or so. The reason was simple – if he had to pay American prices he wouldn't be able to afford to keep up his hobby!

Count yourself lucky, Australia. Not only do we have good quality components, readily available, but we also have magazines which will publish projects and support the kit sellers.

Don't just sit back and cry 'Woe is me' – get up and do something! Write a project article and send it to your favourite magazine (sorry for the flood, Jim). Try keeping kit suppliers honest, by demanding kits with only the best quality components, and be prepared to pay a little more for quality.

Most of all, though, don't get the idea that we are the poor downtrodden relics of an ancient colonial outpost. If only Australians would open their eyes and ears, they would realise we are potentially one of the greatest technological powers on this earth – if only we can stop talking ourselves down!

Well – I'm not too sure how John managed to hop onto that soap-box at the end, but I left it in anyway as I happen to agree with him.

I can also verify from first-hand experience what he says, about components being rather harder to get over in the USA, and prices being higher. We really are rather lucky here, in many ways.

I do think he's being a bit hard on the kit suppliers who buy components at low cost from auctions of importers' or manufacturers' 'distress stock', though. These components are not necessarily 'junk'. In fact they are frequently unused and virtually brand new, and can sometimes be of very high quality indeed – excellent value for money.

In itself, I don't think there's anything wrong with buying 'surplus' parts, providing that the quality is there and the cost savings are passed on to the end customer. The potential trouble comes if the parts do indeed turn out to be 'junk', as John says, and/or the customer is wrongly charged for prime-spec parts.

It really does get back to the kit buyer, to keep demanding quality parts and complaining if they don't get it. That's the only way that the suppliers will be kept honest.

And so to the last letter that I'd like to quote from, on the subject of project and kit problems. This letter came from Mr Derek Hobbis, of Winmalee in NSW, and again it was rather too long to quote in full. But here's the part that I thought was most noteworthy:

References to legalities and the 'Consumer Affairs' people becoming involved to sort out liabilities in project building would seem to be way off target. Even if one COULD apply this as a means of apportioning responsibility, placing a spotlight over guilty parties would likely reveal customers with egg splattered all over their faces! They would never again muster the fortitude to be seen switching on the soldering iron.

Mind you, EA readers would be assured of a few good laughs on occasions, and your cartoonist would have a field day.

However, while I would not call for the drastic proposals in Mr Spyker's letter, I would like to see more feedback – whether positive or negative – from readers who have embarked on projects. If they meet with instant unqualified success, let's hear about it!

At the same time, those who have been less fortunate should also be encouraged to write and tell their tales. If there are a few 'real headaches', the more successful individuals may be only too willing to assist others. After all, next time around it might be their turn in the hot house.

Should repetitive letters in a positive vein be received, it would be a simple matter of reporting that fact from time to time, serving as proof to all of the design reliability.

I believe such a rapport would establish a generous amount of goodwill, and many of the recent claims being bandied around about 'shirking of responsibility' – however misdirected – could be dismissed as nonsense.

Going one step further, it might even be considered practical to call for some contributions, and present them as a story in much the same entertaining style as the 'Serviceman'. I for one would find a similarly based monthly article on 'EA Project Building' highly appealing, and we might all learn something.

Thanks to you too, Derek, for those comments and suggestions. Like you, I'm sure that the most practical solution is for readers and project/kit constructors to provide us with plenty of feedback, both positive and negative. Then we can *all* help ensure that everyone gets the most out of our published project designs, in the most efficient and effective manner. We may well be able to improve the good projects, and make them even better, as well as sorting out any problems that crop up in the not-so-good ones.

Actually it's this kind of feedback that we're trying to encourage, in the Information Centre column. Peter Phillips has been asking for exactly this kind of help, and slowly it is starting to build up. Perhaps soon we will have the kind of 'project information clearinghouse' you have in mind – it sounds great, doesn't it?

If we get some really good contributions along these lines, we'll certainly look at the idea of expanding the idea still further. And of course we're prepared to pay a fee for contributions that have obviously involved significant preparation.

And that's it for another month, folks. My thanks to the correspondents who wrote in to share their views with us, and I hope you'll join me again next time.

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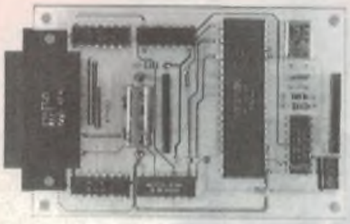

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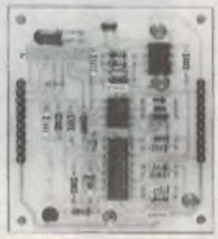

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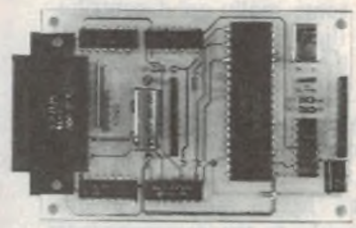

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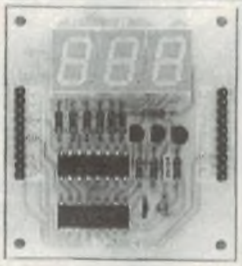

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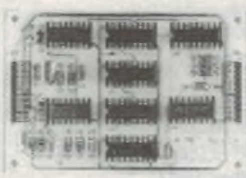

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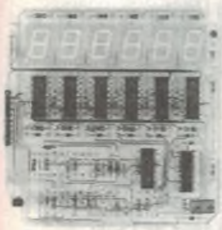

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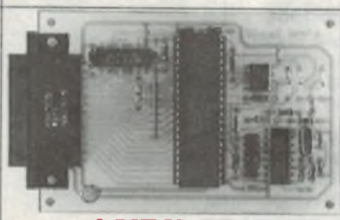

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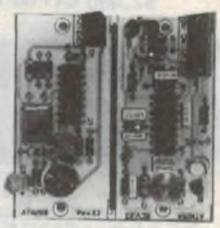

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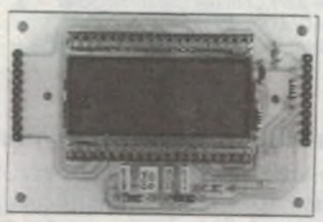

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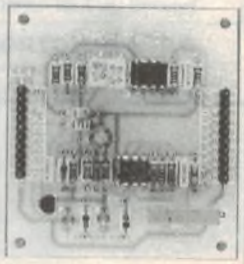

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The Serviceman

The phantom transistor swapper, another elusive electro and more

It's contributors' month again, and this time I have several letters from readers who have taken the trouble to drop us a few lines about their own servicing experiences. There's also an interesting story from a local colleague, which shows how easily you can be bamboozled by high technology!

First cab off the rank is one from L.K. of Daintree, Queensland, a serviceman who contributed another story to these columns a few months ago. His latest story is quite short, but certainly leaves one wondering about the sense of some would-be servicemen:

The set was an old black and white Princess portable TV. It was a nice little unit, designed to work off 12V or 240V and fitted with a snap-on cover to protect the entire front face of the set.

Its pensioner owner had brought it to me several times during its life, yet outwardly the set was still like new. I knew the owner to be an avid reader, so I suspect he only uses it spasmodically, especially as he now lives alone.

His complaint was simply that 'it doesn't go', and he left it to my discretion as to the value of any needed repairs.

On the bench, the first thing I noticed was that the AC fuse had failed. Now lightning-induced surges on the mains supply are a major cause of trouble in this area at certain times of the year; the most usual damage being rectifier diodes associated with the power supply. So my first move was a quick check of the bridge. However this confirmed that all was well.

A little further probing with my multimeter revealed an odd but definite low impedance to earth on the B+ rail. I say 'odd' because the reading was similar to that of a forward biased diode – different values on different meter ranges.

Although somewhat confused, I decided to treat the indication, at least for the moment, as a low resistance on the line – which made the horizontal output transistor a prime suspect.

It didn't take long to remove and check it, and here I got the surprise of my life. While the transistor itself showed no evidence of any malfunction, it was a PNP type and not an NPN as required! Also, the transistor was clean of any markings that might have given a clue as to the type or manufacturer.

Fitting the correct transistor and a new fuse brought the set back to life, and it displayed a picture as good as new. (Maybe I'm getting nostalgic in my old age but I get a real lift from seeing a piece of old equipment well cared for and still performing at its peak!)

Meanwhile, the big question remained. How did the wrong transistor get into the set? The owner, now well into his 70's, assured me that I was "...the only person ever to touch the set." He admitted that his eldest son had visited from interstate some weeks ago, but he was sure the TV had been working since the son went home.

So there the story must end. Who was it who had sufficient knowledge of electronics to locate the faulty component, yet insufficient knowledge to fit a suitable replacement?

Thanks, L.K., for an interesting little yarn. I guess the mystery serviceman assumed that because his replacement transistor looked like the dud, it must be the same as the dud. (I get mixed up between radial and cross-ply tyres. My local mechanic has tried for years to teach me the difference, but I can't see any and would be just as likely to put one of each on front wheels!)

Our next contributor is A.S., of Blackburn, Victoria. A.S. calls his story 'Two Pyes in a pod!' He writes:

I had occasion to work on two colour TV sets recently, a few months apart. Both were early Pyes, with slightly different cabinets but identical T29 chassis. The sets had different faults, but both arose from the same cause.

The first set worked quite well except for an annoying intermittent frame collapse, where the picture reduced to a bright horizontal line at the most inconvenient times. It would usually restore to normal at the slightest touch, but by fairly careful manipulation it was finally established that slight flexing of the timebase board could make the fault come and go.

The second set also had an intermittent fault, in which the picture disappeared completely – accompanied by a peculiar squeak and a weird pattern on the screen as the picture faded. Again, careful manipulation showed that the fault could be made to come and go, this time by simply swinging the timebase board on its hinges.

By careful inspection of the boards, both sets were found to have a fractured solder joint where the bottom mounting lug of a large component came through the board and was soldered to the PCB pattern. In both cases it appears that movement and vibration over a long period, combined with the high inertia of the physically large component, has put too much strain on the solder joints.

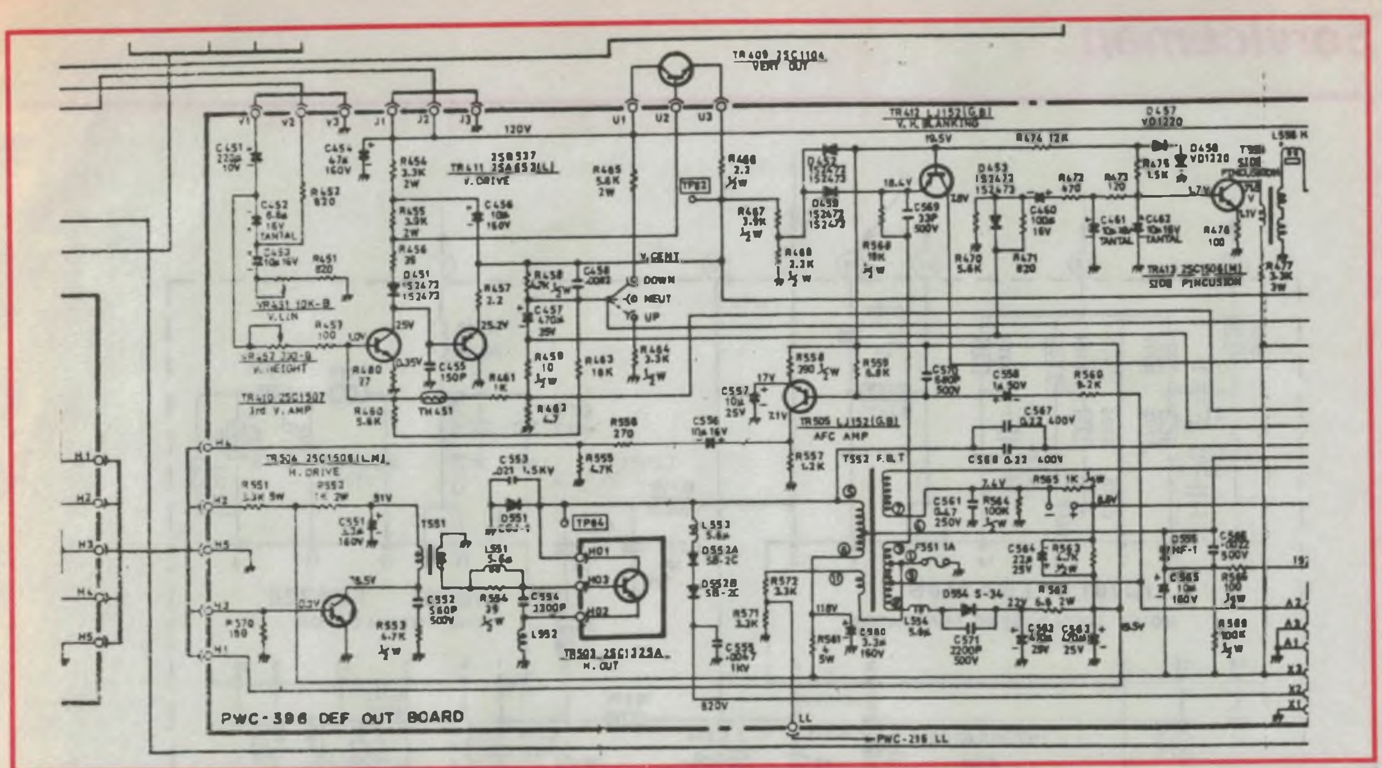
In the first set the component involved was L502, in series with the vertical yoke coil. In the second it was the line output transistor driver transformer, T1. The physical construction of these components are the same, featuring substantial windings on a heavy powdered iron core.

The lesson to be learned from this seems to be – if you have an intermittent fault which appears to be sensitive to manual forces, a careful inspection of the solder joints of the largest and heaviest components may well save a lot of time and frustration.

Thanks for your story, A.S. I can accept your interpretation of the reason for the dry-jointing, but I feel that you have overlooked the most likely cause.

I have never found a dry joint that was not associated with localised heat generated by heavy current, on a PCB that had only the most cursory association with the solder bath during manufacture. Some joints carry so little solder that the component pigtails can be pulled free without using an iron.

I was once told that the production Kriesler 59-01 chassis were two pounds lighter than pre-production models that had been hand soldered. This is the amount of solder saved on each set with the then-new wave soldering machine.



The 'Def Out' board schematic for the Rank C-1851 colour set, the subject of this month's second story. After much searching, the cause of its faulty horizontal sync turned out to be yet another faulty electro – on this board.

Anyone who services early Kriesler sets will know all about dry joints.

I would hazard a guess that the dry joints found by A.S. in his Pyes were secured with minimal solder. It's this, plus the heat generated by heavy AC currents, that causes most dry joints. The weight of T1 and L502, in A.S.'s story may well have contributed to the trouble, but could not be blamed for all of it.

Troublesome Rank

Now we come to a contribution from K.McG., of Mundubbera, again in Queensland. Mr McG. tells of his trials and tribulations with a Rank model C-1851:

My first encounter with this particular Rank was late in 1987, when the owner brought it in with the complaint that "It just stopped!"

I made the mistake of asking "What's wrong with it?", and got the smart-alec reply "If I knew that, I'd fix it myself!" Some customers deserve... don't they?

Anyway, on that occasion, I found fuse F601 would glow like a neon before burning out. The fuse should have been at 120V to ground but was only 20V, indicating a heavy load on the B+ rail. It turned out that this wasn't the usual shorted line output transistor, but the vertical output transistor TR409 (2SC1104).

That stopped the fuse from glowing and blowing, but didn't restore the picture. I still had to replace the vertical driver transistor TR411 (2SB537), before I could return the set in proper order.

Some six months later the set was back again, this time with the complaint that there was no video or sound from the VCR, and no TV when the antenna was connected directly.

Fixing this part was easy. Like most Rank owners, this one never bothered to disengage the AFT before adjusting the fine tuning. As a result, the adjustments got further and further out until the AFT could no longer hold a channel.

He had lost both local TV channels and his VCR channel in this way, but he neglected to tell me why he had needed to adjust the fine tuning in the first place. Finding out cost me many hours and him a lot more money than was necessary.

Once I had retuned the channels, I could see the true cause of the trouble. There was an almost entire lack of sync when playing videotapes, and even TV was not without its problems – with severe flagwaving at the top of the screen.

I was told that the set had once been taken to another serviceman when it lost horizontal hold, beyond the range provided by the rear panel control. This had been 'corrected' by manipulating the internal Sub-hold VR501, but I suspect that it was really the beginning of the fault now before me.

The sub-hold could still stabilise a TV picture, but on the VCR it was hopeless. Quite obviously, the problem was not one of simple adjustment but was more likely a synchronising fault.

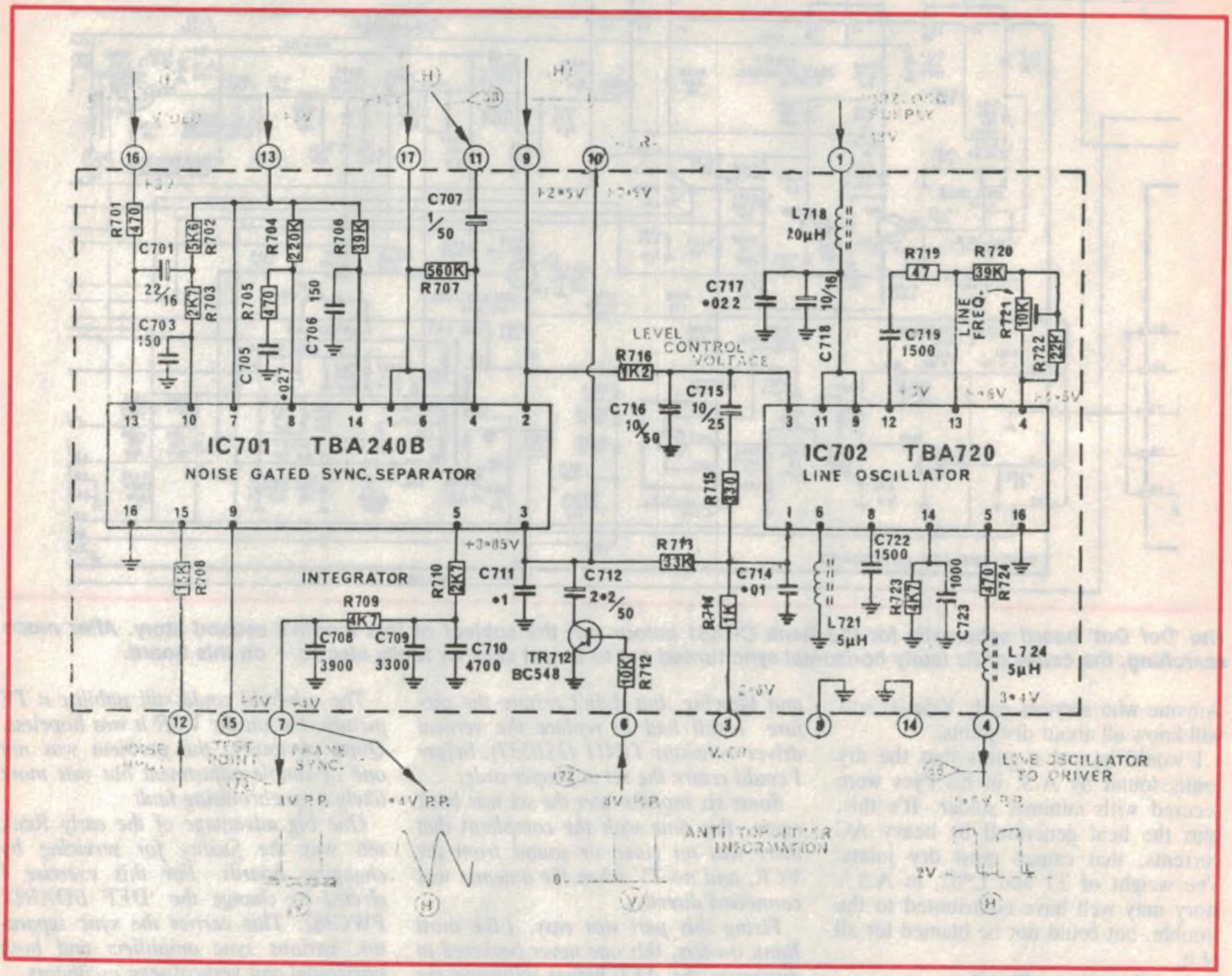
One big advantage of the early Rank sets was the facility for servicing by changing boards. For this exercise I elected to change the 'DEF BOARD' PWC367. This carries the sync separator, various sync amplifiers and both horizontal and vertical scan oscillators.

Unfortunately, this produced no improvement. So I went on to change the video IF board, PWC312. You've probably guessed already – this did no good either.

About this time I was getting desperate, because I was running out of ideas. I would have liked to investigate the sync chain with the 'scope - but this was impractical because I had mislaid my Rank C-2201 manual, which is the only one that shows any waveforms for this series of sets.

There can be all sorts of problems with Rank power supplies – particularly the 19 volt rail – so I spent some time checking both this and the 120 volt rail; but to no avail. I couldn't find a thing wrong to account for the weak sync.

About this time I recalled the problems that can arise when C351 on the sound output board goes open circuit. This can make the volume control act like a brightness control, and could conceiv-



The schematic for the CU701 line control unit in the Kreisler 59-01 set which formed the subject of this month's last story.

ably crush the sync pulses. But that wasn't the trouble, either. Replacing C351 made not the slightest difference.

After all that, there seemed to be only the tuner and the picture tube to be tested, and I guessed that neither of those were likely to be the cause of the trouble. But just to be sure, I removed the tuner and checked the attached circuit board. I have found dry joints on that board and these can do funny things to the signal. I found nothing.

At this point the only thing that hadn't been changed or thoroughly tested was the Deflection Out Board PWC396. But at first I couldn't see how an output board fault could upset the line oscillator.

Then I recalled how the old black and white sets used a pulse fed back from the line output transformer to the AFC discriminator, ahead of the line oscillator. If only I'd had the Rank waveforms I might have been able to solve this in a minute.

As it was, I had to study the circuit diagram very carefully, to determine first if there was such a feedback loop and then where in the loop was the most likely source of trouble.

Fortunately, there was a loop and it was made easy to find by the label on TR505, the AFC Amp. This could only be part of the loop and sure enough, it came from the line output transformer and went to the discriminator, ahead of the line oscillator on the Def Board.

The base of TR505 is driven through C558, a 1uF/50V electro, and the collector feeds into C556, a 10uF/16V electro. I couldn't get any odds on one of those being faulty and sure enough it was C556.

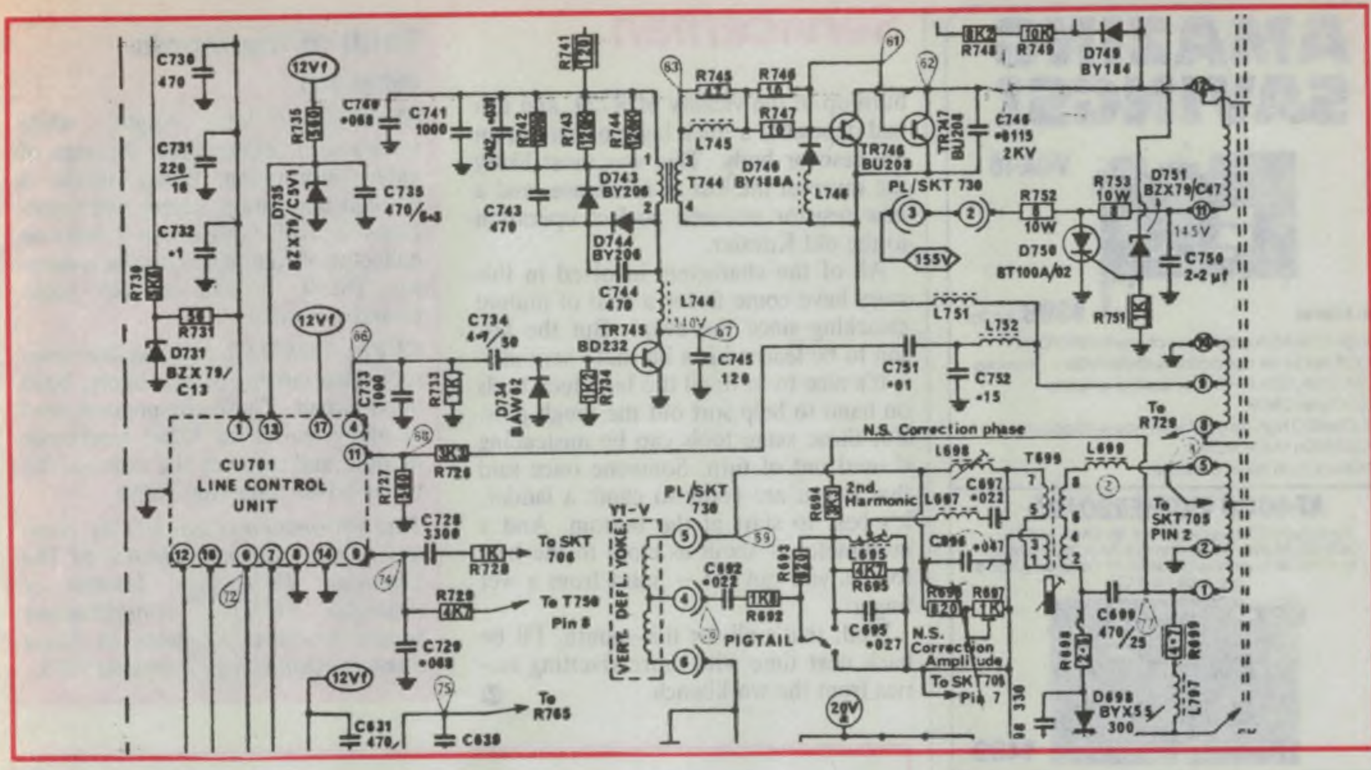
The 'scope showed a clean 15V p-p waveform going into the + terminal of the capacitor, but on the – terminal there was only a garbled output, at about 5 volts.

A new capacitor and re-adjustment of the sub-hold pot put the old Rank back into first class order, both on TV and video.

But after the euphoria of solving that tricky problem, I was faced with the task of having to explain to the owner how it came to take 14 hours to find and replace a 50 cent capacitor. It's a lot easier not to attempt an explanation.

Well, I'm glad it was K.McG. that had to solve that one, and I'm thankful that he had enough enthusiasm left to write it all down. I would probably have taken just as long to find the trouble, and then been too weary and miserable to write it down.

Now it will be noted on my own Rank



But the elusive cause of the Kreisler's abnormally low line frequency actually turned out to be on the main board, in the circuit area shown here. And it was found with a multimeter!

circuit, and will hopefully save me time when I come across it in the future. Thanks a lot, Mr McG!

Hi-tech approach

Now, here's one from closer to home. A colleague of mine is a working director of a small service company with five technicians, including himself and his partner. By the way, in the story that follows, all names have been changed to protect the innocent, as well as the guilty...

A few days ago my friend was strutting around the workshop like a dog with two tails. He was 'king of the heap', and he was letting everyone know. The others didn't want me to talk to him while he was in that state, but I talked anyway!

Before I go on, I should explain that Ray is a marine electronics specialist. He works mostly on two-way radio, radar and echo sounders. His partner Fred is the TV expert, then there's Angus the VCR man and Mal the car radio technician. The fifth tech Tom is the audio expert, but he doesn't feature in this story.

It seems that a Kriesler 59-01 came in, with the note 'No Horizontal Hold'. Eventually Fred got round to working on it, and decided that the horizontal oscillator was running slow. A check with a frequency counter proved that he was right, but did nothing to show him what was wrong.

He tried all combinations of adjustments in the control unit and on the main board, and he managed to change the speed of the oscillator, but not enough to correct the fault. After several fruitless days he gave it away and went on with other work.

Angus took over, as a break from VCR servicing and he decided that the fault had to be a dodgy electro. We all know that electros cause more faults than any other component, so Angus spent a day removing and testing every electro on the line control module and then the line output board. He tested them for leakage and he tested them for capacity, but he didn't solve the problem.

Next, Mal had a go. He decided that as Fred with the frequency counter and Angus with the capacity meter hadn't done any good, he would see what he could find with the oscilloscope.

There would have been no story if Mal had found anything unusual. In fact, he found all waveforms to be more or less normal. They all seemed to be a little bit less than they should be, voltagewise, but otherwise normal in shape. The main trouble was that they were all too many microseconds long!

After a week in the workshop, the set was about to be written off and the owner advised to take it somewhere else – like the local tip. Then Ray said "Hang on a minute! Let me have a look at it."

After a few minutes discussion with the others, he realised that they had spent hours and hours working with the highest of high tech instruments, but no one had thought to make use of the simplest tool of all – a multimeter.

It took Ray all of ten minutes to find the trouble. His first test was to measure the voltages along the contacts on horizontal control unit CU701. Most of these were abnormal to some extent, but pin 9 was more abnormal than any of them. This is shown as +2.5V on the circuit diagram, but in this set he found a voltage nearer 4.5 volts.

Assuming that his workmates had given the control unit a thorough going over, Ray decided that the fault was off that board and probably on the main line output board. So he checked the continuity from pin 9, back through R729 to the line output transformer and ground. And that's when he found it.

The ohmmeter should have shown about 5k ohms to ground, but it read about 2.4k. R729 had dropped from 4.7k to 2.4k, and was thus upsetting all the critical voltages around the line oscillator.

The main board had suffered a small

Serviceman

burn-up in the vicinity of R729, and this had deposited a thick layer of carbon on the resistor body. This was most likely the cause of the loss of resistance, and a new resistor restored perfect operation to the old Kriesler.

All of the characters involved in this story have come in for a deal of mutual chiacking since the event. But the lesson to be learned is a bit more serious.

It's nice to have all the high tech tools on hand to help sort out the tough jobs. But those same tools can be misleading if used out of turn. Someone once said that if you are going to climb a ladder, it's best to start at the bottom. And a multimeter is about as close to the bottom as you can get – apart from a wet finger!

Well, that's all for this month. I'll be back next time with more rivetting stories from the workbench. EA

Fault of the month

Philips K11

SYMPTOM: Very bright, white screen with retrace lines. No sign of video information. Beam current is so high that power supply will sometimes trip off. Only about 2 volts on collector of luminance output transistor TS290, instead of 115 volts. Sound is normal.

CURE: R606 (4.7 ohm fusible resistor) open circuit, or less likely, S610 open circuit. These components feed blanking pulses to U260 luminance module and also set the bias on the video driver transistor TS291.

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

Ever thought of contributing to 'Serviceman'?

Our regular 'Serviceman' is getting on toward retiring age, and does not wish to continue 'slaving away' full time in his own workshop. This means that there will be fewer stories of his own to relate in these pages.

But while he might be getting a little beyond hoisting heavy TV's onto the bench, he can still drive his word processor – and is still capable of writing up the stories, provided the 'raw material' is available. And of course we're still very keen to keep the 'Serviceman' column bubbling along, because it's extremely popular.

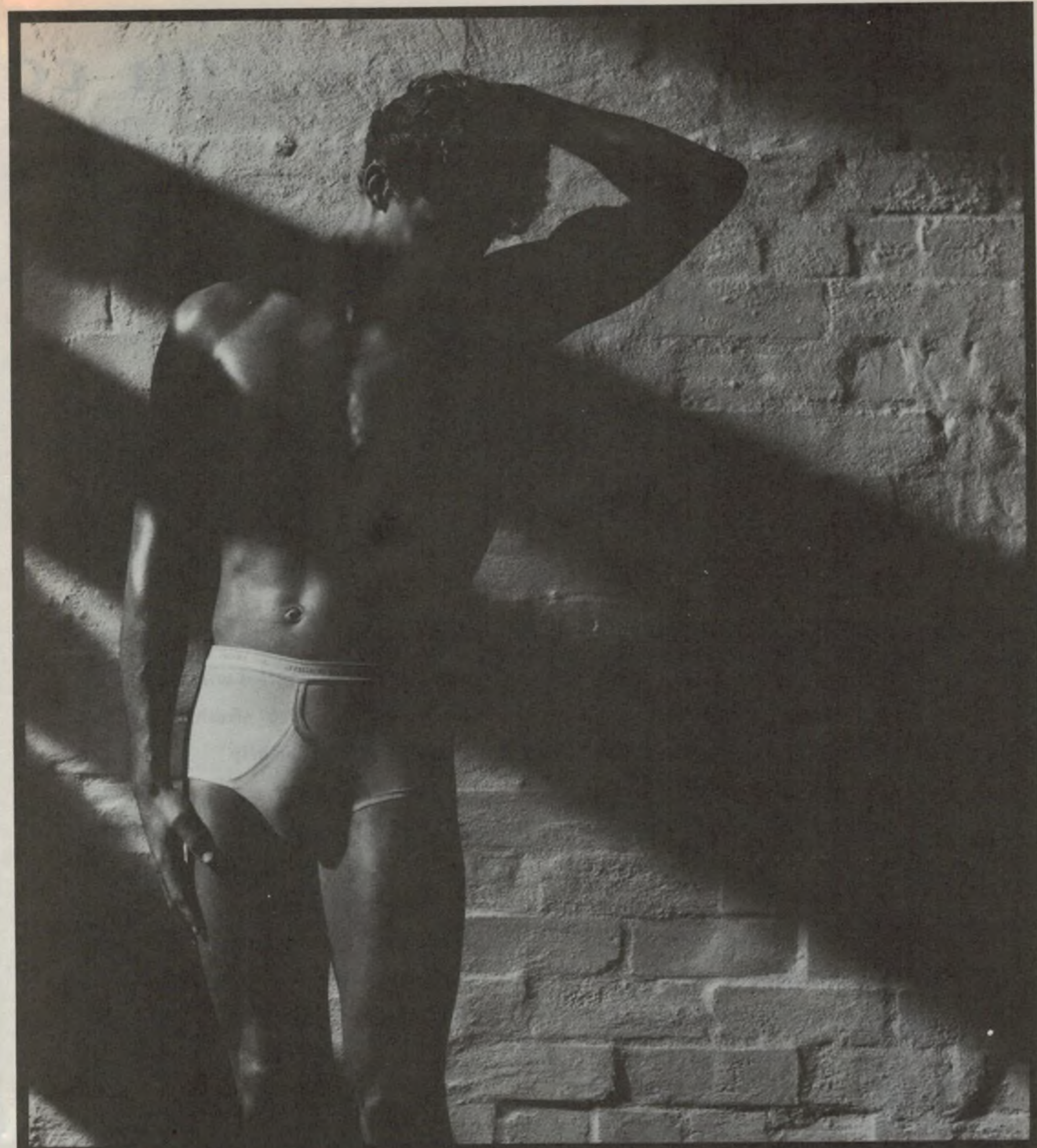
This is where you come in. If you are an active 'electronics technician' fixing electronic gear (not just TV sets), and you have the ability to describe an interesting problem and the way you went about solving it, then you can be a contributor to these columns. And you don't even need to be writer to do it – although we're quite happy to accept stories that are already written, if you're able to do this.

But if writing isn't your bag, here's all you need to do: simply get a cassette recorder and a copy of the relevant circuit diagram. Record your description of the symptoms, your investigation, and the final solution. Send us the cassette and a copy of the circuit diagram, and leave the rest to us.

If your story is used, this will of course earn you a publication fee. It's not possible to say what the payment for any particular contribution might be, because it all depends on the time needed to turn your notes into a story. But anything that is usable must be worth at least $50. If the contribution is in good shape and needs little work to get it to publication standard, then the payment could be considerably more.

Please bear in mind that typing the material into the *EA* computer costs a lot of money, so a long story can earn less than its apparent value. Still, we will be as fair as is commercially possible and we will encourage good contributors with good fees.

Remember, you don't have to be able to write finished material. All we need is a clear outline of the problem and how you went about solving it. We use 18 to 24 different stories each year so there is plenty of room for your contribution. Why not give it a go?

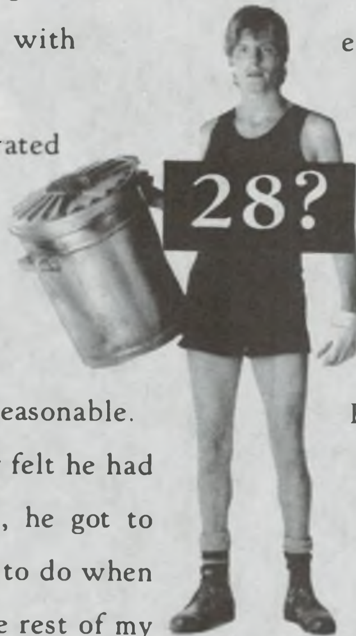


At what age are you co

Allow us to tell you the unusual but true story of a SCUBA-diving instructor.

He was pretty happy with his life.

The small school he operated on the Barrier Reef was doing alright.



There were plenty of tourists who wanted to learn the sport, so the income was reasonable.

All in all the instructor felt he had it made. But after a while, he got to thinking, "What am I going to do when I get older? I can't spend the rest of my life diving".

Too old for new tricks?

His friends thought he was worried about nothing. "Just about anyone would give their right arm to do what you do," they said. "And besides, you're only 22." Still, the instructor's concern continued, so he looked at a paper to see what was going, and made a few calls.

The enquiries led him to the conclusion he'd suspected; that he was too old for any worthwhile training or apprenticeship schemes. Even if he'd been 18, he was told, he'd have been considered a dog too old for new tricks.

This story does have a happy ending, however.

Can you do something about it?

The instructor sent off a coupon not unlike the one you see in the bottom corner, and subsequently found out about the RAAF's Adult Technical Training.

The instructor's plight, in fact, was not unusual. There'd be thousands of men and women who discover some time in their lives that they are dissatisfied with their jobs, and want to start afresh. This is where the RAAF can help.

We can retrain you as an aircraft technician if you're between 17 and 34.

Working with jet engines, navigation systems, armaments and the like, may be something you've never considered.

Out of your depth?

Indeed, you may feel you'd be completely out of your depth in such a highly technical environment. But there's a good chance that this may not be the case.

We could tell you, for instance, the story of the 30-year-old railway ticket collector who can now put a Hercules engine together in his sleep. Or there's

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. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Stereo dynamic expander

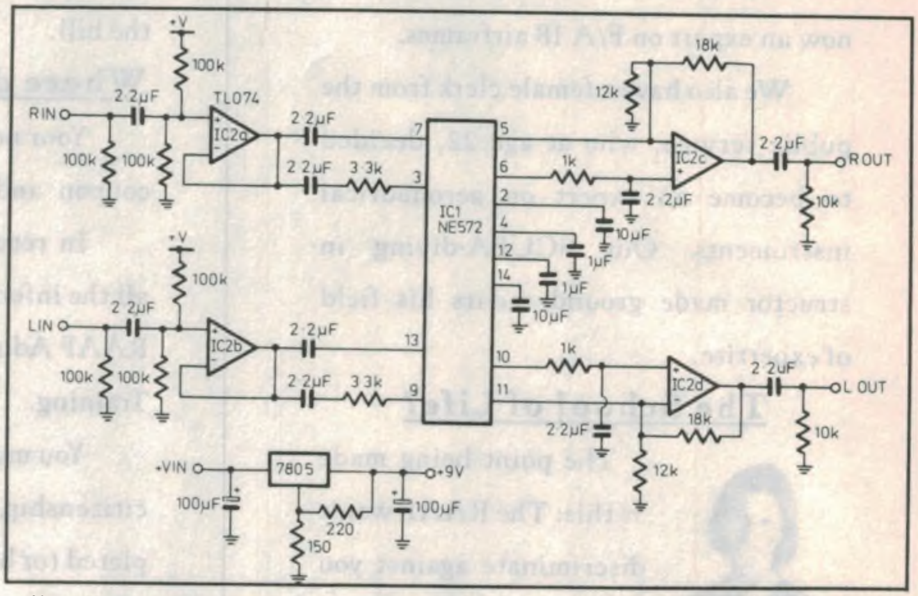
Many audio & video cassette recorders use the system of automatic level control (ALC) to produce clear undistorted sound, but they ruin the dynamic range. By bringing all input signals to the same level, they make a pin drop almost as loud as a cannon's roar.

This circuit when placed between the output of a signal source and the amplifier will help stretch out the dynamic range and give more realistic reproduction.

The circuit uses the NE572 compander IC, which contains two separate compandors. The input signal is buffered by IC2a and IC2b. From here it is passed onto the NE572 compander IC to two sections.

At pins 7 and 9, the signal enters the current-controlled amplifier (CCA) and at pins 3 and 13, it enters the voltage rectifier.

As the input signal increases, the current from the rectifier increases and so the gain of the CCA increases.



When the input signal decreases, the current to the CCA decreases and so does the gain, reducing the amount of signal.

The four ground capacitors (pins 2, 4, 12, 14) set the attack and decay time of the expansion for both channels.

The subsequent output signal is converted from a current back to a voltage by IC2c and IC2d and then taken to any high-quality amplifier.

The DC output of IC2c and IC2d is set by the 12K resistors to ground, and should be 4.5V with a 9V supply.

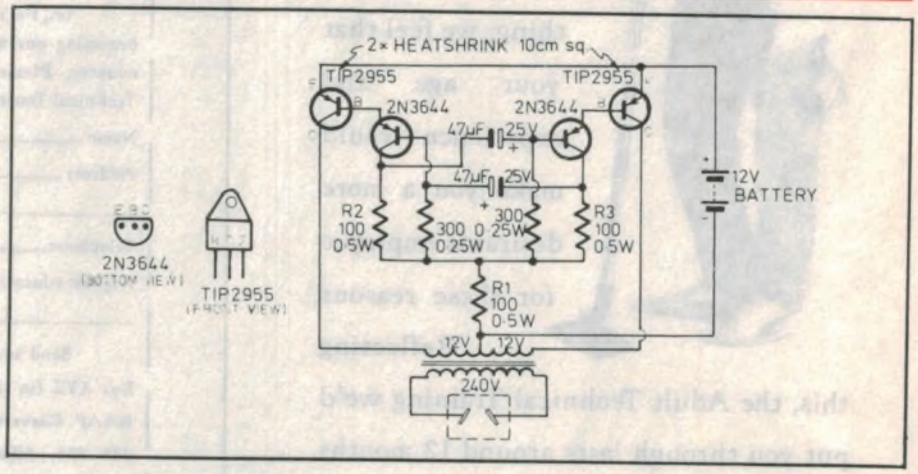
Darren Yates,
French's Forest, NSW.

$40

Simple low power inverter

This low cost inverter is designed to power an air pump for a fish tank, in case of power failure. As can be seen by the configuration the circuit is basically an astable multivibrator, powering two power transistors (TIP2955). Power supply is from a 12-volt car battery.

The component values shown will yield a free-running frequency of approximately 50Hz. The 47uF 25-volt capacitors will be reversed in polarity during operation and hence will need to be aluminium electrolytic types (not tantalum). Resistor R1 in the series with the multivibrator section effectively limits the charging voltage on the capacitors to less than half the supply as, at any instant, one side of the multi is switched on. Hence R1 is in series with either R2 or R3, the V_{be} of a TIP2955 and the $V_{CE(SAT)}$ of a 2N3644. By limiting the voltage to approximately 5V, the reverse V_{be} voltage of the 2N3644 and TIP2955 will not be exceeded during their off cycle.

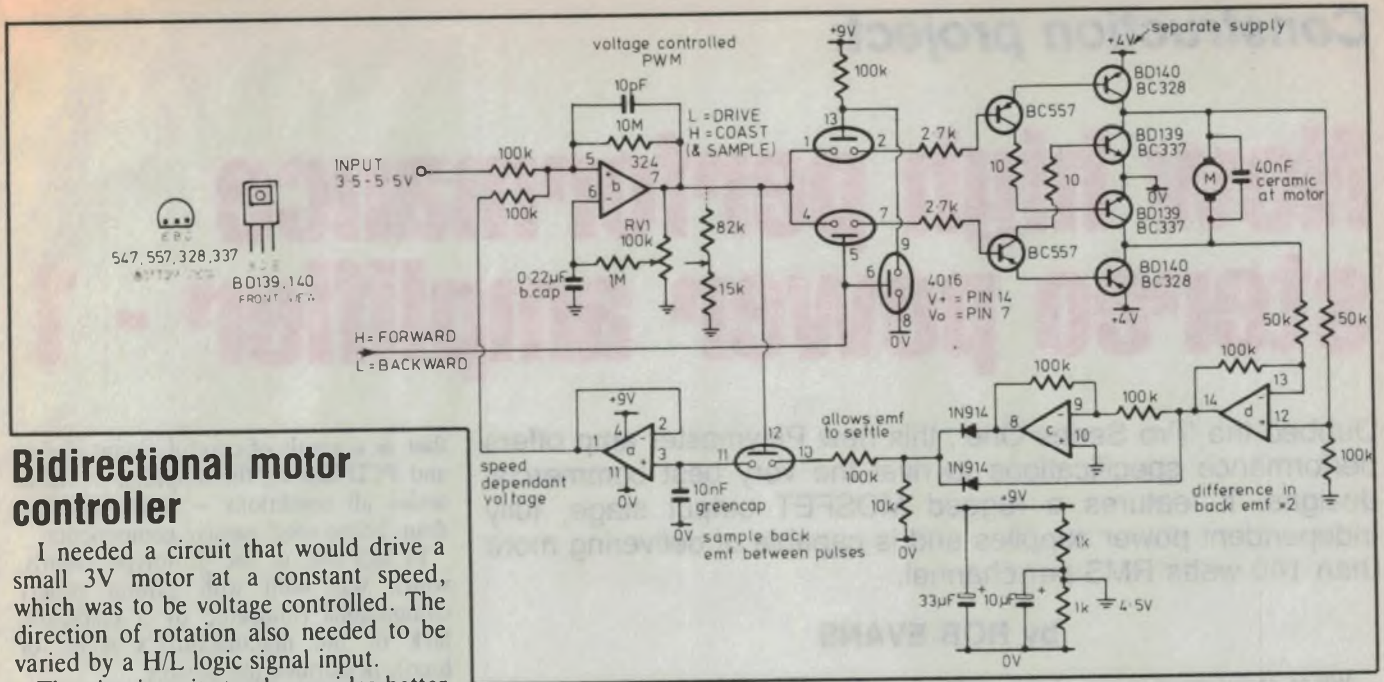


The transformer for the unit was a 50Hz type salvaged from existing audio equipment and had two 12-volt windings which I connected in series for the job. The unit was constructed in a small box with a small heatsink provided for the power transistors. In operation the unit performed well providing a reasonably good square wave to a resistive load and to the mainly inductive load of the fish tank air motor.

The use of PNP power transistors and drivers was purely arbitrary, and the circuit could easily be modified to run with NPN type transistors. The power rating could also be increased, if the drive were increased and a larger transformer used. The existing circuit easily provided the 6VA required by the air motor.

H.F. Nissink,
Burnie, Tasmania

$35



Bidirectional motor controller

I needed a circuit that would drive a small 3V motor at a constant speed, which was to be voltage controlled. The direction of rotation also needed to be varied by a H/L logic signal input.

The circuit as it stands provides better speed regulation at high speed than variable voltage circuits and much better speed control at low speeds than pulse width modulation techniques.

The circuit works by converting a variable input voltage to PWM (pulse width modulation), which is then applied to the motor.

In between power pulses the back-emf of the motor is amplified and rectified, and the value, which corresponds fairly well to the speed, is stored in a sample and hold. This is then combined with the input voltage which tends to keep the motor speed constant under varying load conditions.

To give an idea of the performance, a small 3600rpm motor was driven at 60rpm (one rev/second) under varying loads, the drive current increasing to stall values under very high loads.

Constructors should note the following: The gain of the back-emf feedback can be increased by decreasing the value of the two 50k resistors in the difference amp, to allow for less efficient motors. The gain of the voltage controlled PWM can be varied by RV1. I found the optimum gain to be 5, corresponding to the 82k and 15k resistors shown. The gain should be set so that low speeds are possible, but not so high as to cause oscillations in the speed (these occur at about 1Hz).

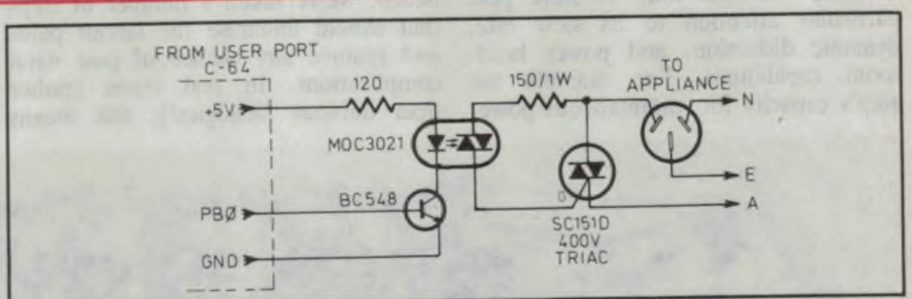
BC337's and 328's have a rated maximum current of 800mA, and are suitable for the smallest 1.5 - 3V motors. BD139/140's are suitable for larger motors such as ones found in larger radio controlled cars and have a rated max. current of 1A. TIP31/32's could be used for currents to 3A.

The motor should be driven from a separate power supply to the electronics, as is done in radio controlled cars; I suggest 3-4 nicads supplying the driver circuit, and a 9V battery for the electronics. These two supplies should have a common earth.

James Moxham,
Urrbrae, SA

$50

Mains controller for Commodore 64



With one or more of these simple controller interfaces, a Commodore 64 computer can be used to control up to eight different 240V appliances – turning each one on and off independently, under software control.

Each interface consists of the circuit shown, using an MOC3021 opto-coupled diac to isolate the 240V circuit from the computer. The MOC3021 is driven from the computer's parallel user port, via a BC548 buffer transistor, while it in turn drives an SC151D triac to perform the load switching.

The circuit shown is effectively just one control channel, driven by the bit-0 output of the user port. If you wish to provide further channels, these would be driven from bits 1-7.

The channels are turned on and off by POKEing appropriate numbers from 0 to 255 into location 56297, the user port address. For each channel, the number corresponds to the weighting of the bit that is used. Hence a 1 will turn on channel 0, as shown, while a 2 will turn on channel 1, a 4 will turn on channel 2 and so on.

All channels can be turned off together by POKEing a 0, while individual channels can be turned on and off by adding or subtracting the number corresponding to that channel's bit weighting to the last number POKEd, and POKEing again.

The SC151D triac will switch up to 15 amps. An alternative device which could be used is the SC141D, but this will only switch up to 6 amps. Remember to take great care with the 240V wiring, to prevent the risk of shock or damage.

Adam Nelson,
Bendigo, Vic.

$30

Construction project:

New high performance stereo power amplifier - 1

Dubbed the 'Pro Series One', this new Playmaster amp offers performance specifications to rival the very best commercial designs. It features a rugged MOSFET output stage, fully independent power supplies and is capable of delivering more than 140 watts RMS per channel.

by ROB EVANS

We're really quite proud of this project. It represents the result of a great deal of research into amplifier design, and many hors spent in testing countless circuit configurations. While this development period has not been without its challenges and frustrations, our efforts have been well rewarded by the resulting design, which is probably the highest performance Playmaster amplifier to date.

In short, if you require a powerful amplifier with really exceptional performance, this is the one for you.

As well as providing high power and extremely low distortion (see associated specification panel), this new amplifier has been designed with the CD devotee in mind. To this end, we have paid particular attention to its slew rate, dynamic distortion, and power headroom capabilities. For example the amp's capacity for instantaneous power is a healthy 190W RMS into 8 ohms, and a massive 320W RMS into 4 ohms.

However we haven't forgotten the practical aspects involved in construction projects. Designing an amplifier with superb performance figures is pointless if the kit version is prone to oscillate wildly, or instantly destroys the output devices. Over the years some hapless constructors have been greeted by a pungent mushroom cloud rising from their new 'high performance' amp, when the power is first applied. Fortunately this is a relatively rare occurrence, as the majority of kit amplifiers are trouble-free.

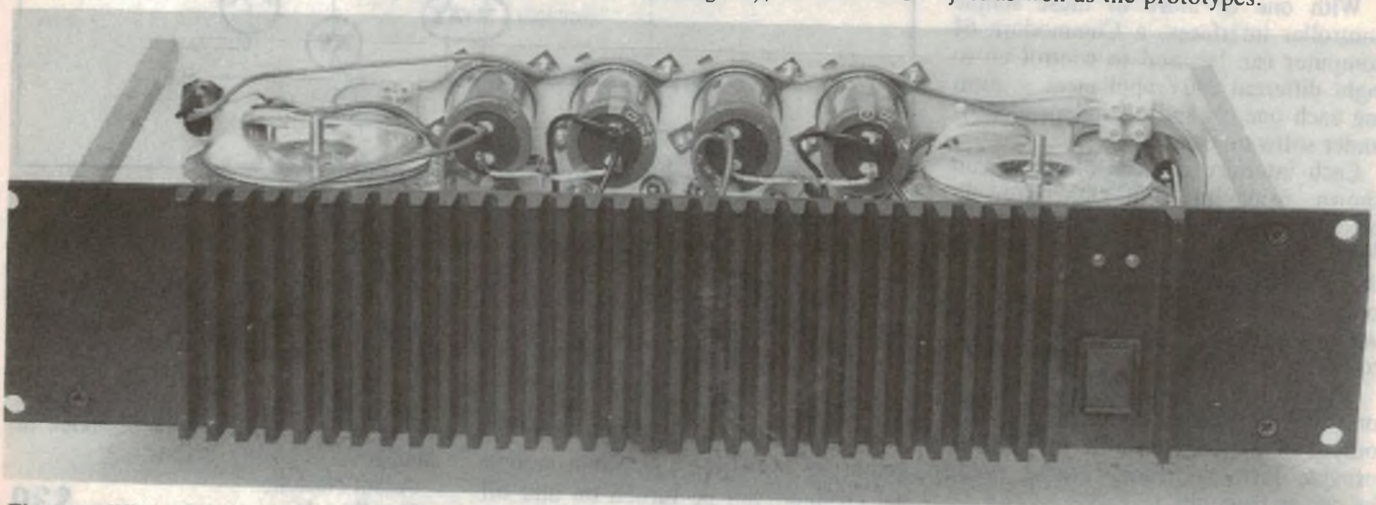
So to ensure that our new Playmaster amp has a smooth birth on your workbench, we've taken a number of steps that should minimise the labour pains and remove any chance of post natal complications. In real terms (rather than dubious analogies!), this means that as a result of careful circuit design and PCB layout, the amplifier is stable under all conditions – even with less than 'prime spec' passive components.

In fact one of the prototype boards, which was built with garden variety components (indicated by a suspicious lack of the manufacturer's name or logo), performed impeccably.

The potential for disaster here is that many capacitors of a dubious origin exhibit poor high frequency characteristics, and a higher than normal self inductance. The 5W wirewound source resistors can also be a cause of trouble, through unpredictable capacitive and inductive effects.

However, in the unlikely event that your new amp gives trouble, the next fault-finding section – including a number of tips that will help you cure just about any contemporary audio amplifier. Naturally, the issue will also include a detailed construction guide and setting-up procedure, which are both very straightforward due to the use of a simple single-sided PCB, and only one calibration trimpot.

So with all of our pre-planning, you shouldn't have any trouble in getting this new Playmaster amp to perform just as well as the prototypes.



The amplifier with its cover removed – while it may look rather unassuming, its performance is exceptional.

Output devices

The objective of this design was to produce an amplifier of the highest possible quality with a power capability comfortably in excess of 100W RMS per channel (into 8 ohms), and a circuit arrangement which would be both easy to construct and extremely reliable.

Since an amplifier's output stage plays a crucial part in determining its final performance, stability and overall reliability, the logical choice for our requirements was to use the popular MOSFET power transistors. These enhancement-mode devices offer a number of significant advantages over their bipolar counterparts, due to their unique performance characteristics.

The first important advantage is a MOSFET's very high input impedance, which basically appears to the driving stages as a low value capacitance (less than 1000pF). This in turn allows the MOSFETs to be driven by a low-power class A amplifier, which will maintain its linearity due to the high load impedance presented by the output stage.

As a further advantage, the largely capacitive input (with a very low series resistance) of the MOSFETs sets their bandwidth to at least 3MHz, which adds up to an output stage with unparalleled frequency response and slew rate. However such a high input impedance, wide bandwidth and fast response is a prime environment for oscillations to occur.

Fortunately the MOSFET's response may be tamed by the simple addition of gate 'stopper' resistors, which in combination with the gate capacitance form a simple high pass filter.

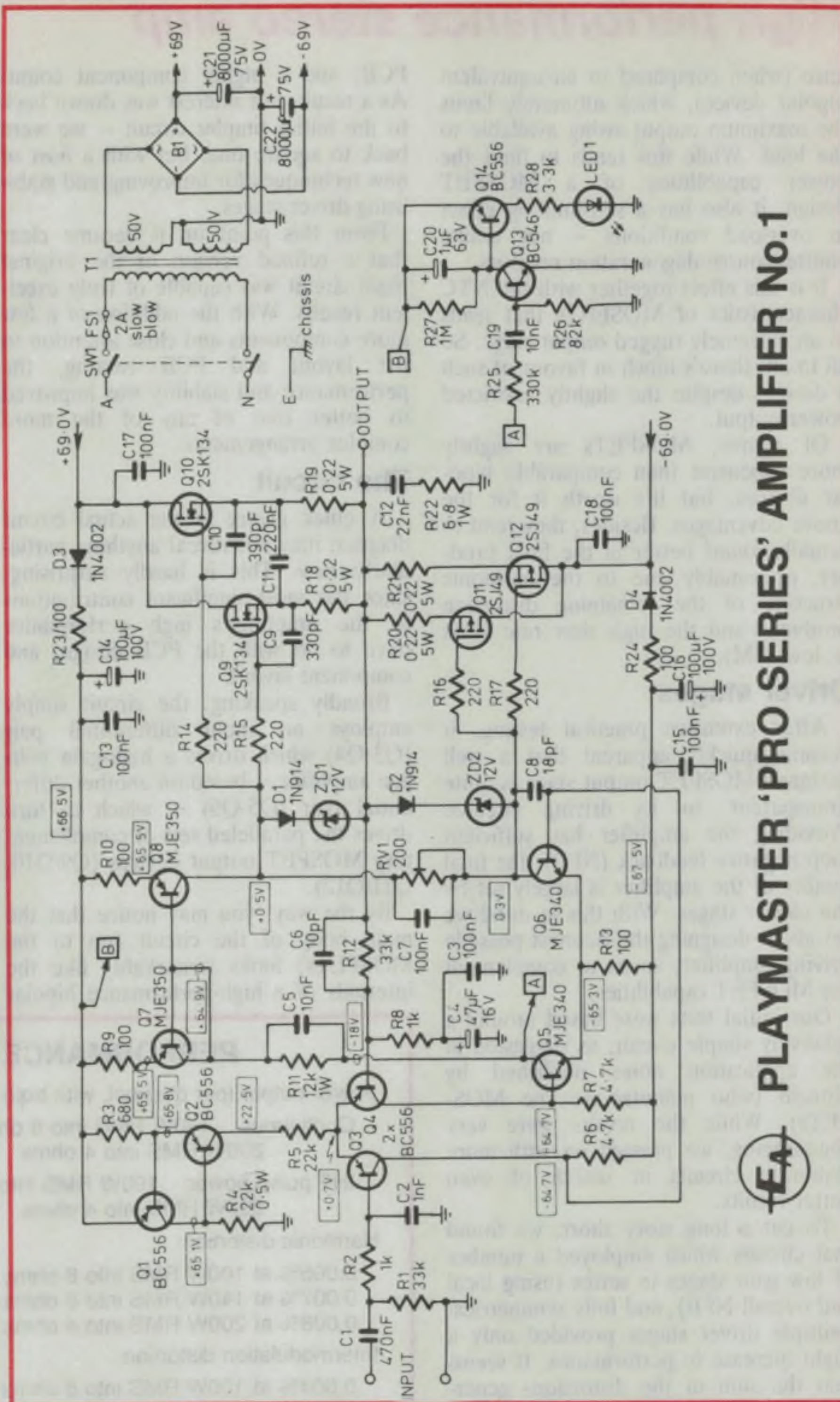
So the dynamic performance of the MOSFETs allows us to produce an output stage which is at least as fast as the driving stages. This is a significant improvement on an equivalent bipolar design, where the heavy-duty output transistors cannot keep up with the rapid response of the preceding stages. The result is a *slew rate limiting* effect, giving rise to unacceptable levels of Transient Intermodulation distortion (TIM).

In our case the maximum signal slope is entirely defined by a passive input filter, which is set to a point well beyond the audio spectrum (about 100kHz). This is possible because thanks to the MOSFETs, the actual amplifier has a bandwidth of around 1MHz and a slew rate of more than 60V/us. The end result is extremely low levels of TIM and a very stable design.

The other significant advantage of MOSFETs is their temperature stability and absence of secondary breakdown effects, which is a considerable problem in bipolar designs. The MOSFETs have a negative temperature coefficient (NTC) at drain/source currents of more than about 100mA, where the drain to source resistance begins to increase as the chip temperature rises. This has the stabilising effect of decreasing the drain to source current.

The same effect also operates on a much smaller scale. Any hotspots developing on the chip surface (the source of secondary breakdown effect in bipolar devices) will cause an increased resistance in that area, and a lower localised current. This ultimately distributes the current and heat evenly across the chip surface.

MOSFETs also tend to have a relatively low forward transfer admittance. To put it simply, this means that a MOSFET has quite a high 'ON' resist-



The schematic for one complete channel, including quiescent voltage levels.

ance (when compared to an equivalent bipolar device), which ultimately limits the maximum output swing available to the load. While this tends to limit the power capabilities of a MOSFET design, it also has a self-limiting effect in overload conditions – not unlike emitter/source degeneration resistors.

It is this effect together with the NTC characteristics of MOSFETs that leads to an extremely rugged output stage. So all in all, there's much in favour of such a design, despite the slightly restricted power output.

Of course, MOSFETs are slightly more expensive than comparable bipolar devices, but it's worth it for the above advantages. Besides, they tend to actually *sound* better in the final product, presumably due to the harmonic structure of the remaining distortion products, and the high slew rate (that is, low TIM).

Driver stages

After extensive practical testing, it became quickly apparent that a well designed MOSFET output stage is quite 'transparent' to its driving circuits. Providing the amplifier has sufficient loop negative feedback (NFB), the final quality of the amplifier is largely set by the earlier stages. With this in mind we set about designing the cleanest possible driving amplifier, so as to complement the MOSFET capabilities.

Our initial tests were based around a relatively simple circuit, as suggested in the application notes published by Hitachi (who manufacture the MOSFETs). While the results were very encouraging, we pressed on with more elaborate circuits in search of even better results.

To cut a long story short, we found that circuits which employed a number of low gain stages in series (using local and overall NFB), and fully symmetrical multiple driver stages provided only a slight increase in performance. It seems that the sum of the distortions generated from each stage was virtually the same as the total distortion from the simpler circuit. This effect is largely due to the non-linearities produced at the base/emitter junctions of the lower gain stages, which have to cope with larger input signal levels.

So while these more complex circuits offered a small improvement in the overall performance figures, we found these designs much more difficult to stabilise. Of course we also had to put up with a more complex and larger PCB, and a higher component count. As a result, our interest was drawn back to the initial simpler circuit – we were back to square one, but with a host of new techniques for improving and stabilising driver stages.

From this point on it became clear that a refined version of the original basic circuit was capable of truly excellent results. With the addition of a few more components and close attention to the layout and PCB routing, the performance and stability was improved to better that of any of the more complex arrangements.

The circuit

A quick glance at the actual circuit diagram may not reveal anything particularly new. This is hardly surprising, since the most significant contributions to the amplifier's high performance have to do with the PCB design, and component layout.

Broadly speaking, the circuit simply employs an input differential pair (Q3-Q4) which drives a high-gain voltage amplifier – based on another differential pair (Q5-Q6) – which in turn drives the paralleled sets of complementary MOSFET output devices (Q9/Q10, Q11/Q12).

By the way, you may notice that the main body of the circuit (up to the MOSFETs) looks remarkably like the internals of a high-performance bipolar op amp. This is more than a coincidence, since a number of the current sourcing and balancing techniques in the circuit are borrowed from op amp practice. So just like a quality op amp, the amplifier offers differential inputs, high open-loop gain and bandwidth, low output impedance and a high slew rate. However the circuit is worth a general analysis, since its operation is not quite as simple as it looks.

The input signal is coupled to the first differential pair Q3/Q4 via the input network composed of C1, R1, R2 and C2. The input capacitor and resistor (C1 and R1) form a high-pass filter, which restricts the amp's low-frequency response to a –3dB point of 10Hz. Similarly, the overall high-frequency response is restricted to a –3dB point of around 100kHz by the low-pass filtering action of R2 and C2 – this controls the rise time of the input signal to a realistic level, which reduces the possibility of slew-induced distortion components.

The input differential pair based around Q3 and Q4 essentially functions to compare the input and output (feedback) signals, and generate an error signal which in turn drives the following voltage amplifier stage. To improve its performance and power supply rejection, the common emitter connection is supplied by a balanced, two transistor constant current source formed by Q1, Q2, R3 and R4.

When power is initially applied to the constant current source, current flows

PERFORMANCE OF PROTOTYPE

Power output (per channel, with both channels driven)

Continuous: 140W RMS into 8 ohms
200W RMS into 4 ohms

IHF pulse power: 190W RMS into 8 ohms
320W RMS into 4 ohms

Harmonic distortion

0.005% at 100W RMS into 8 ohms
0.007% at 140W RMS into 8 ohms
0.008% at 200W RMS into 4 ohms

Intermodulation distortion

0.004% at 100W RMS into 8 ohms
(4:1 ratio of 50Hz and 7kHz)

Frequency response

10Hz to 100kHz (–3dB points)

Signal to Noise

More than 100dB below rated output (unweighted)

Sensitivity

0.83V RMS for 100W into 8 ohms

Overload indicator

Activated if output distortion exceeds 0.05%
(regardless of load impedance)

Input impedance

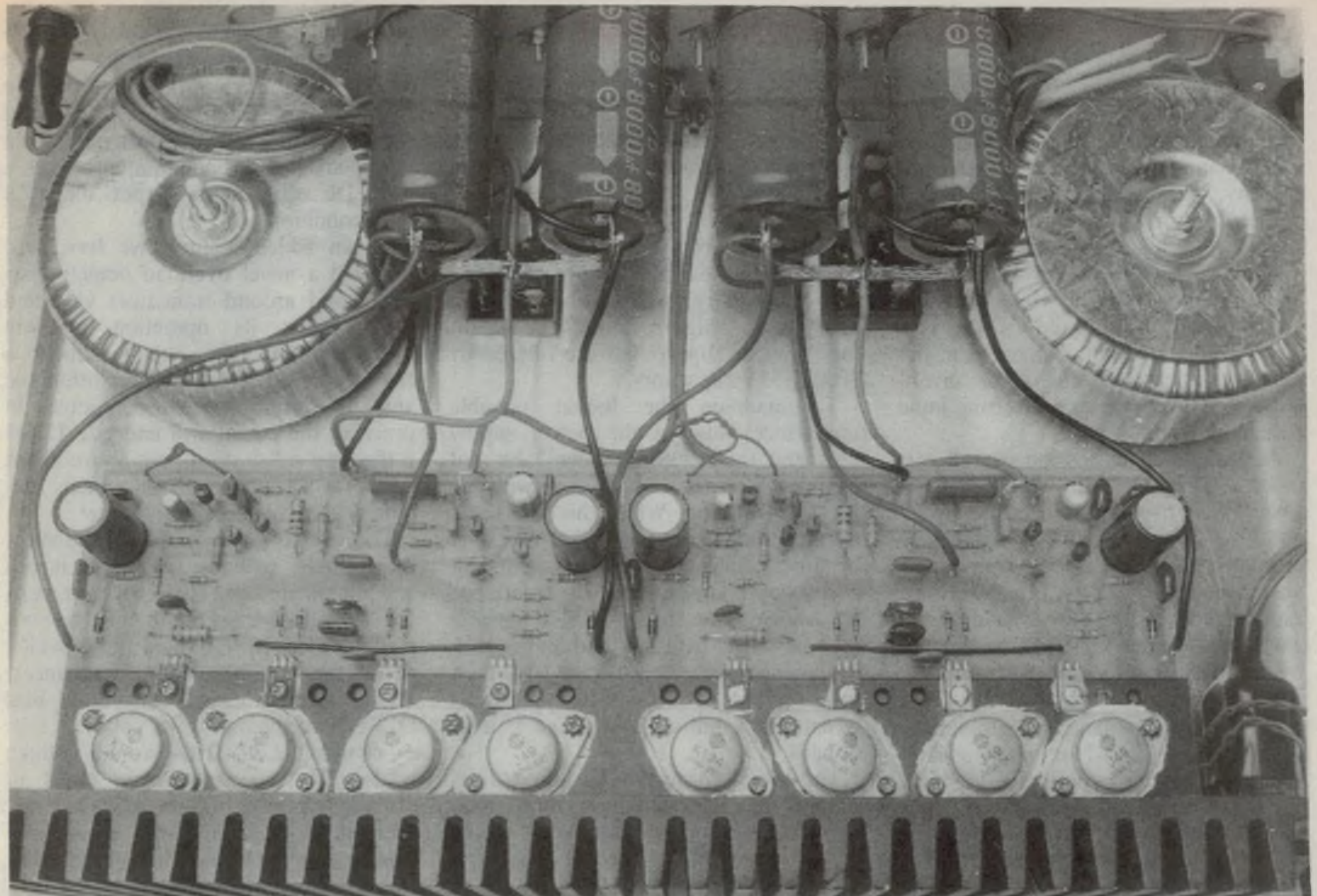
Approx 33k ohms

Output slew rate

More than 60V/us

Damping factor

Greater than 50



The construction and wiring are very straightforward, as you can see from this shot of the prototype.

through R3, the base emitter junction of Q2, and to ground via R4. This will continue until the voltage across R3 reaches around 0.7V where Q1 conducts, robbing base current from Q2. The reduced emitter current of Q2 then tends to reduce the drop across R3.

The circuit reaches a point of equilibrium where the voltage drop across the b-e junction of Q1 is about 0.7V, regardless of the value of R3. Since this voltage is fixed, the current through Q2 (and the differential pair Q3 and Q4) will be set by the value of R3. With this set to 680 ohms, the current is fixed at around 1mA.

Following the input differential amp is the voltage amplifying stage. This is based around a differential pair formed by Q5 and Q6, and a balanced current mirror load incorporating Q7 and Q8. This section of the circuit provides most of the amplifier's voltage gain, and a highly linear output capable of swinging between the two supply rails.

The current mirror (Q7 and Q8) acts as the collector load for Q5 and Q6, which operate at a shared quiescent current of around 20mA, as set by R13 and the collector loads of Q3 and Q4 (R6 and R7 respectively). The current mirror itself is not unlike a programmable constant current source, with the current through Q7 and R9 modifying the amount of current sourced by Q8 – the collector load for Q6.

So, as a differential input signal tends to turn Q5 ON and Q6 OFF, the increased current through Q7 and R9 will bias Q8 on a little harder. Therefore as Q6 is turning OFF, the action is assisted as Q8 (its collector load) effectively becomes a lower impedance. Due to this active collector load, the stage offers an extremely linear output and a very high voltage gain.

To balance the power dissipation and operating points of Q5 and Q6, R11 is inserted in the collector of Q5, while C5 bypasses its effect at higher frequencies. Also, C7 is included to decrease the gain of the stage at very high frequencies, which in turn controls the overall phase shift and ensures stability. The outputs at the collectors of Q6 and Q8 are separated by a fixed voltage as set by RV1, which sets the MOSFET's gate to source bias – thus ultimately their quiescent drain current.

The output stage is formed by the complementary set of MOSFETs Q9-12, with their respective source degeneration resistors R18 to R21, and gate 'stopper' resistors R14 to R17. Since the MOSFETs may be driven to destruction by excessive gate drive, such as an output overload where the NFB applies excessive compensation, the gate to source voltage is limited to about 12V by D1, ZD1, D2 and ZD2.

Capacitors C8 and C9 raise the effective gate to source capacitance of Q9 and Q10 to around that of the complementary pair Q11 and Q12. This provides a more balanced high-frequency load for the preceding driver stage, which enhances the overall amp's high-frequency performance and stability.

C11 is added between the sources of Q9 and Q10 to provide a low impedance path at high frequencies, where the inductive effects of the wire-wound resistors R18 and R19 can lead to instability.

You may also notice that the values of C9 and C10 are slightly different (330pF and 390pF) – this avoids a symmetrical arrangement of Q9 and Q10's source circuitry, which may promote oscillations when the amplifier is driving complex loads. To further assist stability, the network comprised of C12 and R22 ensures that the output always has a load at high frequencies.

The overall closed-loop gain of the amplifier is set by the voltage divider action of R12, R8, C3 and C4 – as with an equivalent op-amp configuration, this network supplies the amplifier's 'inverting input', while the non-inverting input accepts the input signal.

At audio frequencies the overall gain is set to 34 by the ratio of R12 and R8, since R8 is bypassed to ground by C3 and C4. Of course at very low frequencies these capacitors offer a high impedance, which increases the NFB and rapidly reduces the gain. Similarly, the gain is reduced at very high frequencies by the bypassing action of C6 on R12. By the way C3 is in parallel with C4 to ensure a low impedance path to earth at high frequencies, where many electrolytic capacitors offer poor performance.

For a further increase in power supply rejection, the amp's driving circuitry has heavily decoupled supply rails by virtue of D3, D4, R23, R24, and capacitors C13 to C16. This guarantees the performance of the earlier stages, even when the output devices are delivering heavy transient currents.

The power supply itself is quite a conventional arrangement based around a 225VA toroidal transformer, with two 45V secondary windings feeding a heavy-duty bridge rectifier. The resulting balanced supply rails are filtered by 8000uF/75V capacitors.

To maintain the lowest possible impedance between the power supply rails and the MOSFETs, we have not included fuses directly in series with the MOSFET drains. While this is a little unconventional, we found that this style of direct connection provided significant performance benefits. Also, experience has shown that the MOSFET devices are extremely reliable and quite self-protecting, and a catastrophic (that is, a full short circuit across the supply rails) is extremely unlikely – unlike bipolar designs.

The overall protection in our circuit is simply the 2A slow-blow fuse FS1, which will disconnect the mains supply in the event of a gross overload. For those that are uneasy about this situation, we would recommend the addition of Polyswitch devices in series with the amp's output leads. In fact, a fused supply will provide little protection for a loudspeaker if the amplifier produces a large DC offset at its output, due to a fault condition.

As an added feature, we have also included a novel overload detector circuit based around transistors Q13 and Q14. While its operation is very straightforward, the circuit utilises a complex effect which occurs within the amplifier during overload conditions. In practice, the circuit will energize LED1 if the amp's distortion rises above about 0.05% – a lower figure than many amplifiers can ever hope to achieve!

The circuit basically detects transient AC signals, extends the pulse length and illuminates the LED for that period. The signal from point A is AC coupled to Q13 by C19 and R25 (which raises the circuit's input impedance). When sufficient energy arrives to bias Q13 ON momentarily, its collector falls – charging C20. This stored voltage holds Q14 in conduction for an extended period, while C20 is discharged by R27 and the transistor's base current. During this period, the collector of Q14 rises to the full supply voltage (connection B), energizing LED1 via the current limiting resistor R28.

The signal at the collector of Q5 (point A) represents the amplifier's overall error or correction voltage. This occurs since the other half of the differential pair Q6 generates the full output signal swing – if we consider the MOSFETs as electrically transparent for the moment. Now if the signal at the collector of Q6 represents the corrected output (that is, less the distortion components), and Q5 and Q6 represent a true differential amplifier, we can expect the signal *difference* to appear at the collector of Q5 – or in effect, the distortion components which are cancelled at the output – thanks to the overall NFB.

In practice this effect is quite easy to detect with an oscilloscope. If for example, the amplifier is driven into clipping, large spikes are generated at point A as the NFB attempts to compensate for the flattened peaks at the output. So in general, whenever the distortion is high at the output (for whatever reason), sufficient voltage is generated at point A to drive the overload indicator circuit.

Unlike conventional overload indicators which simply sense the output swing, this simple circuit will warn the user of any unacceptable (and dangerous) distortion components – and of course its action is true *for any* load conditions and supply rail voltages.

That about covers the circuit and operation of our new Playmaster amp. Next month we will bring you all of the relevant construction details, setting-up procedure and fault-finding information.

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Multimeter specs: 20,000 ohms/volt, 23 ranges, continuity buzzer.
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MINI STEREO AMPLIFIER

This amplifier was originally supplied with a pair of 5 watt walkman speakers. We believe this amplifier has much more merit on it's own rather than accompanied with two very ordinary speakers, which effectively doubles the price. The amplifer is battery operated (requires 4 x AA) or can be used with a DC 6V external source. Its input and output connections are via 3.5mm stereo sockets. One for in, one for out. It has 3 leds for each channel to monitor output, a high pass and low pass filter switch and an on/off switch with LED indicator. Size 150 L x 70 D x 225 H mm. Ideal for walkmans, or anywhere a low power battery operated amplifier is required.

SPECIFICATIONS

Output	0.5 watt per channel 8 ohms
Input & Imp	600 ohm
Band Width	120 H2 - 20 Kh2 - 3dB
Voltage Gain	8 dB +/- 1 dB (walkman only)
Input voltage	250 mv + power output 30 (walkman)

Cat. AA-0350
$29.95

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1N 4003	1 AMP	300V	$2.50 for 50
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ARLEC No. 61365
A chassis type tranny that gives 240V to 24V CT @ 500mA and 9V @ 5A/ This tranny could give you a ±12V 500mA and +5V @ 5A DC power supply (with rectifiers, regs, and electros of course).
Caat. MA-2600
Normally $25
A bargain at $9.95
10+ $8.95
P & P $4 extra

ARLEC No. 61435
A grain oriented steel chassis type unit giving 240V to 9V AC @ 3A, 16V AC @ 2A, 16V AC @ 1A. The secondaries can be wired to give 16V @ 3A or 24V @ 3A. This is ideal for burglar alarm power supply as burglar alarms use 16V. You could also make a 13.8V regulated power supply from this.
Normally $30 - $35
ONLY $9.95
10+ $8.95
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P & P $4 extra

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An in-line "Maxibox" type power supply. 240V to 6V AC @ 3 AMP. (Output lead fitted with 5.5 OD 22.1 10 DC plug.)
Normally worth $40
ONLY $9.95
10+ $8.95
Cat. MA-2608

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A standard style plug pack of 10.5V DC @ 300mA. We don't know what to use them for, but at $3.95 each, who cares. (Output lead same as 61439.)
Cat. MA-2612
$3.95 EA
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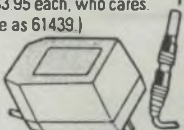

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A large chasis grain oriented steel transformer that gives a massive 20V centre tap at 15 AMPS! This would enable you to, say build a regulated DC supply of ±9V @ around 10 AMPS.
A tranny of this size would normally cost over $60
ONLY $15
Cat. MA-2604
P & P extra $6 each
LIMITED QTYS

ARLEC PS-561
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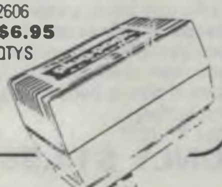

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Bargain of the century
100 assorted LED's including 3mm and 5mm in yellow, orange, red and green, rectangular, triangular and other shapes and displays! All for less than 9¢ each!
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$8.95

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For december you can grab the unique "Microchart" (see over for cat details) for never to be repeated prices

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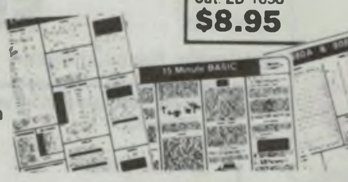
BM-8504	Algrithms
BM-8510	Basic Intro Data
BM-8516	68000 Data



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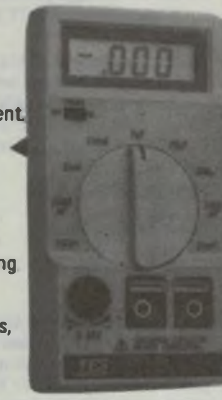

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Specifications:

Range	Resolution
200pF	0.1pF
2nF	1pF
20nF	10pF
200nF	100pF
2uF	1nF
20uF	10uF
200uF	100nF
2,000uF	1uF
20,000uF	10uF

Cat. QM-1572
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DON'T BUY YOUR YOUNG CHILDREN A COMPUTER!
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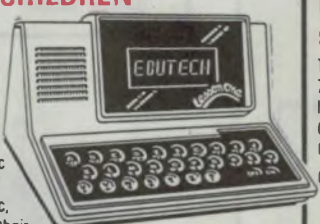

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Children are encouraged to learn to compose music, spell, learn maths and play strategic games all on their own without supervision!!
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We dare you to buy a better, more useful gift for your children, and, once again, Jaycar has purchased these at a price whoh is so low you will be amazed. Each 'LESSON ONE' comes in an attractive gift box, fantastic instruction book and is Q.C'd right here in Australia! This unit would be valued at $149 (commpetition sells for this) but the 'LESSON ONE' is only $79!

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Measures 280w x 145h x 170d
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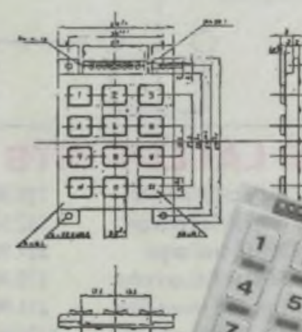

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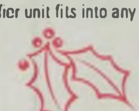

UHF/VHF INDOOR TV AMPLIFIER SPLITTERS

Another distress stock purchase which saves you money. This time two TV amplifiers.

LT-3818

This unit has a boost of 70dB x 2. It has a 75ohm socket for input and two 75ohm outputs. It operates from 240V. Its UHF and VHF and its frequency range is 40 - 860MHz. We don't recommend this unit be used in high signal areas.

Normally $89

NOW ONLY

$59.95

NEW

LT-3819

This unit has a 75/300ohm input and two 75/300 ohm outputs. Further splitters can then be used as this unit is designed to drive up to 8 - 10 TV points. It also has a channel 3, 4, 5A and FM switchable trap (-25dB) in case of cross modulation of 18dB x 2.

Normally $109

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5VA P.C.B. Mount Transformer Bargain

A 15-0-15V tranny less than 1/2 the normal cost!
The Ferguson equivalent to this now sells for around $20.
This is what you get for 1/4 of that: 240V AC to 30-15-0 @ 150mA and 3V @ 150mA

MANUFACTURERS! We have a large quantity of these. Buy in bulk and save!

1 - 9	**$4.95**
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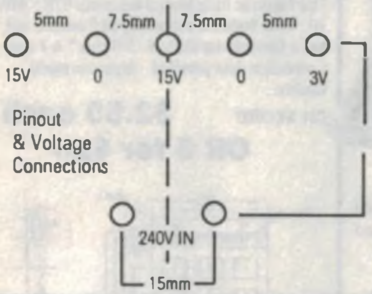
Dimensions (excluding pins): 41W x 34D x 32H
Cat. MA-2622



BRAND NEW "5000" TYPE HI-FI AMPLIFIER

REF: EA Dec '89, Jan '90

"Pro Series I"

At long last the 9 year old 5000 amp design has been totally redesigned to accommodate latest technology!
This totally new design features the best of the old ETI 5000 features including:

- Magnificent heatsink front panel
- Rugged chassis bar 2 rack unit construction
- Proven Hitachi Mosfet technology

BUT ALL ELSE IS NEW!

The new pro Series I features two especially European made 225VA Toroidal Transformers feeding two separate power supplies, one for each channel. (The ETI 5000 had a common power supply for both channels). This massive bank of energy not only increases channel separation, but gives the amp an ENORMOUS LEAP in POWER HANDLING. (See specs.)

Better Features. The Pro Series I not only kills the 5000 for perfomace, it has great features. For example, it has a chassis plug IEC 320 style mains inlet and a switched chassis IEC 240V socket to power other mains equipment. It also features signal clipping LED's on the cast front panel. This keeps in mind the highly likely professional applications for this amp.

Simpler to Build. You would think that this new amp would be harder to build than the straight forward 5000. Not so! The Pro Series I, infact, is far easier to build and actually has less signal distorting components than the 5000.

What do you pay for this magic? Incredibly, we have managed to well withing sight of the old 5000 - only $100 more. That's right! You get all this for only $599!! INCREDIBLE.

As usual, the Jaycar kit comes with every conceivable part - nothing else to buy - and Jaycar quality as a bonus!

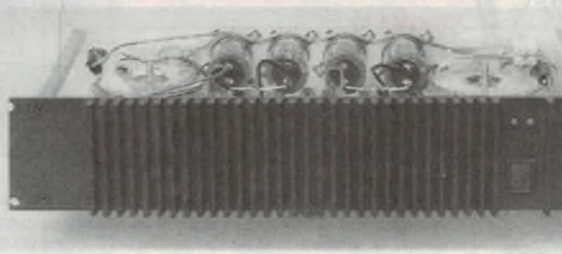
Cat. KA-1725 **$599** **INTRODUCTORY PRICE**

NEW

Specifications: Playmaster Pro Series I

Power output (per channel, with both channels driven)	
Continuous:	140W RMS into 8 ohms
	200W RMS into 4 ohms
IHF pulse power:	190W RMS into 8 ohms
	320W RMS into 4 ohms
Harmonic distortion	0.005% at 100W RMS into 8 ohms
	0.007% at 140W RMS into 8 ohms
	0.008% at 200W RMS into 4 ohms
Intermodulation distortion	0.004% at 100W RMS into 8 ohms
	(4:1 ratio of 50Hz and 7kHz)
Frequency response	10Hz to 100kHz (-3dB points)
Signal to Noise	More than 100dB below rated output (unweighted)
Sensitivity	0.83V RMS for 100W into 8 ohms
Input impedance	Approx 33k ohms
Output slew rate	More than 60V/us
Damping factor	Greater than 50
Overload indicator	Activated if output distortion exceeds 0.05%

JAYCAR - CONTINUING THE EXCELLENCE OF HI-FI WITH THIS SUPERB KIT



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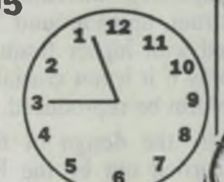

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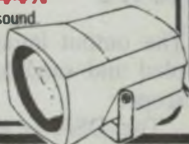

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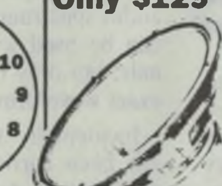

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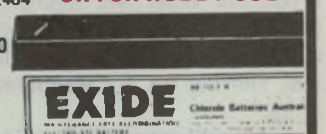

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Construction Project:

Digital storage adaptor for scopes

Here's a low cost and particularly easy to build unit which effectively converts any normal analog oscilloscope into a digital storage instrument, with sampling rates up to 200 kilosamples/second. It's also remarkably compact, with all circuitry fitting on two small interconnecting PC boards.

by JIM ROWE

The Digital Storage Adaptor or 'DSA' described here has been designed to form an external accessory to any conventional analog oscilloscope. Its function is to take an incoming analog signal and convert it into a stream of 8-bit data words, which are then stored in sequence in a 2048-word-deep memory. From the memory the stored data samples can then be 'replayed' as often as needed, converted back into analog form and displayed on the scope.

The particular advantage of a DSA is that 'one shot' or widely spaced events can be captured and examined at leisure, whereas conventional oscilloscopes are useful only on repetitive waveforms.

For example, it may be desirable to examine the sound of a bell ringing. A microphone and preamp would be set up and the DSA controls configured ready to receive the signal. On receipt of the first part of the bell's ring waveform, the DSA will digitise and store the signal for 2048 samples – and then continously replay the result for convenient viewing on a conventional oscilloscope.

A trigger output is provided by the DSA to allow triggering of the scope sweep at either the beginning or middle of the replayed sample stream.

The 2048-sample memory depth provided by the DSA is more than the average scope can resolve along its horizontal axis, so by activating the scope's X5 or X10 timebase magnifier the resolution can be greatly enhanced.

The DSA has input and output sensitivities of 0 to 2.5V DC, and the input has switch selectable AC or DC coupling with an input impedance of 1M. The output impedance is 1k, DC coupled and suitable for any conventional scope.

The DSA is manually 'armed' by a pushbutton which sets the unit ready for a new recording. The 'TRIG' control sets the threshold at which the recording will start, between 0 and 2.5V. If higher sensitivity is required an external opamp preamplifier can be used, while an external resistive attenuator can be used to lower the sensitivity for larger signals.

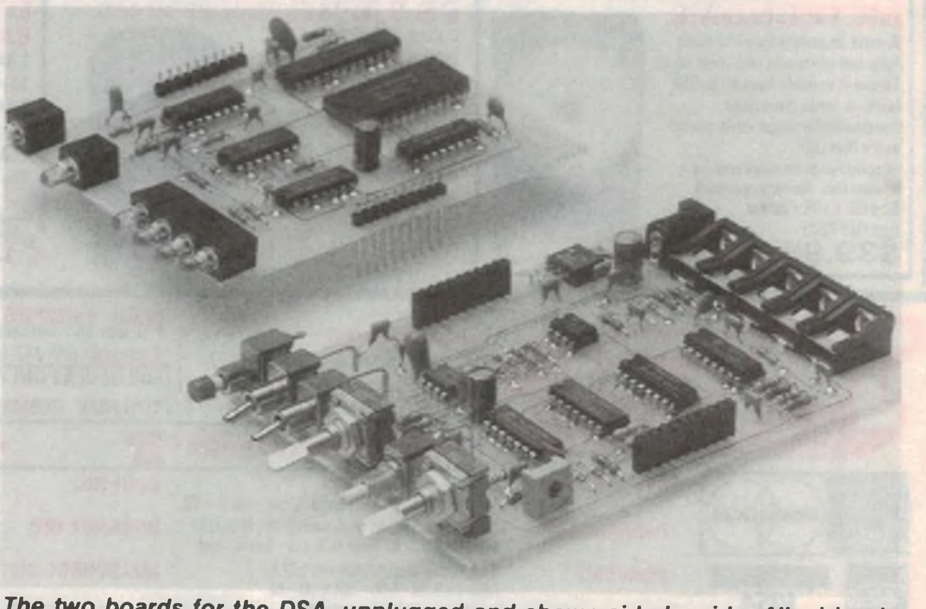
The uses for a DSA are manifold, but there are a few practical limitations. There is no point in taking fewer than say 20 samples of the highest frequency component in the incoming signal, because the nature of the signal is not discernable on replay.

For example if a 10kHz sinewave were recorded at 40k samples per second, it is not clear from the replayed signal whether the original was a sine, square, triangle or whatever! There are just not enough samples to give adequate resolution.

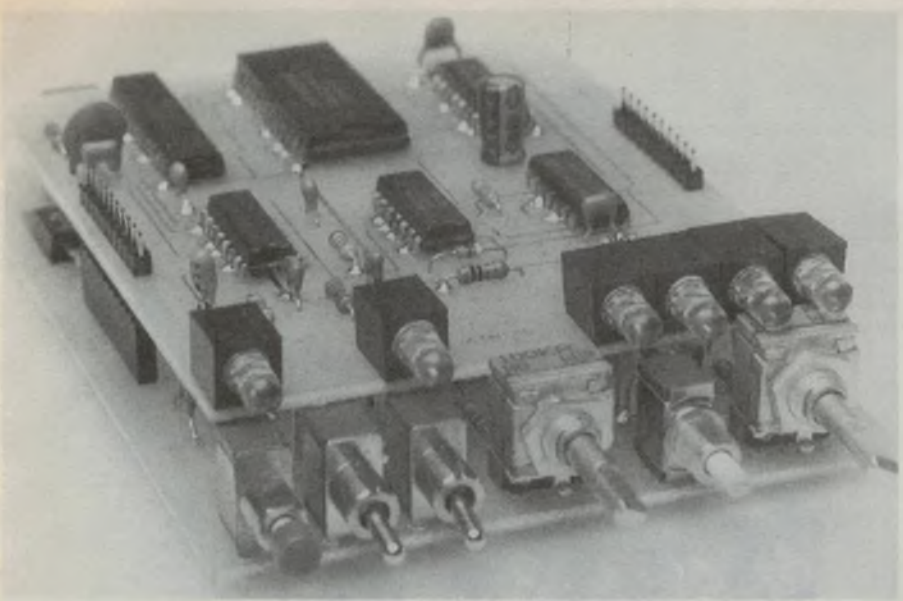
From Nyquist's sampling theorem it is not possible to record and faithfully reproduce any signal of frequency more than half the sampling rate, but in practice the signal should be at least 10 times lower in frequency if the waveform is to be reproduced faithfully.

Hence with a maximum sampling frequency of 200ksps, this DSA is basically fine for capturing waveforms in the audio spectrum, up to around 20kHz. It can be used with higher frequency signals, but only if it is not crucial that the exact waveform be reproduced.

Incidentally the design of this DSA has been carried out by the R&D department at Australian Test and Meas-



The two boards for the DSA, unplugged and shown side by side. All wiring is on the two boards.



The two boards assembled, and shown almost exactly full size. As you can see, it's a very neat and compact little instrument...

urement, and accordingly the PCB etching patterns and other aspects of the design are proprietary. This means that other firms are not able to offer them for sale. However AT&M is making available two complementary kits for the DSA, one for the complete electronics module and the other for a very neat matching case.

The electronics module kit has catalog number ATM17, and is priced at $161 plus 20% sales tax, if applicable; the matching case kit is the ATM17-01, and is priced at $23 plus sales tax.

Compact construction

The electronics section of the DSA consists of two compact double-sided printed circuit boards, which connect together via 10-way PCB connectors on each longer side. The two boards perform literally all of the circuit wiring, so that there is no conventional wiring at all.

The lower 'base' board, measuring 121 x 86mm, carries all the input and output connectors, the switches and potentiometer controls, the power supply, analog buffer, comparator and record oscillator circuits. Incidentally to allow the I/O connectors to all be mounted directly on this PCB, all signal connections are made via 3.5mm miniature jack sockets. These provide reliable connections, at a reasonable cost.

The top board measuring 101 x 80mm contains the single chip ADC-DAC, the RAM and the digital control circuits and LED indicators.

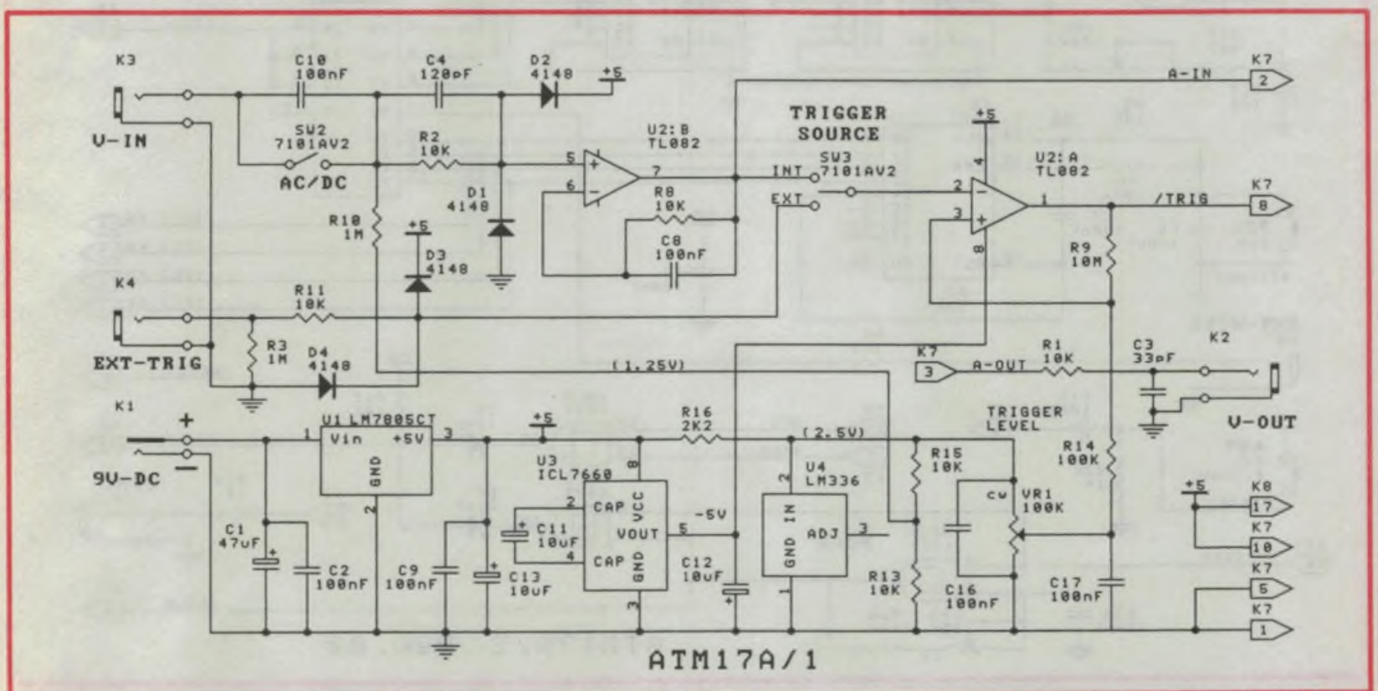
The power supply consists of three voltage regulators (U1, U3 and U4) which provide the +5V, –5V and +2.5V voltages (respectively) from an external unregulated 9V DC plugpack supply, which is connected to power input socket K1.

How it works

To understand how the DSA operates, refer to the circuit schematic. This is in three sections – two covering the baseboard circuitry (ATM17A/1 and /2), and the third covering the top board circuitry (ATM17B).

When power is first applied to the unit, the reset monostable U4a (schematic ATM17B) is triggered and resets the record control flipflop U6a and b, the write monostable U4b and the ADC/DAC device, U1 – an AD7569.

The unit is now in the replay or 'playback' mode, where the digital contents of the 6116 static RAM (U2) are continously read out and converted by the DAC section of U1 into an output analog signal. Generally the initial contents of the RAM will be random and produce an irrelevant 'garbage' analog sig-



The first section of the schematic, showing the input signal processing, trigger level comparator and power supply circuitry on the baseboard.

Digital storage

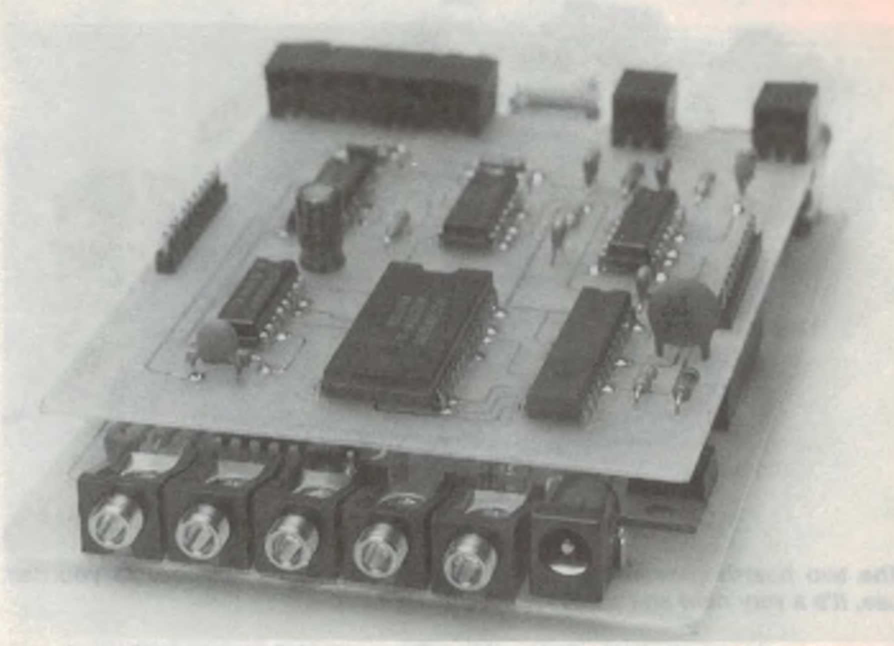
nal at this stage, but if a battery backed NV RAM is used the output will be the last signal that was recorded by the DSA.

The address lines of the RAM are driven by a 4040 counter (U3), which is clocked by the ACLK signal from the base board. During playback the READ signal enables the gated relaxation oscillator U8b (schematic ATM17A/2), to provide the ACLK signal for the counter and the RCLK signal for the DAC '/WR' (U1 pin 15) and RAM '/G' (U2 pin 20) inputs.

On the positive cycle of RCLK, gate U8c produces a negative ACLK signal to advance the 4040 counter. On the negative cycle the /WR and /G inputs are strobed low, to output the data from the RAM and write it into the DAC section of U1.

The most significant RAM address line is output as the SYNC signal for the oscilloscope trigger. By selecting either positive or negative triggering on the scope, the centre of the displayed signal can either be the start or centre of the recorded signal.

The DAC analog output signal (U1 pin 2) is passed down to the baseboard, where it is filtered by R1 and C3 prior to being output from the V-OUT connector K2.

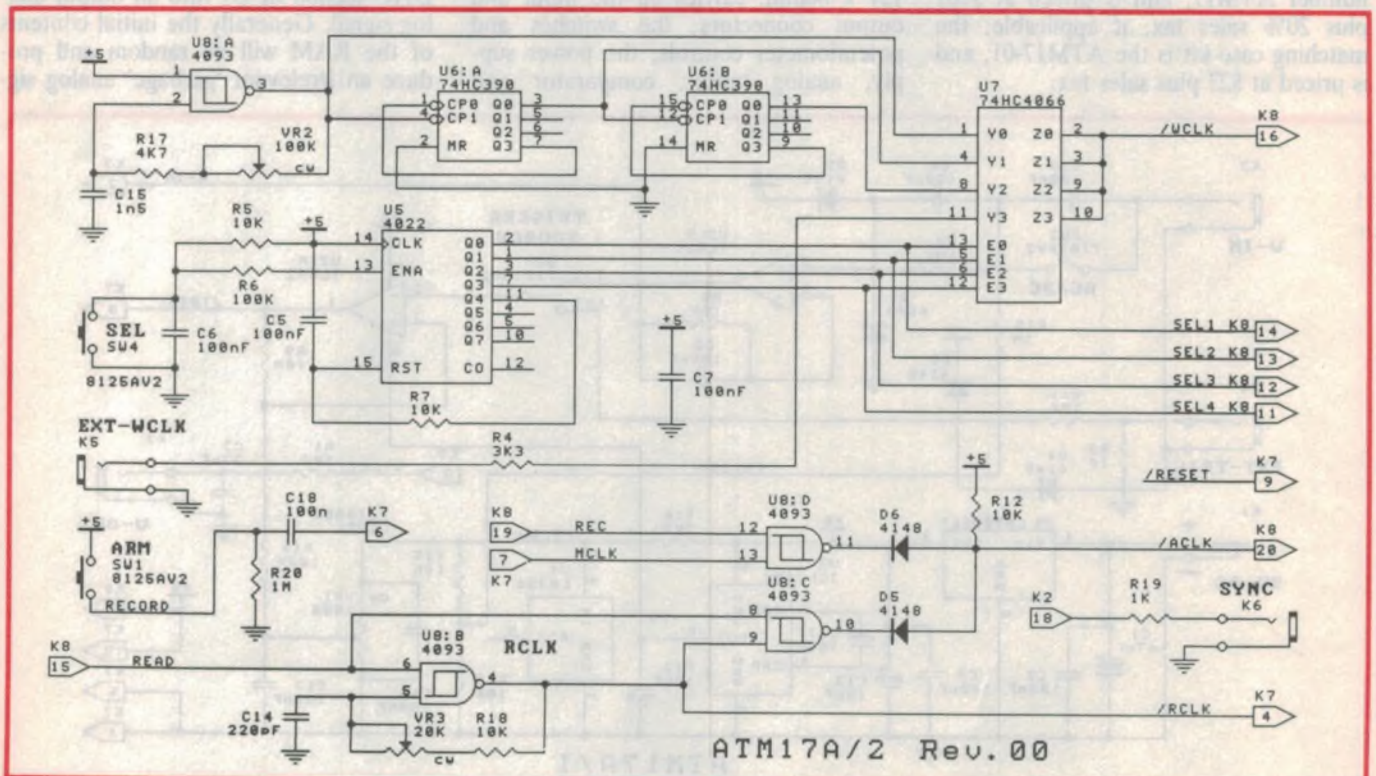


Rear view of the assembled boards, showing the five 3.5mm I/O connector sockets and the DC input connector.

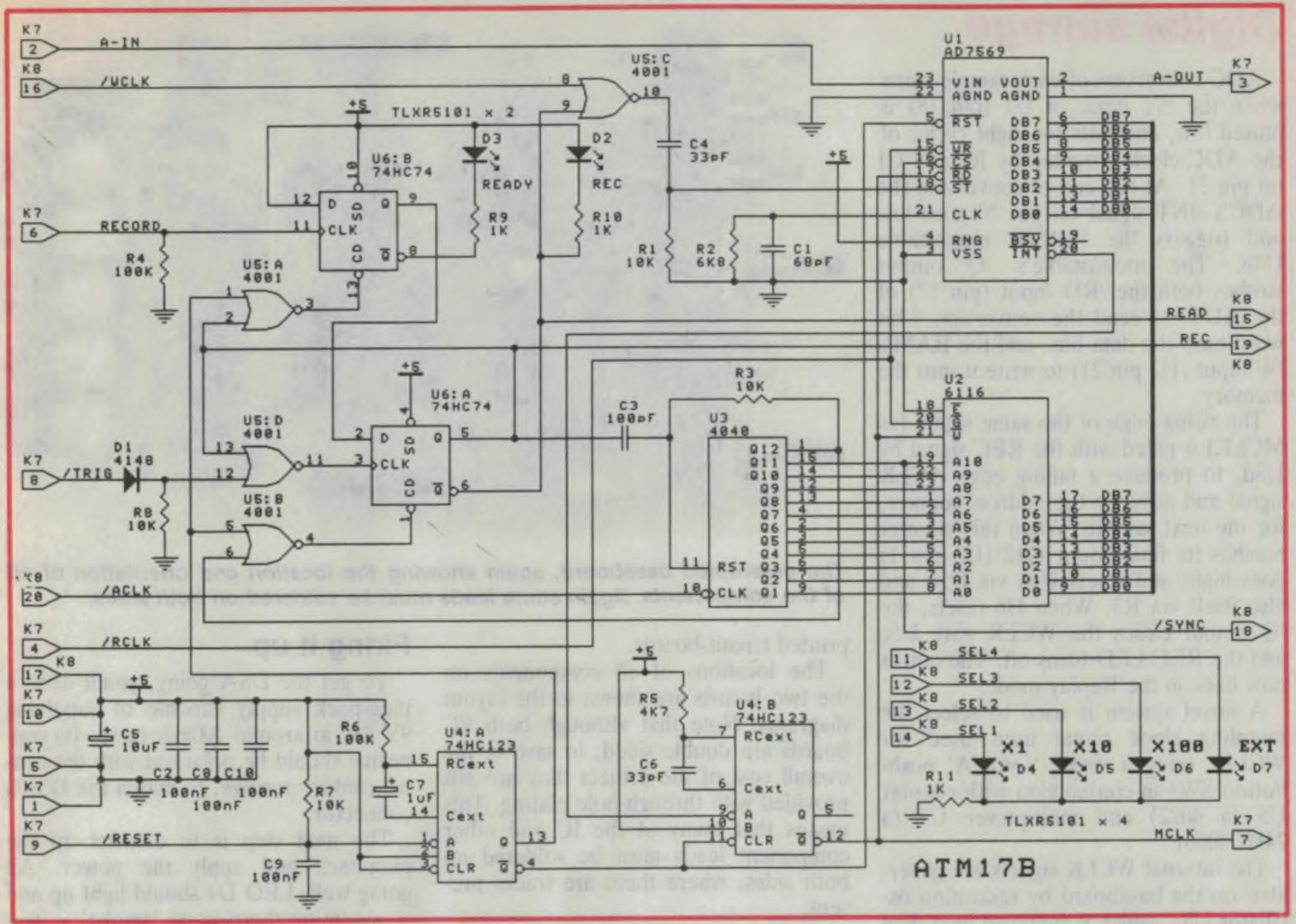
Recording a new waveform is activated by firstly operating the ARM switch (SW1), to place the unit in the READY mode, and then generating a trigger signal to start the recording sequence. These two states are indicated by LEDs D3 and D2.

When SW1 is operated flipflop U6b will set and the Q output (U6 pin 9) prepares the recording flipflop U6a to set on the next trigger input. The /Q output of U6b turns on the READY LED.

The input signal at connector K3 is buffered by amplifier U2b (schematic ATM17A/1) and then fed to the ADC



This schematic shows the remaining circuitry on the baseboard: the write clock oscillator, divider and MUX, range selection counter, read clock oscillator and ARM control.



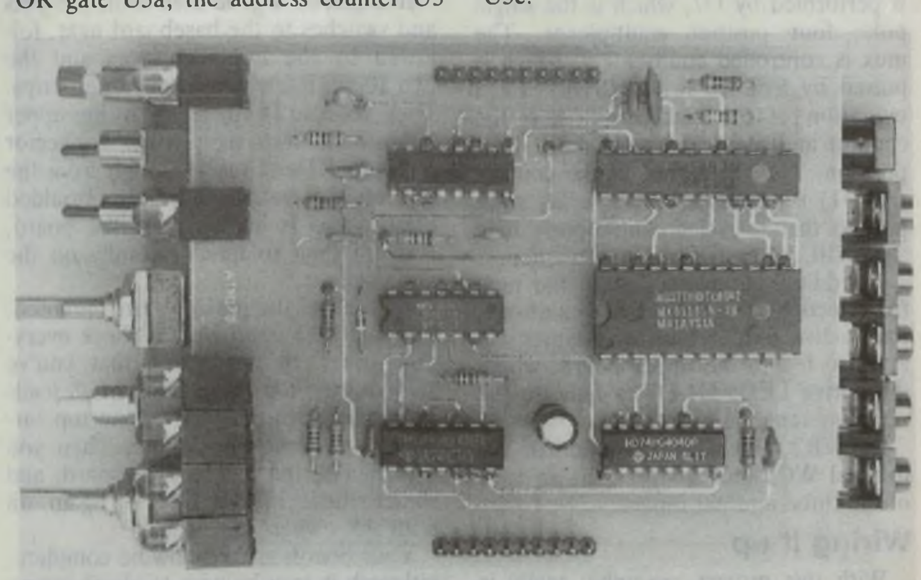
And here's the schematic for the upper board, with the ADC/DAC section, memory and addressing, control flipflops, timing and range indication circuitry.

section of U1 (as A-IN) and the Trigger Source switch SW3. The AC/DC switch SW2 is used to select the input signal coupling as either 0 to 2.5V (DC) or -1.25V to +1.25V (AC). Resistor R2 and diodes D1 and D2 provide input overload protection, by limiting the input signal. When the input is AC coupled R10 provides a 1.25V bias offset from the voltage divider R13 and R15.

When SW3 is set to INTernal trigger, the buffered input signal is applied to the negative input of the trigger level comparator U2a (pin 2). In the EXTernal position an external signal from connector K4 is applied instead. The trigger level control (VR1) applies an adjustable DC reference level to the positive input of U2 (pin 3), so that a negative trigger signal will be generated by U2a when the input signal exceeds the trigger level setting.

Gate U5d provides a 'only-once' trigger switch for U6a, as both inputs must be low for it to generate a high output clock signal. Initially U6a is reset and U5:13 will be low. When a logic low trigger input on U5 pin 12 sets U6a, the level at input pin 13 of U5 will go high and prevent any furthur trigger pulses from reaching U6a.

The Q output of U6a resets U6b via OR gate U5a, the address counter U3 via capacitor C3, and generates the REC signal for the baseboard. The /Q output of U6a turns on the RECording LED (D2) and enables the WCLK gate U5c.



A close-up of the top board, showing where everything goes and is orientated. Note that some leads are soldered to tracks on both sides.

ADC conversion of each sample starts when the /ST input of U1 (pin 18) is pulsed low, and lasts for eight cycles of the ADC clock provided by R2 and C1 on pin 21. At the end of conversion the ADC's /INT signal on pin 20 goes low and triggers the WRITE monostable U4b. The monostable's /Q output strobes both the /RD input (pin 17) of the ADC, to read the conversion 8-bit word onto the data bus, and the RAM's /W input (U2 pin 21) to write it into the memory.

The rising edge of the same signal (as MCLK) is gated with the REC signal by U8d, to produce a falling edge ACLK signal and advance the address counter, for the next sample. When this counter reaches its final count Q12 (U3 pin 1) goes high, and resets U6a via U5b and also itself via R3. When U6 resets, the /Q output closes the WCLK gate U5c and the REC LED turns off. The unit is now back in the Replay mode.

A novel system is used to select the sampling clock signal used used for WCLK, using a single 'form A' push-button SW4 in conjunction with counter U5 (a 4022) and multiplexer U7 (a 74HC4066).

The internal WCLK signals are generated on the baseboard by relaxation oscillator U8a, which is followed by a dual decade divider (U6). This provides a choice of three signals – that from U8a, the 1/10 frequency signal from U6a, or the 1/100 frequency signal from U6b. The fourth possible signal for WCLK is an external clock signal fed in via K5.

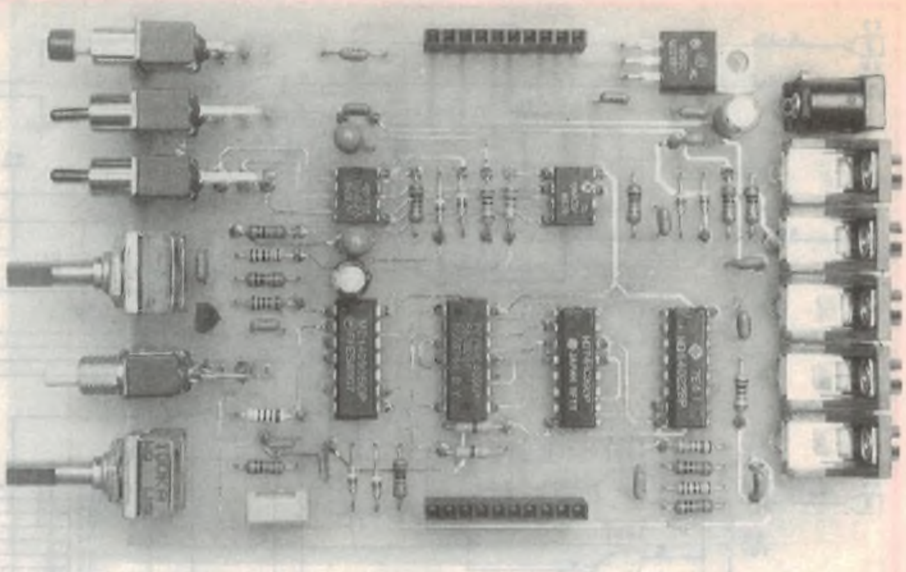
Selection of one of these four signals is performed by U7, which is the single pole, four position multiplexer. The mux is controlled counter U5, which is pulsed by SELect switch (SW4). Each operation of the switch will step the counter and move the mux to the next position. The Q4 output of the counter (pin 11) is connected back to its reset pin, so that it cycles continuously in a 'X1, X10, X100, EXTernal' sequence.

In addition to being fed to the mux for selection of the WCLK signals, the four active output lines of counter U5 are also fed to the upper board, where they drive LEDs D4-D7 to indicate the sampling range in use.

Pot VR2 allows fine variation of the internal WCLK oscillator U8a, on each of the three internal ranges.

Wiring it up

With this project, assembly really is the easy part, thanks to the ATM design with everything on those two small printed circuit boards.



The assembled baseboard, again showing the location and orientation of all of the components. Again some leads must be soldered on both sides.

The locations of all components on the two boards are shown in the layout diagrams. Note that although both PC boards are double sided, to save in the overall cost of the project they are not provided with through-hole plating. This means that many of the IC and other component leads must be soldered on both sides, where there are tracks present.

On each board we suggest that, as usual, you fit the resistors and other low-profile passive components first – taking care with the diode polarity. Then fit the capacitors, again taking care with the polarised aluminium and tantalum electrolytics.

It might be a good idea to fit the pots and switches to the baseboard next, followed by the I/O connectors and the two 10-pin interconnection socket strips. Then you can fit the LEDs to the upper board, and also the 10-way connector pin strips. These push through from the top of the board, until the moulded plastic strip is hard against the board, and are then soldered carefully on the underside.

With all of the passive parts mounted, it would be a good idea to check everything over, to make sure that you've soldered the top connections of all leads which mate with a track on the top surface, as well as the bottom. Then you can then fit the ICs to each board, and solder these in carefully – again on both sides where necessary.

Your boards should now be complete, although it may be wise to check everything carefully, before plugging them together and proceeding.

Firing it up

To get the DSA going, you'll need a plug-pack supply capable of supplying 9V DC at around 100mA or so. Its connector should be polarised with the centre contact positive, to match the DSR's connector.

The next step is to connect up the plug-pack and apply the power. All going well, LED D4 should light up and – assuming there is no 'smoke' – you can quickly check the power supply rails.

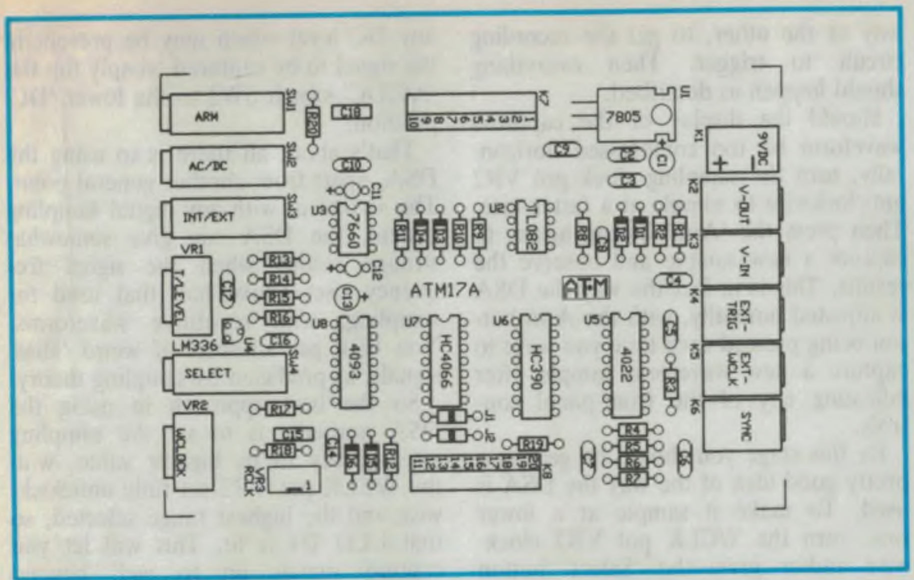
The +5V rail can be checked by connecting the negative test lead of your multimeter to pin 1 of 10-way connector K7, and then the positive lead to pin 10 of the same connector.

Similarly the -5V rail can be checked by connecting the positive lead to pin 1 of K7, and then the negative lead to pin 8 of the TL082 op-amp U2, on the baseboard. And finally the +2.5V rail can be checked by measuring across the ends of the 'Trigger Level' pot, at the centre front of the baseboard.

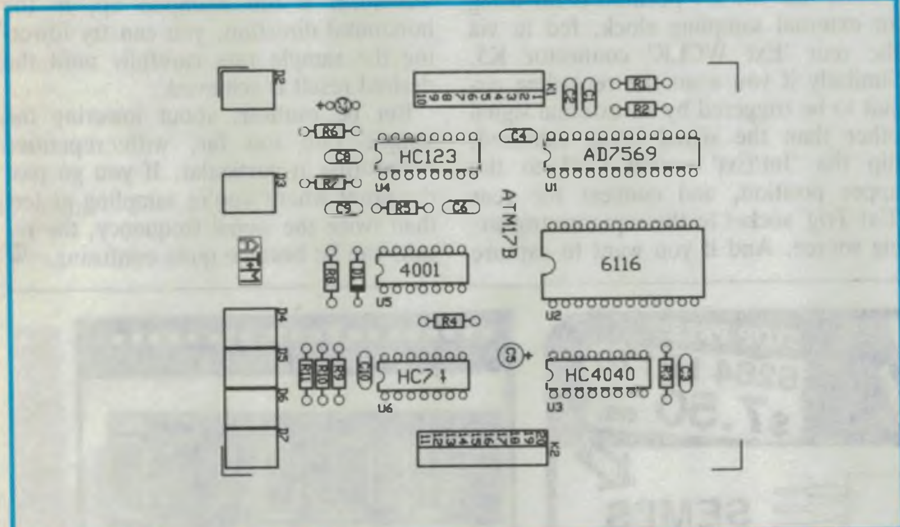
If any of the supply rails are significantly different from their correct voltage, switch off fast and begin troubleshooting. However if all voltages check OK, the odds are that your unit is ready for functional testing.

For this you'll need a conventional analog scope, of course, plus a source of suitable signals – such as an audio generator. You'll also need three connection cables, fitted with 3.5mm miniature jack plugs at one end, and BNC or similar connectors at the other to mate with your scope and generator.

First of all, set all three pots on the DSA to the centre of their travel. Also



Above: Wiring diagram for the baseboard, which can be compared with the photo opposite to help you in wiring it up.



And here is the wiring diagram for the upper board, which can again be compared with the photo given earlier.

flip the AC/DC input coupling switch to the 'AC' (upper) position, and the Ext-/Int trigger switch to the 'Int' (lower position.

Now hook up the DSA to your scope. Assuming this is one of the common dual-trace instruments, connect the 'V-out' connector K2 to the scope's Y1 input, and the 'Sync' connector K6 to the Y2 input. On the other hand if the scope has only one Y channel, the best plan is to hook up K6 to the Y input first, to set things up.

The idea here is quite simple. With the scope's timebase set for 1ms/div or 0.5ms/div, as desired, the Y2 or Y sensitivity set to 1V/div and the triggering set to respond to the same Y channel, you should get a steady display of the DSA's 'Sync' signal – a square wave of just on 5V p-p.

You should now be able to adjust the RCLK preset pot VR3, on the right-hand side of the baseboard, to get the scope to display a complete single cycle of the Sync signal squarewave, spread right across its screen. As one cycle of this signal corresponds to a full sequence of the DSA's RAM addresses, this will ensure that you will be able to display the full contents of the DSA's RAM, on the current timebase setting.

At this stage, if you have a dual-trace scope, the Y1 channel will almost certainly be displaying 'garbage' – the initial random contents of the DSA's RAM. You'll get the same result with a single-trace scope by swinging the Sync lead from K6 over to the scope's 'Ext Sync' input, switching to external sync, and then hooking up the DSA's 'V-out' connector K2 over to the Y input –

PARTS LIST

(Basic unit only)

- 1 PC board, 121 x 86mm, code ATM17A
- 1 PC board, 101 x 80mm, code ATM17B
- 2 Miniature SPDT toggle switches, 90° PCB mounting
- 2 Miniature SPDT momentary pushbuttons, 90° PCB mounting
- 5 3.5mm miniature jack sockets, PCB mounting
- 1 DC input jack, 2mm centre pin PCB mounting
- 2 10-way PCB connector pin strips
- 2 10-way PCB connector socket strips

Semiconductors

- 6 LEDs, PCB mounting TLXR5101 or similar
- 7 1N4148 or similar diodes
- 1 4001 quad CMOS NOR gate
- 1 4022 CMOS counter
- 1 4040 CMOS counter
- 1 4066 CMOS switch/mux
- 1 4093 quad CMOS Schmitt NAND
- 1 74HC74 dual CMOS flipflop
- 1 74HC123 dual CMOS monostable
- 1 74HC390 dual CMOS counter
- 1 AD7569 8-bit ADC/DAC
- 1 6116 2048-bit CMOS static RAM
- 1 TL082 dual opamp
- 1 LM7005CT 5V regulator
- 1 ICL7660 -5V inverter/regulator
- 1 LM336 2.5V reference

Resistors

All 1/4W, 5%: 4 x 1k; 1 x 2.2k; 1 x 3.3k; 2 x 4.7k; 1 x 6.8k; 14 x 10k; 4 x 100k; 3 x 1M; 1 x 10M.

- 2 100k linear pot, miniature PCB mounting
- 1 20k linear trimpot, vertical PCB mounting

Capacitors

- 3 33pF ceramic
- 1 68pF ceramic
- 1 100pF ceramic
- 1 120pF ceramic
- 1 220pF ceramic
- 1 1.5nF monolithic
- 14 0.1uF monolithic
- 1 1uF 35V TAG tantalum
- 4 10uF 35V TAG tantalum
- 1 47uF 35V TAG tantalum

Digital storage

without changing the timebase setting.

With the DSA's replay rate and scope timebase now locked together, you're ready to capture or 'record' a waveform sample in the RAM. So connect the 'V-in' connector K3 to the audio generator, which can initially be set to produce a sinewave signal of about 2.5V p-p at around 1kHz.

LED D4 should still be lit, indicating that the sampling rate is still set on the highest 'x1' range. And both the WCLK rate pot VR2 and the 'Trigger Level' pot VR1 should also be set to the middle of their ranges.

This being the case, pressing the 'Arm' button SW1 should cause the DSA to capture a waveform sample. The screen display should blink momentarily (replay stops during recording), the 'Ready' LED (D2) should light briefly, and the 'Recording' LED (D3) should light for a little longer. Then the scope screen should return, and show the newly captured waveform.

If this sequence doesn't happen, but only the 'Ready' LED lights, this will probably be because the setting of the Trigger Level pot is not quite right. The solution here is to adjust this pot one way or the other, to get the recording circuit to trigger. Then everything should happen as described.

Should the display of the captured waveform be too compressed horizontally, turn the sampling clock pot VR2 anticlockwise to sample at a faster rate. Then press the 'Arm' button again, to capture a new sample and observe the results. This is in fact the way the DSA is adjusted normally, with the Arm button being pressed each time you want to capture a new waveform sample after adjusting any of the front-panel controls.

By this stage you should be getting a pretty good idea of the way the DSA is used. To make it sample at a lower rate, turn the WCLK pot VR2 clockwise and/or press the 'Select' button SW4, to change clock ranges – which are indicated by LEDs D4-D7.

Note that the D7 position is for using an external sampling clock, fed in via the rear 'Ext WCLK' connector K5. Similarly if you want the recording circuit to be triggered by an external signal other than the signal being captured, flip the 'Int/Ext' switch SW3 to the upper position, and connect the rear 'Ext Trig' socket to the separate triggering source. And if you want to capture any DC level which may be present in the signal to be captured, simply flip the 'AC/DC' switch SW2 to the lower 'DC' position.

That's about all there is to using the DSA, apart from another general point. This is that as with any digital sampling system, the DSA can give somewhat strange results when the signal frequency rises above half that used for sampling, with repetitive waveforms. You then get all sorts of weird 'alias' signals, as predicted by sampling theory.

So the best approach in using the DSA normally is to set the sampling rate initially to its highest value, with the WCLK pot VR2 set fully anticlockwise and the highest range selected, so that LED D4 is lit. This will let you capture signals up to well beyond 20kHz, before there is any aliasing.

Then if you find that a captured waveform is too cramped up, in the horizontal direction, you can try lowering the sample rate carefully until the desired result is achieved.

But be cautious about lowering the sample rate too far, with repetitive waveforms in particular. If you go past the point where you're sampling at less than twice the signal frequency, the results can be become quite confusing. ⓔ

A fax adaptor card for PC's - 2

As promised last month, here are the details of a fax adaptor card for your IBM PC or compatible. Based on a dedicated VLSI chip, it offers the full range of speeds up to 9600bps, auto dial, auto answer, and on-board line isolator. Everything needed fits on a card small enough to fit into one of the short slots of a PC, XT, AT or compatible.

by MARK CHEESEMAN

The advantages of having a fax card in your computer (as opposed to a stand-alone machine) are many – not the least of which is cost. Most of the hard work can be done by the processor in your computer, so that all that is really needed is a modem and phone line interfacing circuitry.

The Yamaha YM7109 is truly a fax machine in a chip. Containing a modem operating under the CCITT V.27ter and V.29 standards, giving speeds from 2400 to 9600 bps, it provides all the facilities required of a modem in a Group 3 fax machine. The V.29 standard offers speeds of 9600 and 7200bps, while the V.27ter option handles the lower speeds of 4800 and 2400bps.

Auto-dialling is achieved through a built-in DTMF tone generator for tone dialling, while the alternative pulse dialling is achieved by pulsing the line looping relay. A built-in ring detector allows the modem to detect incoming calls and answer them.

The YM7109, in common with most modem chips these days, uses digital signal processing (DSP) to generate the transmitted signals, and to decode the received ones. This has the advantage that there are no critical adjustments to be made in setting up the modem – the entire chip is locked to a single 9.8204MHz crystal.

Circuit description

As we have already mentioned, the YM7109 contains almost all the circuitry required for a computer-based fax modem, and is thus the heart of the circuit presented here. IC4 (a 74LS245) is a bi-directional buffer, through which the eight lines of the computer's data bus pass. The IOR (I/O Read) line from the computer determines which direction the buffer passes the data – the fax card thus appears as an I/O device, as opposed to being memory-mapped.

The most significant six of the ten address lines relevant to I/O transfers (A4-A9) are decoded by IC5b, IC5c, IC6, and IC7. The output of this gate thus enables the IC4 buffer when appropriate. The I/O read and write lines are also decoded, via a NAND gate in IC8, so that the card responds only to I/O requests, and ignores memory accesses. The *Address Enable* pin on the expansion bus (AEN) is also decoded – indicating that the levels on the address bus are valid.

The four least significant address lines connect directly to the appropriate pins in the YM7109 (RS0-3). This means that the chip occupies 16 contiguous addresses in the computer's I/O space. Pins E6, E7 and E8 are for jumpers which allow the addresses occupied by the fax card to be moved, should a conflict arise with another device in the system.

The computer's *reset* line connects to the chip, via an inverter, so that the modem is reset when the computer is. The modem may interrupt the processor using either IRQ3 or 4, as selected by jumpers between E3 and E4 or E5.

IC1, a 4N35 optocoupler, serves as a ring detector – to allow the modem to answer incoming calls. Capacitor C1 AC couples the line to the detector (a telephone ring signal is an AC voltage of about 50-80 volts), with D1 protecting the LED in IC1 from the reverse halves of the ring signal, and R1 limiting the current. The output of the optocoupler connects to the RI input of IC4 – where the actual analysis of the signal is done.

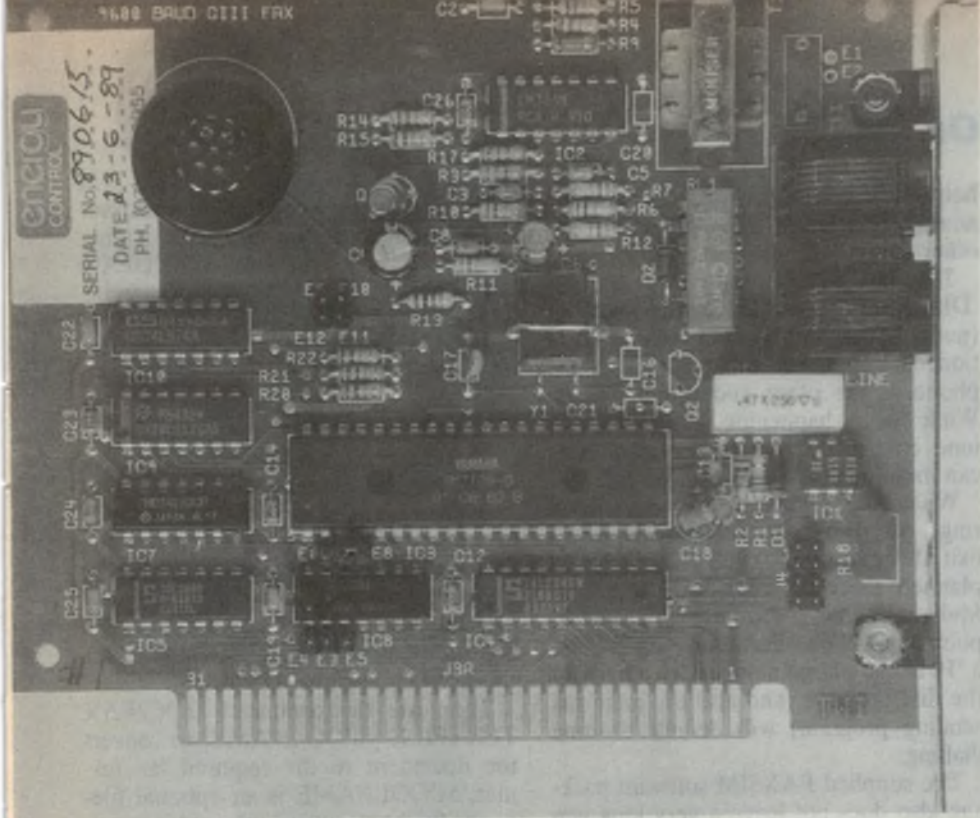
To connect the modem to the line (or 'loop the line'), the chip energises the coil in relay RL1, closing its contacts. Line current then passes through the primary of T1, which lets the exchange 'know' that the line is in use. For pulse dialling, the relay is opened and closed in rapid succession under the control of IC4, to imitate the contacts in a rotary dial.

IC2a and associated components form a line *hybrid* – to separate the transmitted and received signals. The parallel combination of R17 and R3 match the 600 ohm nominal line impedance, and are connected in series between the transmitter (buffered here by IC2c) and the line.

IC2a is configured as a non-inverting amplifier with a gain of 2. However the reference of this amplifier is tied not to ground, but to the output of the transmitter (IC2c). Because the transmitted signal is attenuated by half, due to the divider action of the paralleled 1.2k resistors and the line impedance, IC2a actually amplifies the *difference* between the transmitted signal and the signal on the line.

In an ideal world, with exact tolerance resistors and a constant 600 ohm line impedance, this would result in none of the transmitted signal appearing at the receive input of the modem chip. The real world isn't as good, with the telephone line impedance in particular varying over quite a wide range – but the hybrid still tends to give a useful amount of rejection of the transmited signals from those received.

IC2b generates a half-rail voltage (2.5V), as set by R6 and R7. This is applied to the transformer secondary, effectively biasing the whole hybrid circuit



A closeup of the assembled prototype. Note that the boards supplied may be slightly different, to meet Australian Telecom requirements.

at a DC potential half way between the ground and 5V rails of the computer.

IC2d and Q1 form a simple audio amplifier, driving the small on-board speaker. This gives an audible indication of the progress of a call – an invaluable aid during testing.

Construction

Construction of the fax card is reasonably straightforward, being carried out on a double-sided plated-through board which conforms to the IBM-PC 'short slot' form factor. Note that the final version of the card will differ slightly from that shown in the accompanying photographs, to ensure that the line interface complies with the relevant Telecom specifications.

Note that kits containing the YM7109 chip, the PC board, the end bracket, the line coupling transformer, the 9.8304MHz crystal and basic driver software needed for this project will be available from the Australian distributor for Yamaha Semiconductors, Energy Control International of 26 Boron Street, Sumner Park 4704 – telephone (07) 376 2955. The cost for this basic 'short form' kit will be $199.00. Complete assembled and tested fax cards will also be available, for $399.00.

To begin assembly, mount all the resistors and non-polarised capacitors, and also the diodes – making sure that their polarity is correct. Next mount the electrolytic capacitors and transistor Q1, again watching their polarity.

These may be followed by the dialling relay, optocoupler IC1, speaker level control pot R18 and the ring detector capacitor C1. At this point, the speaker, crystal and the various jumper blocks may also be fitted. The crystal has a wire strap placed over it and soldered in place, to keep it lying flat against the board.

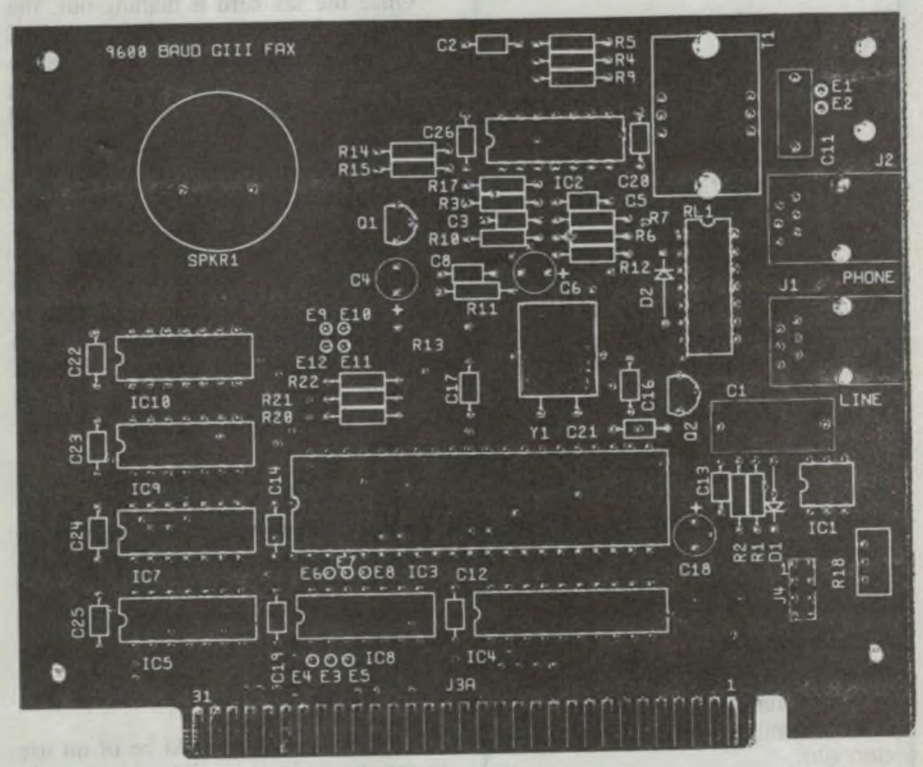
The line coupling transformer T1 may be mounted next, by first mechanically securing it to the board with its mounting tabs (if fitted), and then soldering the pins which comprise the electrical connections to its windings. Also mount the two modular phone jacks, again fixing them in place by melting their plastic support tabs a little with the soldering iron, and then making the connections.

Finally, mount the integrated circuits, making sure that their orientation is correct. All ICs have pin 1 closest to the bottom left-hand corner of the board, when the edge-connector is facing downwards. Attaching the card mounting bracket to the right-hand edge of the board completes the assembly procedure.

Testing

After a final visual check, plug the completed card into an unused slot of an IBM PC, XT, AT or compatible, and boot up the system. If the computer fails to boot-up normally, remove the card and look for constructional errors around the bus interface circuitry on the board (ICs 4 to 9).

Assuming all is well so far, the next thing to do is make the connections to a phone line and phone, and try out the supplied FAXSIM software program. It



And here's the PCB silk-screening pattern, almost full size, to further assist you in wiring it up.

Fax adaptor card for PC's

PARTS LIST

1 PC board, 107 x 127mm, with IBM-PC edge connector
1 IBM PC card bracket to suit
1 Line coupling transformer, 600:600 ohms
1 DIP relay, SPST with 5V/10mA coil
2 Modular phone sockets, PCB type
1 Crystal, 9.8304MHz parallel cut
1 Small piezo speaker, PC mounting type

Semiconductors

2 1N4001/1N4004 or similar diode
1 2N2222A or similar transistor
1 4N35 or similar opto-isolator
1 LM324 quad op-amp
1 YM7109 fax/modem chip
1 74LS245 octal buffer
1 74LS04 hex inverter
1 74LS30 8-input NAND gate
1 74LS00 quad NAND gate
1 74LS125 quad buffer
1 74LS74 flipflop

Resistors

All 1/4W, 5%: 1 x 100 ohms; 2 x 1.2k; 1 x 2.7k; 11 x 10k; 2 x 12k; 1 x 68k.
1 10k trimpot, vertical PCB mount type

Capacitors

2 22pF NPO ceramic
1 3.9nF metallised polyester
1 4.7nF metallised polyester
1 10nF metallised polyester
8 0.1uF monolithic
1 0.47uF 250V polycarbonate
2 10uF 16VW electrolytic, PCB mount
1 47uF 16VW electrolytic, PCB mount

Miscellaneous

10 x PCB jumper pins; 2 x 3mm x 10mm machine screws and nuts to mount PCB bracket; solder, etc.

helps if you have a 'real' fax machine nearby, or a known-good fax card in another computer.

The best place to start is to use the 'DIAL' utility, to dial another number (perhaps that of the fax machine mentioned above), and make sure that the phone at the other end actually rings. While this is happening, adjust the volume control on the card, so that you can monitor the progress of the call.

When the phone at the other end rings, press any key on the keyboard to exit the program. If all did not go as planned, there are a few thing to check. Make sure that if you have a decadic or pulse type phone line, that you include a 'P' in the phone number, as otherwise the dial program (and also the main fax sending program) will default to tone dialling.

The supplied FAXSIM software package also does not leave a very long gap between dialled digits, which may upset some exchanges. If the dialling does not seem to be getting through the exchange, try inserting a pause between the digits (denoted by a comma). Thus to pulse dial the number 123456, with a longer inter-digit pause, you would enter the command:

DIAL 1,2,3,4,5,6P

Once the fax card is dialling out, the next step is to try receiving an actual fax. For this step, another fax machine is compulsory. Run the program 'RECVFAX', which will wait for a call and save the fax to a file called 'FAXSPOOL'. Now, transmit a fax from the fax machine to the fax card, and make sure that the transmitting machine reports an 'OK' result.

Once that has worked, you should have a file which you can send back to the real fax machine from the card. To do this, use the command SENDFAX xxxxxxP, where xxxxxx is the number of the other fax machine (assuming pulse dialling).

If you found that you needed extra pauses between digits with the 'DIAL' command, then these should also be inserted in the number supplied to the 'SENDFAX' command. This will send the fax which you have received back to the fax machine.

Software

All this hardware would be of no use to anyone without suitable driving software. For this reason, kits for the fax card are supplied with two 5.25" disks with several programs, some of which have already mentioned in the construction section. There are the main sending and receiving prc 'ams, SENDFAX and RECVFAX, re: :ctively. There are also utilities for co.. erting an ASCII text file to fax format, for displaying fax files on CGA, EGA and VGA monitors, and printing them out on an Epson-compatible dot-matrix printer.

To send a fax, one first needs to generate the text contents of the message, using a word processor. Make sure that the word processor saves the document in standard ASCII format, otherwise you'll just be sending rubbish. Use the DOS 'type' command to make sure that the file is indeed standard ASCII, with no funny characters.

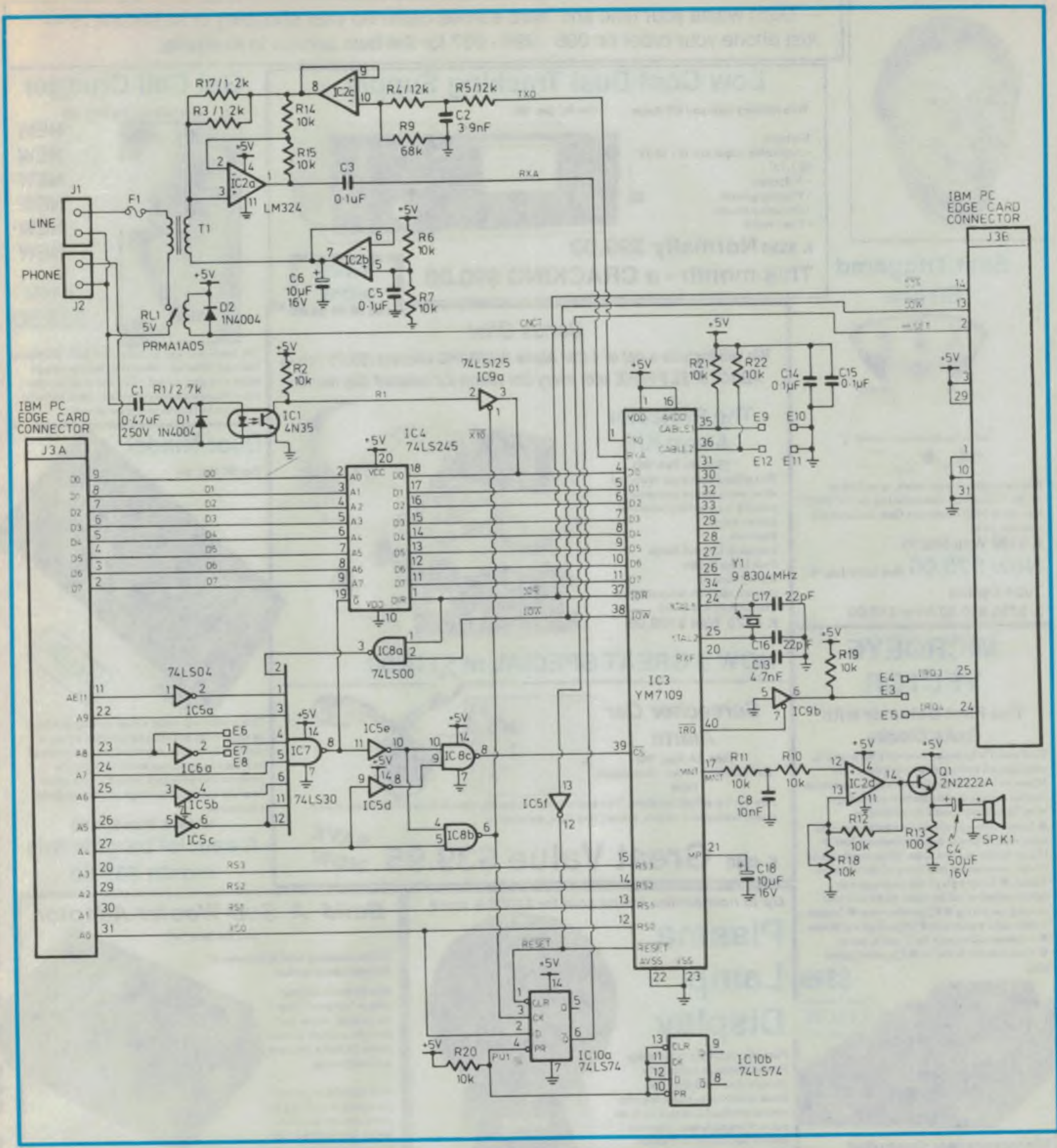
Then use the command DOC2FAX TEXTFILE [SPOOLNAME] to convert the document to the required fax format. SPOOLNAME is an optional filename (without extension), which specifies the name of the output file(s). One file per page is generated, with page breaks inserted every 80 lines, or whenever a form-feed is encountered in the input file. So, if the document is two pages long, and the default spool filename is used, then DOC2FAX will generate two files, FAXSPOOL.FO1 and FAXSPOOL.FO2.

SENDFAX sends a fax file to a specified number, and the baud rate can optionally be specified as well. In this case, the fax card will override the normal automatically determined speed, which is determined by line conditions as observed by the modem.

Facsimiles are stored in a standard format, consisting of one page per file. Each fax has a unique filename, which is FAXSPOOL by default, but alternative names may be specified on the command line. The extensions indicate the page number, starting with F00, giving a maximum possible length of 100 pages (!) for a single fax document.

So, typing SENDFAX <number> -fFILENAME will send the file FILENAME.F00 as the first page, FILENAME.F01 as the second page, and so on, until all pages of the document are sent. Omitting the phone number allows the operator to manually establish a connection, and then send the fax.

RECVFAX is the receive program. Options on the command line allow you to specify the filename where the incoming message will be saved, how many rings to wait for before answering the call, and the baud rate. If you spec-



The complete circuit. Note that J3A and J3B are the two sides of the PC-bus edge connector.

ify a ring count of zero, then the modem will not wait for the phone to ring, and will attempt to receive immediately – for manual connections.

There are three graphic display programs to display received faxes on screen: FAXCGA, FAXEGA and FAXVGA, for CGA, EGA and VGA graphics adapters, respectively. Typing the command followed by an optional spool filename will display that file on screen in graphics mode. The document will slowly scroll up the screen, and can be paused during the standard <CTRL>–S combination.

Users of Hercules (or compatible) graphics cards can use the public-domain CGA simulator, SIMCGA, available from most bulletin boards and user groups. However, due to the slow update time of this emulation, you may need to pause the display frequently to actually read the message.

Spooled faxes can also be printed out, using the supplied FAXPRINT program. The printer used must have an Epson compatible graphics mode to operate with this program, and must be addressed as the logical DOS device PRN:. Note that fax files printed out in this manner are about 20% smaller than actual size – a limitation imposed by the size of the dots on Epson printers.

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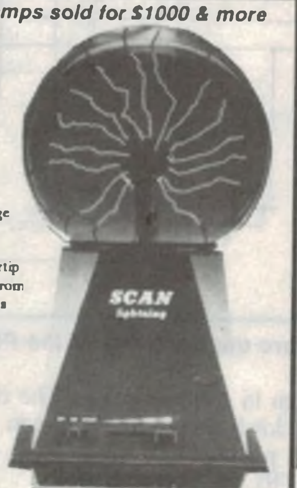

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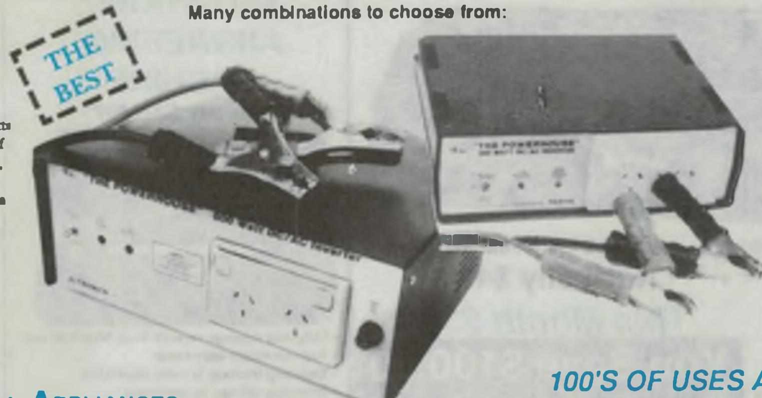

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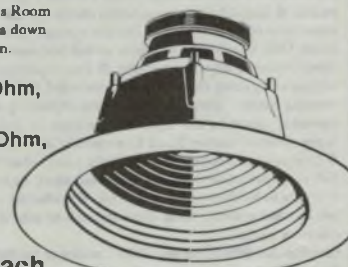

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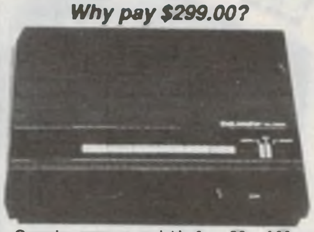

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Measuring Mode: Frequency Measurements CHANNEL A
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Resolution: Direct counter: 1, 10, 100Hz switch selectable, prescaled: 10, 100, 1000Hz switch selectable **Gate Time:** 0.01S, 0.1S, 1.0S, switch selectable
Accuracy: +/- 1 count +/- time base error x frequency
CHANNEL B Range: 100MHz to 1GHz **Resolution:** 100HZ to 1kHz switch selectable **Gate Time:** 0.027S, 0.27S, 2.7S switch selectable
Period Measurements (Channel A) Range: 10Hz to 2.5MHz
Resolution: 10-7S, 10-8S, 10-9S switch selectable
Totalize Measurements (Channel A) Range: 10Hz to 10MHz **Resolution:** +/- 1 count of input **Display:** 8 digits. 7mm red LED display with decimal point, gate, overflow, kHz, MHZ and uS indication.
See our 1989 Catalogue Page 62 for full specifications of this top quality counter, now at even greater value for one month only.

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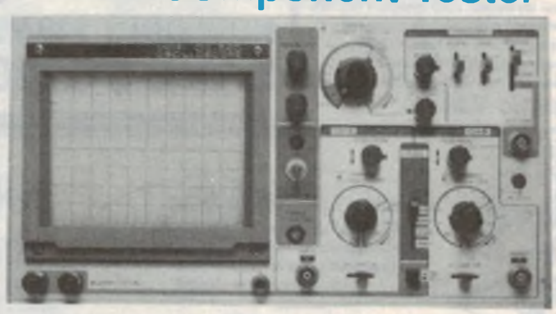

DESCRIPTION: This model is a dual -trace 20MHz Oscilloscope using high brightness CRT. The vertical amplifiers have high sensitivity of 5mV/Div and the frequency characteristic response with the smooth roll off exceeding 20MHz. The special circuit is designed so that a single component or components in or out of the actual circuit board can easily be tested, requiring no power to drive the circuit. The display shows component faults, component value, characteristics and tests components dynamically.
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- Sends signals down power line to activate one or more remote sirens

The main control receiver runs on 240V AC with a 12V 1.2AH battery for emergency back-up. All other units with the exception of the line carrier run on a 9V battery each. The average life expectancy is approx. one year. System works around 305MHz frequency where there is less chance of a false alarm. The range of the unit is normally 80 metres in open space.

S 5265 Take it with you when you move

$349.00

Detector/Transmitter Unit (Reed Switch)

Suitable for windows and doors
Consists of enclosed reed switch and removable enclosed magnet.

S 5270 **$55.00**

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This unit is an optional line carrier receiver. Receives signal through 'AC' line i.e. it would ideally be located in, say, the roof space and plugged into mains power.

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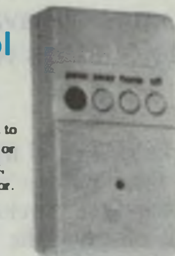

Keep it at the bedside table — allows you to arm the house perimeters when you retire or you can take it with you when you go out, arming your system after you lock the door.

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The 'Maggie' - 2: Making the replica

In this second article devoted to Marconi's 'magnetic detector', the author describes how to make a working replica using commonly available hand tools. Most of the materials used for the author's replica came from the junk-box.

by PETER R. JENSEN, VK2AQJ

In the first of these articles we looked at the invention of the magnetic detector and the development of its commercial offspring the 'Maggie'. In addition the general theory of operation and use of the Maggie were presented, together with quotations and illustrations from the *Handbook for Wireless Telegraphists* of 1913. This publication, in particular, has provided an accurate picture of how the Marconi Company considered the Maggie should be employed in a working environment.

It was also noted that the personnel of the Naval Experimental Station, *H.M.S. Vernon*, had examined the workings of the Maggie prior to 1912 and this had served as the basis of an explanatory section of the 'secret' *Wireless Telegraphy Manual* which, although published initially in 1912, had not been released to the public until 1950.

Quite apart from some perceptive remarks relating to the limitations of the Maggie in regard to the reception of continuous wave transmissions, the other result of the *H.M.S. Vernon* experiments was to provide an alternative arrangement of the positioning of the magnets. This was claimed to lead to a slight increase in the sensitivity of the apparatus, but also eliminated the 'breathing' sound that was normally heard in the headphones. This noise could be heard whenever the steel wire band was moving between the magnetic poles and, as mentioned, was later to become known as 'Barkhausen' noise. This conclusion also makes an interesting contrast with Hawkhead's reference to the same issue in the later *Handbook*.

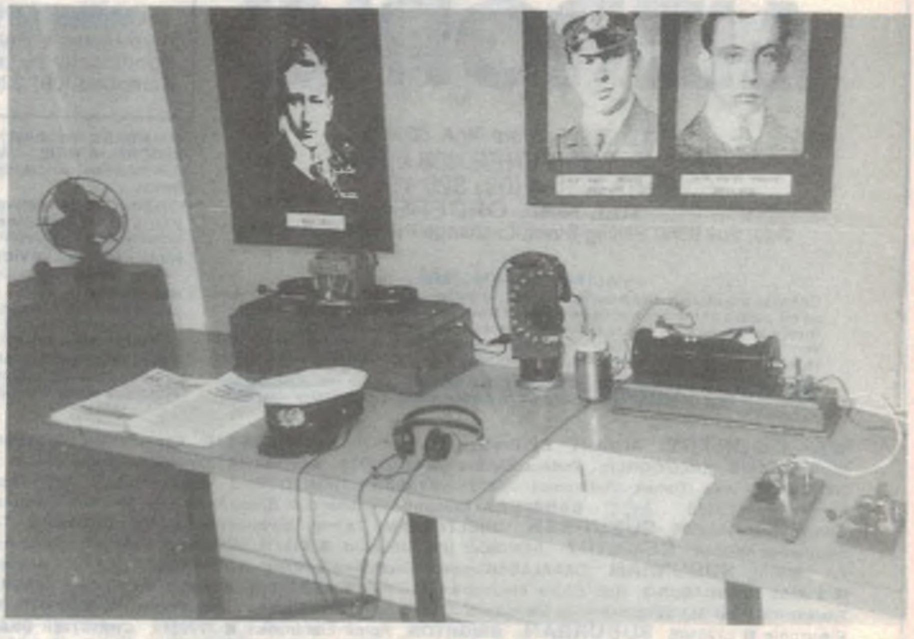
Apart from a slight disagreement with the Navy about sensitivity, for the most authoritative and detailed description of the mechanical and electrical construction and charactersitics of the Maggie, it is neccessary again to turn to the work of Hawkhead for information. In the *Handbook* it says of the Maggie:

Two ebonite discs, A and B, are grooved round their peripheries with B being mounted on a spindle forming part of a clockwork driving mechanism contained in the body of the instrument and A being mounted on a brass plate, C, capable of sliding along a bed piece, D.

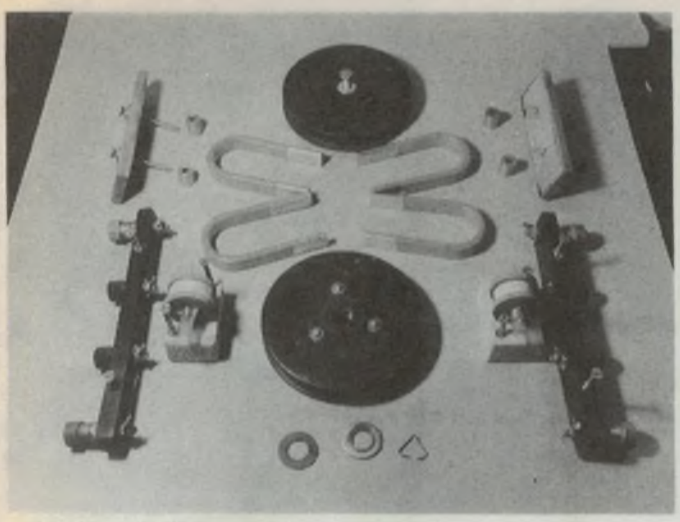
The adjustment is effected by turning the screw, E, which is used to put the necessary tension on a continous band of stranded soft iron wire, F. This band is made up of 70 strands of No.40 SWS (single wound silk covered) iron wire, twisted into the form of a small rope, which is rotated by the clockwork at a rate of about 1.6 metres per minute. This band passes through the centres of two sets of coils, the primaries being marked P, and the secondaries S. The ends of these coils are connected to four terminals on each side of the instrument, the secondary winding being connected to the inner pair of terminals in each case.

Between these two sets of coils a wooden block, W, carries four horseshoe magnets, two on either side. The usual position of the magnets with respect to the coils is shown in the figure, where it is seen that the like poles are together.

This arrangement results in a slight hissing sound being produced in the telephones all the time the band is moving.



The author's demonstration station, showing the replica Maggie at left rear, behind the operator's cap, and an induction coil at right rear. Note the pictures of Marconi, and early operators.



The main components for the replica Maggie, laid out. Missing here are the clockwork motor and tension adjustment screw.

If the magnets be rearranged this hissing or breathing effect is eliminated and at the same time the sensitiveness of the receiver is slightly lessened. The matter of arrangement is largely a matter of personal choice.

Many operators claim that the breathing effect renders the reading of very weak signals difficult and that the latter arrangement is the better. But other operators prefer the former arrangement, because while they do not agree with those who claim breathing to be an obstacle in the way of the reception of weak signals, the cessation of breathing, when no signals are coming through, at once indicates that the clockwork had run down or that the band has stopped from some other cause or that there is a faulty connection in the circuit.

H is the handle for winding up the clockwork, which will drive the band round for an hour and three-quarters for one winding up. The clockwork is specially designed for even and silent running. Means of stopping or starting the clockwork is provided by the brass knob, T.

The primaries are wound over small glass tubes, and are made of No. 36 DWS (double wound silk covered) copper wire. They are wound for a distance of about 2 centimetres over the tube, this giving them a resistance of between 2 and 3 ohms, and an inductance of about 30 microhenries. Each secondary coil is wound on an ebonite bobbin to a resistance of about 140 ohms, which is about the same resistance as that of the telephones which are used with the detector.

Turning now to the actual construction, it can be said immediately that this is a far easier device to build than the Ruhmkorff coil. In essence it is simply a rectangular box on which is mounted a timber base. On this base, in turn, is fixed the clockwork motor (underneath) and above it are the two pulley wheels and the timber block on which are fixed the horseshoe magnets.

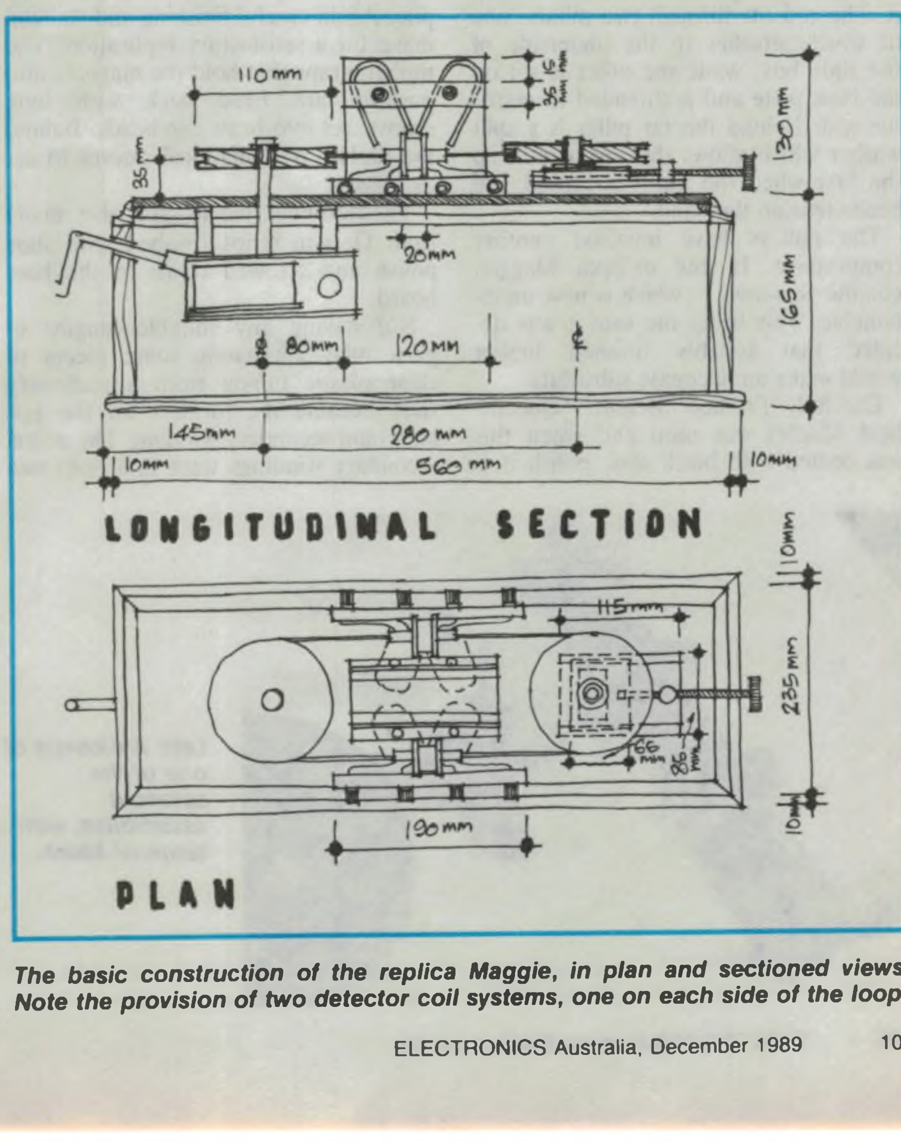
One of the most difficult items to reproduce was the horseshoe magnets. At first it had been assumed that a couple of old magnets out of a telephone magneto would be suitable, until it was appreciated that four would be required. After much hunting a third was obtained but not a fourth and so some other solution had to be found.

After all the searching it came as a pleasant surprise to find some magnets at Woolworths, of all places. They are very much the right size and shape and the only fault is that they have a bright red plastic covering, whereas the original had a metallic finish.

The next problem was what to use for a driving mechanism. This is of some importance in that the size of the motor may well determine the dimensions of the box. The correct dimensions for the original are as marked on the diagram.

In the event an old wind-up gramophone clockwork motor was obtained and this forced an increase in the overall width of the box by 25 millimetres. This was annoying but not terribly obvious, unless one has the genuine article close by to examine.

Incidentally if such a clockwork motor is not available, it would seem that the substitution of a mains power driven fan motor would be quite in order: such a substitution is discussed in the *Telegraphist's Handbook*. This is true even if the speed is increased by up to 50%. It



The basic construction of the replica Maggie, in plan and sectioned views. Note the provision of two detector coil systems, one on each side of the loop.

Making a replica Maggie

seems that the velocity of the band is by no means critical, and if anything a faster rotation may make the Maggie more sensitive.

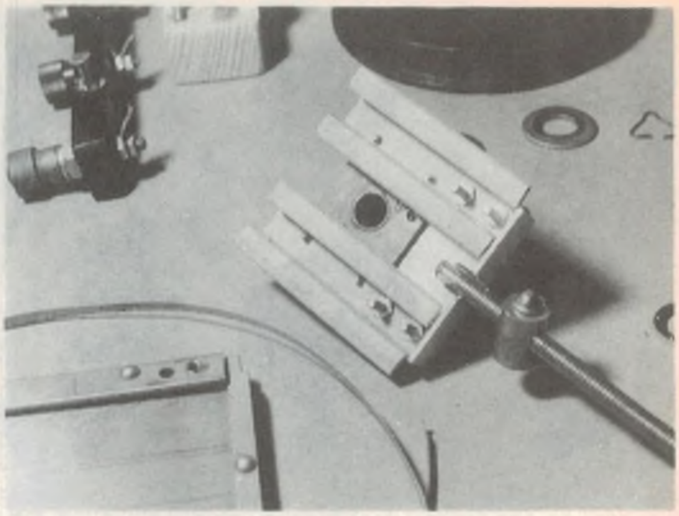
The next item which may require some scrounging for is the sliding bed plate and the pulley spindle. It was possible to use the discarded bed plate from an old army Morse key, courtesy of the junk box, and for the sliding bed, a small flanged box was made from aluminium and plastic angle. Perhaps not appropriate materials, but easy to work and largely hidden from view by the pulley.

The spindle for this pulley came from an ancient Garrard turntable. Not only was the centre spindle set on a small plate, which made it easy to attach to the metal slide box, but it came equipped with a ring of small ball bearings. The pulley therefore runs very smoothly.

The other part of this assembly involves the tension rod and knob. The rod is made from threaded brass rod and a brass knob was found in the junk pile, just the right dimension to fit onto it. The rod fits through two pillars, one of which attaches to the underside of the slide box, while the other is set on the base plate and is threaded to match the rod. Behind the far pillar is a split washer which allows the rod to pull up the box when the knob is turned and hence tension the band.

The pulleys have involved another compromise. In the original Maggie, ebonite was used – which is now unobtainable. This being the case it was decided that suitably finished timber would make an adequate substitute.

Carefully finished Meranti (Queensland Maple) was used and when this was coated with black shoe polish it is



The sliding bed plate with tensioning screw, with the fixed plate in which it slides shown at lower left.

not easy to tell the difference between the replica and the real thing. As for most other projects at VK2AQJ, the construction of the pulleys involved only the use of an electric drill, set up in a cradle to allow it to be used as a crude lathe.

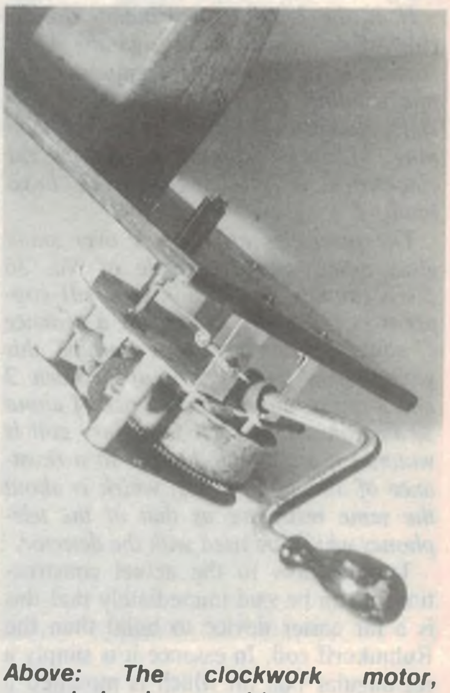
The mounting block for the magnets was made up from a piece of Oregon, found in the building materials junk pile. Again careful finishing and staining make for a satisfactory replication. The timber straps that hold the magnets into position are fixed back with long screws, set into brass cup heads. Behind the timber are cylindrical sleeves to act as spacers.

The terminal blocks are also made from Oregon strips finished with shoe polish and screwed down to the base board.

Not having any suitable lengths of glass tube, ultimately some pieces of clear plastic tubing from a stationery shop became the formers for the primary and secondary winding. The actual secondary windings were laid onto two bobbins turned up on the electric drill and based on the specification earlier quoted from the *Handbook*. To achieve the correct relationship to the moving band, blocks of timber had to be cut to fit under the bobbins.

Finally, there is the moving band. This has involved the most irritating and frustrating search, for a reasonable substitute for the proper stranded iron cable. As the material was described by Marconi as being made of soft iron wire, stretched beyond its limit of elasticity, it seems rather unlikely that anything closely resembling the genuine article will be found. As a result, recourse to a thin metal band, culled from a discarded tape measure, was tried initially

Left: A closeup of one of the solenoid assemblies, with terminal block.



Above: The clockwork motor, mounted in position on the underside of the case top.

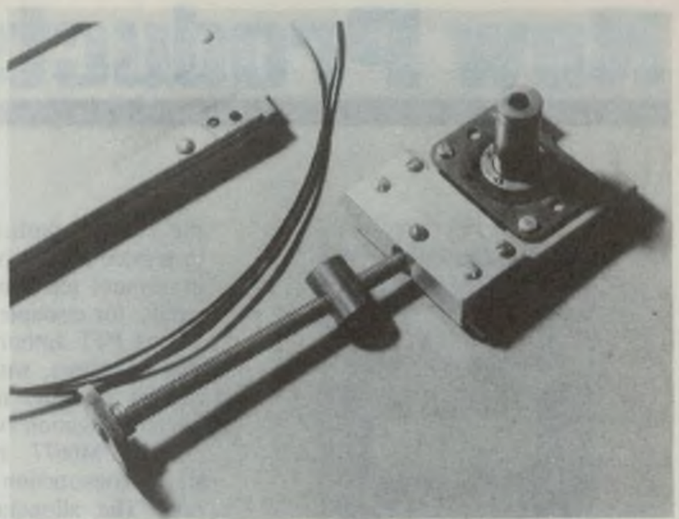
and at the moment a section of audio recording tape has been installed. Probably of no great concern to the casual observer, but most annoying for the knowledgable 'wireless watcher'.

As for other projects involving equipment of the 1900's, the absence of correct wooden mouldings from the shelves of modern hardware shops has led to the need to reshape what is available. This is shown in the detail drawings and is not too hard to achieve.

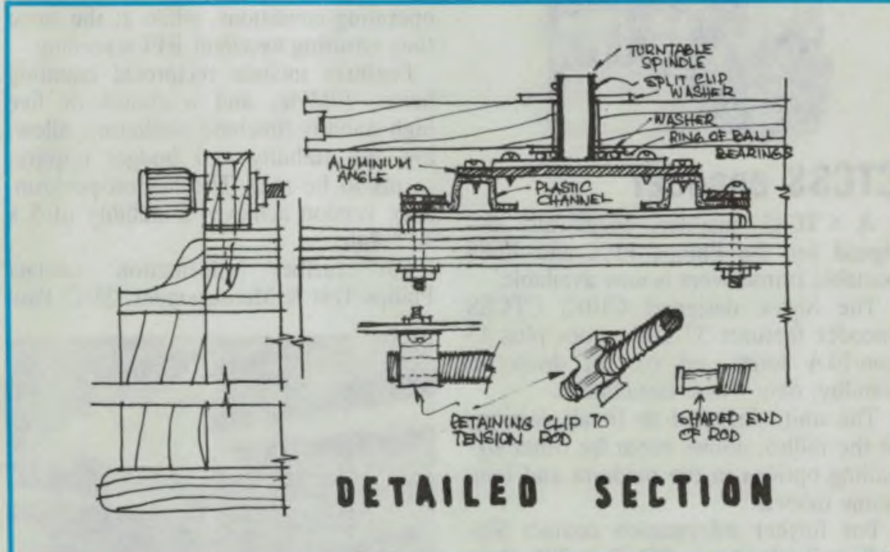
The other task required before the replica Maggie is complete, is finishing the base board and the main box. Normal carpentry skills apply here and an orbital sander is a distinct advantage. After that it is the usual hard work of staining, sealing, smooth sanding and finish sealing.

Just at the moment it is possible to see the very high standard of finish that was achieved in apparatus of this era, if one cares to visit the OTC Exhibition in Paddington. There are some very fine examples of wireless of the period, made by the great competitors of Marconi, Siemens.

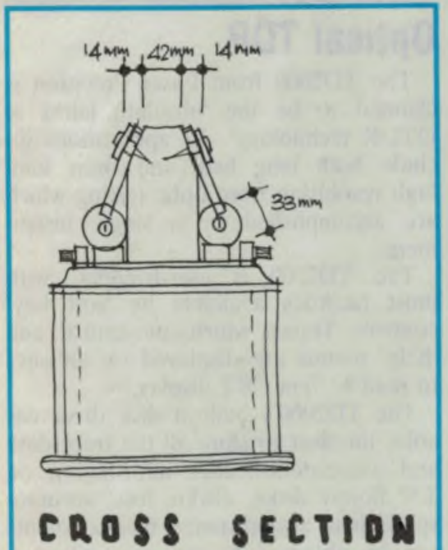
This equipment was used in the trial linking of Tasmania and Victoria by wireless in 1906. It is of interest that, whereas the Siemens equipment appears to have relied on a coherer for its receiver, as the illustration from the Marconi archives at Chelmsford reveals the Marconi station used a Maggie. However, for all this, it seems that this was an occasion when the telephone cable was to win out, for the proposal to use wireless was not accepted by the Government. Ultimately a cable was laid across Bass Strait.



Another view of the slide plate and spindle assembly, this time viewed from the top. The fixed plate is at upper left.



Detailed views of the slide plate assembly, to show the construction. Note that the section on the right is viewed from the end, that on the left from the side.



An end view drawing, showing the remaining major dimensions as well as the magnet mounting block.

As can be seen from the illustrations, the replica Maggie produced from the information provided in this article bears a strong resemblance to the genuine magnetic detector. When confronted with such a device in 1989, it is quite hard to imagine a time when such a large and cumbersome piece of equipment as the Maggie represented the absolute forefront of technology and remained so for a period of nearly twelve years.

About all that has not changed since 1902 is the human operator who then, as now, relied on wireless for communication and safety both at sea and on land. Even the name of the system of communication has changed. It is now Radio!

In closing I would like to thank the Marconi Company of Chelmsford, England, which gave me access to archival records and apparatus and also supplied photographs.

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New Products

CTCSS encoder

A CTCSS encoder, specifically designed for the Philips PFX and PF85 portable transceivers is now available.

The Sigtec designed C1012 CTCSS encoder features 37 EIA tones plus 13 non-EIA tones, nil current drain on standby, only 3-wire installation.

The unit, designed to fit all versions of the radios, allows room for other signalling options in the medium and long frame models.

For further information contact Signalling Technology, PO Box 304, Seaford 3198 or phone (03) 786 0063.

High precision 2.3GHz counter

Philips has extended its range of high-precision microcomputer-based uiversal frequency counters by the addition of the new PM6677 - a top-of-the-line model which covers frequency ranges up to 2.3GHz.

This extended frequency range makes the PM6677 particularly suited for use in service and maintenance applications in advance telecommunications environments, for example in the military field, among PTT authorities and private service operators, with satellite communications systems, microwave links and global navigation systems.

The PM6677 has lightweight yet sturdy construction for easy field operation. The all-metal casing provides a high degree of protection against tough operating conditions, while at the same time ensuring excellent RFI screening.

Features include reciprocal counting below 10MHz, and a choice of five high-stability timebase oscillators, allowing any stability and budget requirements to be met. The highest-performance version achieves a stability of 5 x 10^{-10}/24h.

For further information contact Philips Test & Measurement, 25-27 Paul

Pocket microscope

The new Scope 'Mark III' pocket microscope features a built-in light. This lightweight (80g) instrument has a 4 lens 30 magnification optical system.

Focussing above or below the nominal surface is easily achieved.

Trade price excluding tax is expected to be around $41.00.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042 or phone (03) 338 1566.

Regulated DC/DC converter

For DC to DC converter applications that require regulated output voltages of 5V and 12V, the new UR series from Unison are an economic design choice at ½20.00 in 100-off quantities.

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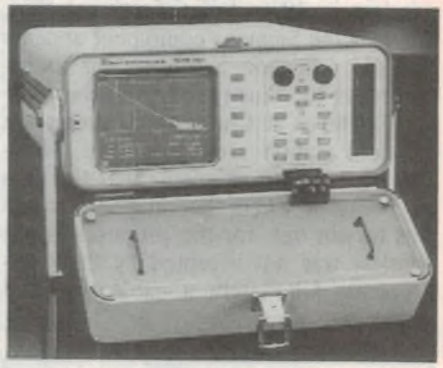
Unison Electric Company also have in their range various low watt – low price DC to DC Converters as well as a range of switch mode power supplies from 15 watts to 300 watts. Some models have Telecome Approval Certificates and custom supplies can be developed from the existing range with minimal engineering cost for single, dual, quad and multiple output requirements.

For applications engineering information contact Priority Electronics in Sydney on (02) 905 6024 or Melbourne on (03) 521 0266.



Optical TDR

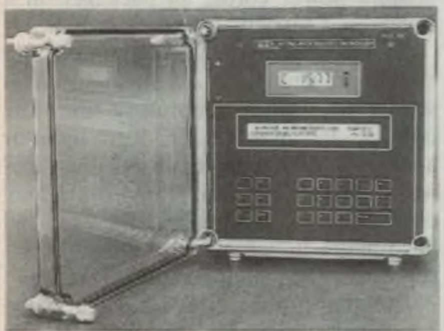
The TD2000 from Laser Precision is claimed to be the 'absolute latest in OTDR technology'. Its applications include both long haul and short haul high resolution fibre optic testing which are accomplished by a single instrument.

The TD2000 is user-friendly, with most facilities available by 'soft key' controls. Traces, which auto centre, and 'help' menus are displayed on an easy to read 17.7cm CRT display.

The TD2000's built-in disk drive enables the user to store all the trace data and associated header information on 3.5" floppy disks. dB/km loss, accurate splice loss and distance measurements can be obtained at any point along a stored trace. The unit operates under MS-DOS and may be connected to an IBM-PC compatible computer utilising the PCTODR emulation software. Disks with stored data can be transferred to an IBM compatible for long term evaluation. External floppy drives, 3.5 or 5.25" are available for additional flexibility.

Other features include uploading data, mapping a cable system, overlaying traces enabling easy checking of fibre link degradation over a period of time. An inbuilt printer option is available when instant hard copy is required.

For further information contact Vicom Australia, 4 Meaden Street, South Melbourne 3205 or phone (03) 690 9399.



Process controller

TPS have just released the new 9000 series Microprocessor Controlled Process Controller which is made in Australia.

The 80-character liquid crystal display and touch sensitive keypad work together to provide on-line help in simple English at any stage of operation, making the handbook virtually unnecessary. A larger, 6-digit LCD is also provided, configurable to prominently display any parameter being measured.

The 9000 series can be customised to suit almost any process control application. Input parameters can include; pH, conductivity, salinity, humidity, temperature, specific ions, flow, level, pressure etc.

For further information contact TPS, 4 Jamberoo Street, Springwood 4127 or phone (07) 290 0400.

NiCad, lithium batteries

Premier Batteries has released a comprehensive range of nickel cadmium and lithium batteries for computer memory, security and standby applications.

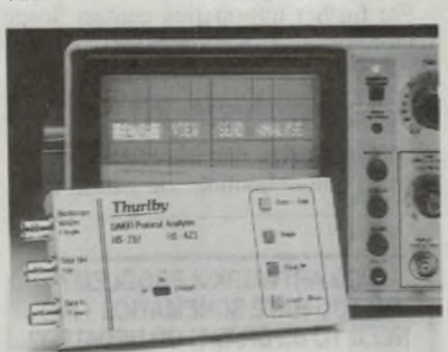
The rechargeable nickel cadmium batteries are available in 30, 60, 100, 170, 280 and 600mAH capacities in voltages of 2.4, 3.6, 4.8 and 6V for memory support applications. These batteries are manufactured with printed circuit board tags for direct soldering to the board, or

with solder tags for connection to leads. Higher voltages are available for security and standby applications.

Lithium batteries are available in two ranges. One is a 3-volt range designed for low current (uA to low mA) applications as memory back up in computers. With long shelf life (over 80% of initial capacity is still available after ten years storage), they frequently outlive the life of the equipment and need never be replaced. They are available in a range of common sizes and can be fitted with PCB leads.

The 3.6 volt range offers even better performance characteristics as they may be used in higher current drain applications and over a wider temperature range (–55°C to +100°C). Because of their high energy densities and their ability to deliver high currents, larger size cells (C size and above) are fitted with an internal fuse.

For further information contact Premier Batteries, Unit 7, 27 Childs Road, Chipping Norton 2170 or phone (02) 726 7701.



Low cost RS232

The Thurlby DA100 is a very low-cost protocol analyser for use on asynchronous serial data communication systems, particularly RS-232. Its diagnostic capabilities can assist in solving many of the common problems that occur when working with such systems.

The instrument provides baud-rate analysis, data-word format analysis, data monitoring (ASCII or Hex), triggered data capturing and test data generation.

The DA100 uses an oscilloscope as its display device. It connects to any standard oscilloscope via a single cable and displays 32 characters of alphanumeric text. Alternatively, an optional LCD display unit can be fitted which allows the analyser to be used independently of an oscilloscope.

In addition to being able to analyse transmission formats and to monitor data, it can also be used to generate test data for checking the operation of printers and terminals when no transmitting device is available or when the operation of the transmitting device is suspect.

The data input to the DA100 is provided via a BNC socket suitable for a standard oscilloscope proble. An optional RS-232 'breakout box' provides a convenient means of making connections into an RS-232 system, as well as providing full breaking, patching and monitoring of lines.

For further information contact Paramaters, 25-27 Paul Street Nth, North Ryde 2113 or phone (02) 888 8777.

'Smart' light switch

The 'Observer' light switch uses IR sensing to activate lights and/or trigger security systems in response to body heat radiation and movement. It can be used for intruder detection, activation of displays and exhibits, and operation of convenience lights in hallways, staircases etc.

Attractively styled, the unit can switch lamp loads of up to 2000W and can be tailored in terms of its sensitivity within a 16 x 25m area, using clip-on screens. An optional transmitter module and receiver unit can be used to replace hard wiring between the Observer and its controlled load, and also to provide audible indication.

The Observer is water resistant to IP54, and is therefore suitable for both external and internal use.

Further details from Hertz Electronics, 539 Glenmore Road, Edgecliff 2027 or phone (02) 32 3029.

New Products

Multi-gauge wire stripper

A new wire stripping tool released recently by Scope handles the six most popular gauges from 0.6 to 3.3mm. Previously it was necessary to purchase both Type A and Type B stripping tools to cover this range.

This new tool will strip six of the seven gauges covered by Type A and B. The exception is 1.0mm. An adjustable stop to control stripping length and an automatic anti nicking feature are standard.

Designed for production wire stripping it has six diameter specific 360° cutting jaws, which bite through insulation to a controlled depth, giving a clean cut and an undamaged conductor.

Trade price is expected to be around $16.90 excluding tax.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042 or phone (03) 338 1566.

Logic analysis kit

OK Industries has introduced a new Logic Troubleshooting kit which combines three logic troubleshooting instruments.

Designated the LK-680, the kit includes an all new multi-pin IC logic monitor (LC-160), a 20MHz logic probe (PRB-20), a 0.5Hz/500Hz switchable digital pulser (PLS-500), a probe tip adaptor with micro-hook (PRB-MH1), the OK Industries' *Digital Logic Troublshooting Guide*, operation manuals and power cords, all packaged in a ruggedised carrying case.

All instruments in the LK-680 kit are circuit powered and are ideal for field service as well as laboratory use. The new LC-160 multi-pin IC logic monitor adapts to IC's with up to 16 pins, and will indicate Hi, Lo, Pulse or Clock conditions. Additionally, the LC-160 has unique IC leg extension pins for exceptionally easy individual leg probing.

The slim-profile PRB-20 Logic Probe has separate Hi, Lo and Pulse LED's and under/over voltage LED's.

Further information from Electronic Development Sales, 2A/11-13 Orion Road, Lane Cove 2066 or phone (02) 418 6999.

Vector/waveform monitor

The Leader 5871 is a TV signal test instrument that combines a waveform monitor with a vectorscope in a single instrument.

Both waveform and vector can be independently or simultaneously displayed

on the CRT, plus there is a built-in SCH phase measuring function which can be numerically displayed and also used for video editing.

The Model 5871 is useful for observing the blanking time intervals for VITS, VIR, character broadcasting and ITS, as well as checking the characteristics of video camera resolution.

For further information contact AWA Distribution, 112-118 Talavera Road, North Ryde 2113 or phone (02) 888 9000.

Cermet trimmer

The Allen-Bradley type 85 multi-turn cermet trimmer is available in a range of standard nominal resistance values ranging from 10 ohms to 2M. It provides 22 turns (nominal) of electrical travel, an operating temperature range of –55°C to 125°C and a power rating of 0.5 watt at 70°C. The temperature coefficients for 10 ohm and 20 ohm values is 0 to +150-PPM/°C; 50 ohm to 2M ohms is +/- 100-PPM/°C.

This compact trimmer is 10mm square and has a depth of 5.1mm. It is available as either a top or side adjust and with in-line or offset termination pin configurations.

For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon 2064 or phone (02) 439 2200. EA

Exclusive to Electronics Australia:

Sneak Preview of Arista's

Well-known Australian electronics distributor and wholesaler Arista Electronics will be bringing out its brand-new 1990 catalog with the January Digest issue of *Electronics Australia*. Here's an exclusive preview of just a few of the many exciting new products you'll find in the catalog, to whet your appetite:

If you're the proud owner of a video camera or camcorder, you'll no doubt be very interested in Arista's two new compact and highly portable video lights – the DVL1 and dvl2. Both operate from rechargeable battery packs, making them suitable for outdoor use as well as indoors.

The DVL1 is the smaller unit and is one of the world's smallest video lights, weighing a mere 60g (2oz). It uses a 6V/10W halogen lamp with dichroic mirror, providing white light at 3200K, and runs for over 30 minutes from the rechargeable belt-pouch battery (supplied). Also supplied with it are interchangeable 'spot' and 'flood' lenses, a right-angle extension bracket and an adjustable extension bracket. Very handy – and it will be priced at only $194.95!

The DVL2 is a little larger, but still weighs only about 150g (5oz) without the battery pack. It uses a brighter 6V/20W halogen lamp and mirror, and runs for over 30 minutes from a fully charged Sony NP-22 or similar video camera battery – which plugs directly into the back. It fits directly onto the camera accessory shoe, and swivels vertically for flexibility. Priced at only $199.95, it will come complete with battery pack and charger.

Speaking of rechargeable battery packs, Arista will also be stocking exclusively a new range of 'Dual Voltage' brand nickel-cadmium battery packs suitable for replacing those in many popular brands of camcorder. For

The new DVL-2 Video Light.

The DV-8022H NiCad battery

example there's the DV-8022H, which replaces the NP-22 type as used in many of the Sony models; the DV-8066, which replaces the NP-55 and NP-77 types; the DV-7044P, which suits many JVC, Panasonic and Zenith models; the DV-2022, which suits Hitachi, Toshiba and RCA models; and the DV-7022, which suits other JVC and Telefunken models as well as the Panasonic PV-100D.

There are also rechargeable lead-acid packs, such as the DV-1919, with a capacity of 12V/2Ah to suit various Canon and NEC camcorders; the DV-1235, with a capacity of 12V/3.5Ah, to suit larger video camcorders and also cellular phones; and the husky DV-1240, which has a capacity of 12V/4.0Ah and is suitable for running large video camera-recorders, cellular phones, video lights and other high-drain equipment. The DV-1240 includes a charging LED, automatic overload protection and resetting, and comes complete with a shoulder carrying strap.

AV transmitter

Still on the subject of accessories for video recorders, another exciting new item in Arista's 1990 catalog is the AVS30 Audio-Video Transmitter, a very compact little unit which allows you to distribute audio and video signals to any UHF-equipped TV set in your home or the office – without the need to run cables.

Measuring only 120 x 83 x 40mm, the AVS30 accepts audio and video signals from a VCR or camcorder and uses them to modulate a low-power carrier on UHF channel 30, radiated from a small built-in telescopic whip

The AVS30 AV Transmitter

antenna. They can then be picked up on any TV set within a 10-30 metre radius, depending on intervening walls or other structures. Incidentally the AVS30 conforms to DOC specification MS315, so operation is completely legal.

Powered from a 12V/300mA AC power adaptor (supplied), it features adjustable video and audio gain controls as well as adjustment of the output carrier frequency, to ensure the best possible results. It will come complete with video and audio connection cables, in a small protective vinyl pack, for the very attractive price of only $89.95.

Portable IR sensor

The PIR90 Security Sensor

Leaving video gear, another very handy new item in the Arista range is a very compact portable security sensor: the PIR90. This is a passive infra-red detector, which

1990 Catalog

senses the movement of any heat-generating body in its range. This helps to prevent false alarms.

Measuring only 108 x 70 x 35mm, the PIR90 comes complete with built-in swivel mounting bracket which allows it to be mounted on a wall, and aimed in any desired direction. It can cover a 12m x 12m room, and can be set to either sound a 'ding-dong' chime for 5 seconds, when movement is detected, or a 'siren' sound which persists until the unit is turned off. It operates from a 216-type 9V battery, which fits neatly inside the case.

An excellent little unit for home and office security, as well as making a great entry sensor for shops. And it will sell for only $64.95!

Wall speakers

Moving on, another couple of new Arista items which should interest audio and hifi enthusiasts – as well as architects and builders – are the WSB525 and WSB650 wall-mounting speaker systems. These are two-way full range woofer/tweeter speaker systems, complete with crossover network, which are assembled onto very attractive flush-mounting wall plates to allow them to be built into wall cavities.

The smaller WSB525 unit features a 5-1/4" polypropylene cone woofer with foam surround, 10oz magnet and high-temperature voice coil, coupled with a 1" polyimide dome tweeter. The two give an overall response from 60Hz to 21kHz in the 'infinite baffle' provided by a typical wall, and are rated for up to 60 watts input, with a nominal impedance of 4 ohms and a sensitivity of

The WSB525 Wall Speaker

90dB at 1W/1m. Crossover frequency is 3kHz, with a first-order crossover network using an air-cored inductor.

Overall dimensions of the WSB525 are 279 x 191 x 70mm, and its front escutcheon/frame is ABS plastic, finished in decorator white with a strong perforated metal grille also finished in white. It will sell for $199.95.

The WSB650 is a little larger, and features a long-throw 6-1/2" polypropylene cone woofer which also has a foam surround, 10oz magnet and high temperature voice coil. The tweeter is a 1" high efficiency soft dome type, and together the two provide a response from 50Hz to 22kHz, again in an 'infinite' baffle. Power rating and sensitivity are as for the smaller unit, but with a nominal impedance of 8 ohms and a crossover frequency of 2.5kHz. The crossover network is in this case a second-order type.

Dimensions of the WSB650 are 307 x 219 x 84mm, and it is finished in the same colour and styling as the WSB525. It will sell for $279.95.

Both systems are fitted with red and black spring terminals at the rear for connection of the input, and come with matching rear mounting plate. They can be fully fitted from the front.

Pocket DMM

The DMM1 Pocket DMM

If you're often called upon to test pieces of equipment unexpectedly, Arista's new DMM1 Pocket Digital Multimeter should be of great interest. That's because it's positively TINY, measuring only 106 x 51 x 12mm, and with a weight of only 100g. Together with its permanently-fitted test leads it fits inside a neat little vinyl wallet measuring only 121 x 78 x 15mm – small enough to slip easily into most shirt pockets!

Despite this, it's a full-featured 3.5-digit MM, sporting a high contrast liquid-crystal display with clear 11mm-high digits and features such as automatic or manual ranging, a range hold button, automatic polarity and overload sensing plus low battery indication.

There are four ranges each for DC and AC volts, with full-scale readings of 1.999V, 19.99V, 199.9V and 450V in both cases. For resistance measurements there are also five ranges, with full-scale readings of 199 ohms, 1.999k, 19.99k, 199.9k and 1.999M respectively. A built-in beeper can also be used for continuity checking, sounding for any resistance of less than 200 ohms.

The DMM1 consumes only 5mW of power in operation, and runs from two LR-44 (SR-44) button cells. For only $74.95 it also represents excellent value for money, and Arista expects stocks to almost fly out the doors, as soon as they arrive!

Bench type DMM

Still on the topic of digital multimeters, another interesting new product in the 1990 Arista catalog is the DMM5. unlike most modern DMMs this is especially designed to operate on the workbenh, with the LCD display in clear view without having to prop it up precariously against something.

Measuring 94 x 90 x 74mm, the DMM5 has a 3.5 digit display and includes a tester for bipolar transistors as well as a full array of voltage, current and resistance ranges. It also includes a diode check range and an inbuilt continuity beeper.

The DMM5 Benchtop DMM

There are five DC voltage ranges, with full-scale readings of 199.9mV, 1.999V, 19.99V, 199.9V and 1000V. For AC volts there are four ranges, with full-scale readings of 1.999V, 19.99V, 199.9V and 700V. There are also three current ranges each for both DC and AC, for full-scale readings of 19.99mA, 1.999A and 10A. Resistance is covered by six ranges, with full-scale readings of 199.9 ohms, 1.999k, 19.99k, 199.9k, 1.999M and 19.99M.

The DMM5 is fuse protected on all except the 10A current ranges, and is fitted with a 'hold' button to store an important reading. It will be priced at $129.95.

And that's about all we have space for, this month. We'll give you a few more sneak previews of the new 1990 Arista Electronics Catalog in next month's issue...

In the meantime, if you need any information on the existing Arista range of products, this is available either from your existing Arista dealer or direct from:

Arista Electronics Pty Ltd, Unit 16, Slough Estate, Holker Street, Silverwater 2141. Phone (02) 648 3488 or fax (02)648 4010.

CAD software package review:

Protel's new 'Easytrax' PCB design program

Back in the September issue, you may recall, we had a review of Autotrax – the new 'top of the range' PCB design package from Aussie firm Protel Technology. Now fellow Tasmanian Tom Moffat has been trying out Protel's revamped economy package, dubbed 'Easytrax'. Here's his report:

by TOM MOFFAT

Tasmania-based Protel has become quite a well-known name in engineering circles for its PCB design programs, which are now being marketed all over the world.

At the moment the company has three design packages. Protel-Schematic is a program to produce electronic circuit diagrams on an IBM-PC or compatible computer. Autotrax produces an actual PCB track design on a computer's graphics screen, and then sends the finished result to a plotter. The plot becomes the photographic master for production of circuit boards. Protel-Schematic can produce a 'net list' which can be fed into Protel-Autotrax, which then 'automatically' lays in the components and routes the PCB tracks. This is a very advanced (and quite expensive) suite of programs.

Easytrax is the baby of the Protel stable. It allows you to draw up a circuit board design on your computer and plot it out. There is no automatic function, and no ability to work from a net list. Easytrax does not support the latest surface-mounted devices, but it does support the normal through-hole devices – the kind you and I use.

The program's designers have gone to great lengths to make it very easy to use, and it has been priced so individual freelance designers (like me) or even electronic enthusiasts can afford to purchase it. Even though Easytrax is the downmarket model, it can still produce boards with six signal layers plus power and ground planes, and a component overlay.

Doing this review is like visiting familiar ground for me. I wrote one of the earliest reviews on the very first Protel-PCB package, just on three years ago. Easytrax is much like it in many ways, although there are significant differences, too. But before getting down to the details, let's look at some history.

My first excursion into PCB design was probably 20 years ago, just as we were coming out of the valve era. Back then we made experimental PCB's by hand. We started with a blank unetched sheet of circuit board material, and drew tracks onto it with a horrible black goo called 'bitumenous paint'.

When the stuff dried we placed the board into a container of ferric chloride, another nasty substance, and then rocked and sloshed it around until the clear copper was etched away, leaving behind only the copper covered by the bituminous paint. This was difficult, unpleasant, slow, and smelly, but life improved somewhat when the paint was eventually abandoned in favour of a gadget called a Dalo Pen.

Drawing circuit boards with a Dalo Pen was still a by-hand job, but the black goo was gone, to be replaced by some free-flowing 'resist' applied directly from the pen. The resist looked and smelled like red fingernail polish, and we soon discovered that the stuff from the wife's dressing table, diluted with acetone and applied with a drawing pen, worked just as well. It was certainly cheaper than a Dalo pen.

As the years went on, professional designers started using a system called 'Bishop Graphics'. This was a method of producing a photographic negative, which was eventually used to photo-etch the copper.

You started with a sheet of translucent plastic. On this you stuck some ready-made adhesive black 'shapes' which represented IC's, transistors, pads, etc. You then joined them up with strips of black tape, which represented the PCB tracks. The finished design was photographed with a big camera to produce the negative.

The 'shapes and tapes' system produced first-class results, but it was slow and it was hard to correct any mistakes. In my own case, a full day with the shapes and tapes meant I went home that night with a screaming headache. It was *awful* on the eyes.

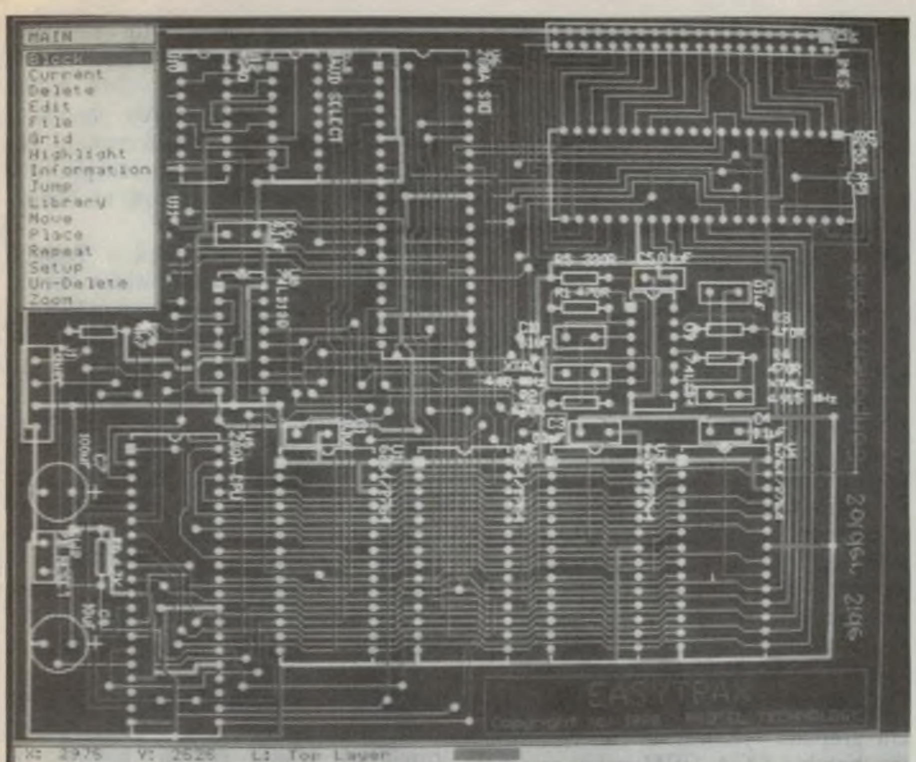
The manual stick-em-down system has largely been replaced with computer design methods now. But there are similarities. The translucent sheet is now the computer screen, there are extensive libraries of pre-defined component shapes, and you lay the tracks with a simple 'draw' command instead of wrestling with rolls of messy tape.

Capabilities

Easytrax works in ways you could only dream about in pre-computer days. If your board has say six 14-pin and two 16-pin IC's, you type 'PC' for Place Component. A message pops up asking you for the name of the component in the library. You type DIP14. Next you are asked for its designation, so you type IC1 or whatever. Finally the computer wants a comment; you type 74LS04 or whatever the IC type will be.

The component shape now appears, but it's not stuck down yet. You can slide it around with the cursor keys (or mouse) and hit RETURN when it's in a likely place on the board.

You keep repeating this over and over until all your IC's are on the board. They don't necessarily have to be in the right places; you can use the MC (Move Component) command to get them into their final places.



Like Autotrax, Easytrax uses friendly pull-down menus, driven by a mouse. However you can also use command key sequences...

Everyone has their own style of doing things. I personally use the first steps to sort of 'toss the components onto the board' so I know what's there. Then I use Move Component to shuffle them into the right positions. I mentally plan tracks and power rails as I go, and each component may be shifted and spun around several times until I'm happy with the layout.

With the old stick-down graphics shapes, you could clip them off their sheets with the backing paper still attached. You could move them around and try various layouts, but once you pulled the backing paper off and pressed them onto the plastic film, they couldn't be moved. If you made a mistake or changed your mind about a component location, your only option was to pull the old one up, throw it away, and try again with a new shape. And each one of these cost money!

Easytrax component shapes are virtually free, since you can use them over and over many times. You can even manufacture your own shapes and store them in the library.

I've had to do this many times, with things like a funny little 3.5mm PCB mounting socket, which was oddly shaped and had its pins spaced in very peculiar ways. Drawing this socket manually each time it was needed would have been a lot or work; it was much easier calling it up as a ready-made 'stick-down' shape.

If you don't want to be entirely original, you can call up an existing component pattern, 'explode' it into its individual parts, and then reassemble them more to your liking. This shape can then be re-stored in the library as a new component.

Connecting up the IC's and other components with Easytrax is a simple matter of typing PT (Place Track) and then zipping around the board layout with the cursor keys, leaving a track wherever you go. Mistakes are easy to fix; you just type DT (Delete Track) and it's gone. Or you don't have to remove it; you can break a track into sections, add new sections, or grab hold of an existing track and 'drag' it across the board.

When you made a mistake with the tape system, you took one end of a track between your fingers, swore loudly, and went R-R-RIPP! If the track was a long one you'd end up with thin tape wrapped around your fingers, to be torn away and tossed into the jumble of other ex-tracks on the floor. Then you'd get out your roll of tape and start sticking it down anew, hopefully to the right destination. If it was hot you'd sweat onto the plastic film and the tape wouldn't stick properly. Oh, life was tough!

Easytrax can tackle changes that would have had you screwing up your design and throwing it in the bin, with the old system. Say you've been working flat out on a board, and come to a situation where you realize something is fundamentally wrong. You've laid down a whole section of IC's in such a way that the most critical tracks want to come in from the bottom. But the area the tracks will come FROM on the other part of the board is sending them out from the side...

You could route all these tracks around to the bottom (messy business). Or you could pick up the whole offending section, tracks, IC's and everything, spin it around through 90°, and bung it down again so the new tracks could enter from the side.

This is only one of the operations you can do to *blocks*. Once you have marked off a rectangular area of your board as a block, you can move it up or down, left or right, spin it around, flip if over, copy it, or use the DELETE command to send it off to 'circuit board heaven'. The block concept is probably one of the most useful features of any circuit board design program, and it's implemented very nicely in Easytrax.

There are lots more capabilities in Easytrax, but there's not enough space here to detail every one of them. There's a very good instruction manual to do that for you.

As far as I can see, Easytrax has pretty much the same editing tools as the up-market 'big fella' programs. The only thing missing is an auto-router, a facility that takes a net list from a schematic design program and uses it to design a board more or less automatically. This shouldn't worry a small user or a prototype developer. It's much more satisfying to do the track routing yourself; then you KNOW they are as short and efficient as possible. You are the artiste, not the computer!

I've used an auto-router, once. It was an imported model, an accessory to an earlier Protel package. That auto-router was supposed to make PCB design a breeze. But it chose to do all the easy tracks itself, leaving all the hard ones for me. And they were made all the harder because the program wasn't able to 'think ahead', planning pathways for tracks that looked potentially troublesome.

I had to manually move some of the tracks the auto-router made, just to make room for the ones it gave up on. It was good fun watching the auto-router work, zipping in new tracks here and there as if by magic. But I personally thought the resulting board was a shambles, and I'm sure I could have done the job better, and quicker, myself. ▶

Easytrax review

The new Protel-Autotrax package contains an auto-router of their own design. Although I haven't used it myself, I hear from around the traps that it's a big improvement on the imported auto-router.

Command structures

There are two basic ways to drive Easytrax. They've been carefully thought out, so Protel could call the program Easytrax instead of Hardtrax!

Using a mouse to shove a cursor around and click on menu choices seems to be the in-thing nowadays, and Easytrax fully supports this system. But the really clever method involves the use of two or three letter typed commands. These are very intuitive, so you don't really have to refer to the instructions all that much. You can take a guess at what a command might be, and chances are you'll be right.

For instance, PT means Place Track. Wouldn't it seem natural then, that PC might mean Place Component? Yep. And PP might mean Place Pad? Yep again.

If DT is Delete Track, how would you delete a pad? DP! Or delete a component? DC! And so it goes...

Every time you hit the first letter, you get a little menu to prompt you for the next one. But you eventually learn to ignore them. Since the IBM-PC stores keypresses in a buffer, you can do things like quickly type FQY (File-Quit-Yes) to get out of the program. You will get a little window asking if you want to save the file before you leave.

Speaking of little windows, these pop up in Easytrax whenever you need to input a filename, the name of a component, or a comment or whatever. The window comes up with a little editor attached so you can chop and change the window contents. The instruction manual shows all the editor commands. From what I can see they're pretty much like WordStar commands, so many people will know them already. It's a nice touch.

The earlier versions of Protel-PCB relied pretty much on the PC's function keys to make things happen. I have spent many, many long hours using Protel-PCB to produce artwork for projects I've been involved in. After a while I got so I could sit there with my left hand on the function keys, my right hand on the cursor keys, and my eyes on the screen. I could produce just about every command by touch-typing on the function keys, the cursor keys, and Shift and Alt. This method, in my opinion, could outrun any mouse in the land.

I was a bit saddened to see that Easytrax had changed the command structure, after I had spent so much time learning the old one. As I was musing about this and staring at the screen my hands started fiddling with the old familiar keys, the old commands. And – they worked!

It seems you can program the function keys and other keys to do just about anything you want using the Easytrax macro facility. The macros you specify go into a file, which can be set up to configure the keys every time Easytrax is started. The macro file that came with the program just happened to be set up to make Easytrax work much like the earlier Protel programs. How nice!

How does it look?

Easytrax can work with many different graphics systems, all the way from the humble CGA (IBM color graphics adaptor) to an extended VGA standard with 1024 by 768 pixels. This would produce quite stunning graphics, but such high resolution isn't really necessary for Easytrax.

You can zoom or blow up the part of the board you are working on, up to 100 times original size. At the most extreme zoom the label on an IC very nearly fills the screen. So seeing what you're working on is no problem. The higher resolution graphics cards just let you see more of your work at once.

I first initialised Easytrax to work with a Hercules monochrome graphics screen, which is my favourite IBM standard. The Hercules video card is installed in my computer right next to a CGA card, and in some cases they share the same memory addresses. Easytrax tried to use the area common to both, with a resulting clash. This is easy to avoid by changing one memory address in the program.

When I mentioned the problem to the Protel people, they said they would endeavor to make the change in future releases. The Hercules card should work fine with the CGA card physically removed.

Firing up the CGA revealed that the program has been set up to show the various board layers and pads as yellow, red, and green on a black backgound. The user can easily change these colours.

Frankly I find such garish colours hard on the eyes during long designing sessions, so I use an amber monochrome monitor driven with the colour information. The colours then become soft orange, light brown, dark brown and black – in other words, shades of gray. You can easily differentiate between the layers, and you can put in a solid ten hours non-stop with no danger of headaches.

I have recently acquired a Toshiba T-1200 laptop computer, which should help promote a more relaxed and pleasant lifestyle. I have decided that my next big PCB design session is going to take place on a beach, instead of behind some miserable desk. So I got Easytrax going on the flat LCD screen.

The Toshiba, and probably most other laptops, is arranged so its display looks to software like a PC-style CGA screen. But each pixel on the display is either on or off – there are no shades of gray. There's a bit of trickery in the computer to provide texture in certain areas to make them look darker or lighter, like the dots in newspaper pictures. Still, this makes only three useful brightness levels: full-on, half-on, or off.

Since OFF is the background color, there are only two levels, half-on and full-on, for the PCB display. But that's enough to do a two-layer board, using half-on for tracks on one side and full-on for tracks on the other. Pads and component shapes can also be full-on.

All of these 'colours' are configurable from within Easytrax. You can also attach a normal colour or monochrome CGA monitor to most laptops, which makes Easytrax look just as nice as it does on a full-sized PC.

The plot thickens...

To be of any use, of course, Easytrax has to produce an end product: a master transparency that can be used for photo-etching PCB's. This is usually done with a plotter which draws sharp black tracks onto a piece of clear film.

Plotters have traditionally been frightfully expensive, although like so many other computer peripherals, they're coming down in price. Still, most people who would buy Easytrax would not feel justified in owning a plotter just for occasional use.

It is possible to have your plots done by a bureau – you send them a disk with your PCB design on it as a file (together with some money) and they return a completed photographic image of your artwork. Many PCB manufacturers will do the whole works for you; you send them a disk (and lots of money) and they return a pile of completed, plated, silk-screen labelled PCB's.

In all the Protel packages, plotting is done by a program which is separate from the main editing program. So if you have two computers, one can be designing a new board while the other can be plotting an earlier one. Protel tell me they are making a big effort to ensure that bureaus and PCB manufacturers have the PLOT program that goes with Easytrax, so the Easytrax user can send off a disk with a '.PCB' file on it, and the bureau or manufacturer does the rest.

It is quite obvious, then, that the average Easytrax user may never have seen a plotter, much less used one. There is a valuable section of the instruction manual that explains plotter operation in general; how to hook the plotter up, how to select the right pens, how to find the best plotting speed. This is the sort of basic information all manuals should have. In fact the Easytrax instruction manual would have to be one of the program's best features.

Easytrax can also produce plots on various graphics printers, such as the Epson FX series and laser printers. The quality will never be as good as from a proper plotter, but it lets you run off a 'check plot' to make sure your artwork is 100% right before you send your disk off to a bureau.

Although many people will frown on the practice as 'unprofessional', you could photograph the check plot and use it to produce a prototype PCB, bypassing the expense of a proper plot. The quality might be a bit rough, but at least you could use it to prove your design. It would certainly beat bitumenous paint.

Hardware needs

If you've read through this review so far, you're probably getting serious about Easytrax. So what will you need to make it work for you? Well, a computer for a start, an IBM or compatible.

As for the memory required, I've been doing some sums and I doubt a machine with 256K like some of the cheapies would hold Easytrax. The main program is nearly 160K long and there's also a big overlay of over 100K. You will also need to load a component library; the standard one that comes with the package takes another 100K.

You could probably squeeze Easytrax into a 512K machine, but it wouldn't leave a lot of room for the PCB you're working on. So you should really have a 640K machine to do justice to Easytrax.

If you happen to have one of the newer PC's that supports the EMS extended memory scheme, Easytrax will use the extra memory to permanently store the big overlay. This would provide instant access to it, speeding up an already fast program. You would not benefit from a maths co-processor; Easytrax uses integer mathematics only, so there would be no advantage.

The instruction manual calls for two disk drives, or one floppy and a hard drive. There are still a few computers on the market with only one floppy drive and no hard drive, but it would be heavy going trying to use Easytrax on one.

I suppose if you used two disks you could put the main program and the overlay on one, and the library and another copy of the overlay on the other. Then you'd start the program from the first disk and then swap to the second once everything was loaded. When the program tried to reference the overlay it should find the copy on the second disk. Your work would also have to be stored on the second disk. I haven't tried this, and it doesn't sound very easy. Best to buy yourself another drive, I think.

Of course if your one drive is a 720K or 1.2M version, everything you need for Easytrax will fit on one disk nicely. This is what I've done with the Toshiba laptop. A hard disk would probably provide the neatest installation for Easytrax or any big CAD program for that matter. Access to the disk is very fast, and there's plenty of room.

Protel say a colour monitor is necessary, but I still contend that an amber monitor is easier to work with. The colour monitor I have here is only on loan – it's going back soon, and I won't miss it. Protel also recommend a mouse. Again, it's everyone to their own taste, but I still prefer to play the function keys.

The program requires DOS 2.0 or greater; I've been using my old favorite DOS 2.11 and it works great.

You also MUST have a parallel printer port, even if you don't intend to use a printer. Easytrax is copy protected by a 'dongle', a little whoozis that you must plug into the printer port to make the program go. The dongle is a bit of a nuisance since it has to be in place every time you start the program, but once the program is going you can remove it again. I suppose any software producer has the right to protect its products from being ripped off. But the trend nowadays, at least in cheaper software, is to do away with protection.

Now comes the crunch: the cost. Prepare yourself for a pleasant surprise. The price of Easytrax has just been reduced, would you believe, to only $295. For this you get three disks full of software and a lovely instruction manual, all bundled up in a solid, bright red, presentation case.

I've used a lot of PCB design packages – SmartWork, the earlier Protels, and I've even had a go at producing PCB layouts on AutoCad (I'll bet every designer has tried that at some stage). The performance from Easytrax is right up there with the best of them, and the price, in comparison, is miniscule. My assessment of Easytrax: Highly Recommended.

Like the other Protel products, Easytrax is available from distributors and suppliers in each state. Further information is available from Protel Technology, GPO Box 536F, Hobart 7001, or you can phone them on (002) 73 0100.

Stop Press News:

Copy protection dropped from Easytrax, Schematic

Just as we were going to press with this issue, Protel Technology's general manager John Powell advised that his company has decided to drop the copy protection on its Australian-developed Easytrax and Protel-Schematic CAD packages. This is a goodwill gesture, in response to complaints by customers about the inconvenience involved in using a 'dongle'. However Mr Powell explained that if there is evidence of a surge in illegal copying, the company may be forced to re-introduce the protection.

But at the new low price of $295, surely everyone will be happy to buy their own genuine copy of Easytrax!

Computer News and New Products

'Workhorse' printer

Replacing the established BP-5420, the all new Seikosha BP-5420 is a wide carriage, bi-directional 8-pin printer with 462cps in draft mode and 106cps NLQ throughput, an 18K buffer and a choice of pics, elite, proportional or condensed pitch.

Also featured are Centronics and RS232C interfaces, a choice of Epson/IBM emulations, a user friendly front control panel, heavy duty performance and quiet operation.

The BP-5460 accepts either tractor or friction feed media with an auto cut sheet feeder available as an option.

Further information from AWA Distribution, 112-118 Talavera Road, North Ryde 2113.

AT-compatible laptop PC

Sharp has announced the release of its newest powerful laptop business computer, the PC-5541, an IBM AT-compatible with a 40MB hard disk drive and a 1.44MB floppy disk drive.

The CPU is an 80286 running at 12MHz (switchable to 6 & 8) with the ability to add an 80287 maths co-processor. The backlit double supertwist crystal display features high resolution (640 x 480), emulating VGA in 16 grey scales.

In addition to the high quality of the LCD screen, the PC-5541 supports as standard a full range of external monitors. This includes VGA, EGA, CGA, MDA and Hercules graphics. Other standard interfaces include a parallel printer port, 9 pin RS232 and external keyboard port. The keyboard supported is an IBM PS2 standard.

The rechargeable battery allows up to 2 hours uninterrupted use without power, or up to 5-1/2 hours with the optional add-on battery pack.

The PC-5541 has 640K of RAM with the ability to expand to 3.6MB. (The additional memory conforms to the EMS standard (version 4.0)).

For further information contact Sharp Corporation, 1 Huntingwood Drive, Huntingwood, Blacktown 2148 or phone (02) 831 9111.

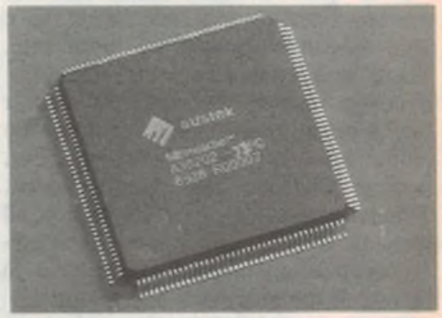
Card gives ISDN access to PCs

A communications adaptor card enabling PCs to access Integrated Services Digital Network (ISDN) has been released by Linkware. The PC Snet card, manufactured by OST, Europe's leading X.25 network supplier, emulates ISDN terminal functions for IBM PC, XT, AT or compatibles.

The full-size card provides complete access to the ISDN basic rate interface (2B+D), which is the ISDN standard in Europe and Australia.

Priced at $4206 (including tax), the PC Snet card is available with a number of optional packages, including OSI transport and session driver, NetBios LAN gateways and drivers for Xenix and Unix systems.

For further information contact Linkware, 604 North Road, Ormond 3204 or phone (03) 578 0821.



Second generation cache controller

Austek Microsystems has announced its A38202 Microcache, a second-generation cache controller for Intel's 386 microprocessor. The A38202 operates at 25MHz and 33MHz, and Austek plans to migrate the design to 42MHz in 1990.

The A38202 is packaged in a 160-pin plastic quad flat pack (PQFP). The 25MHz version is priced at $110 for 10,000 pieces, and the 33MHz version is priced at $130.

Further information is available from Austek Microsystems, Technology Park 5095 or phone (08) 260 0155.

Phaxswitch improved

Banksia Information Technology (BIT), manufacturer of the highly successful PHAXswitch which allows a phone and a fax to operate off a single telephone line, has improved the device and made it better suited to the regional vagaries of Telecom and the idiosyncracies of different telecommunications equipment.

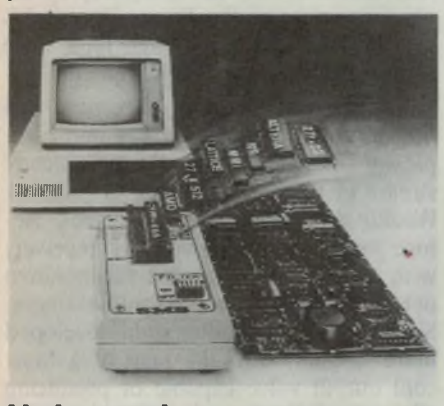
Among the refinements made to the

PHAXswitch to ensure its operation under these special conditions were:

- extended 'deaf' periods to allow for long STD beep sequences in some areas of Australia, such as Burnie and Launceston, before the PHAXswitch made its distinction between an incoming fax and telephone call;
- modification of the firmware to ensure the PHAXswitch distinguished between the 900Hz STD calls in some older Telecom exchanges, and the 900Hz continuous tone of a particular brand of fax;
- removal of software that also caters for overseas conditions, thereby ensuring the PHAXswitch was adapted exclusively to Australian conditions.

PHAXswitch, which is manufactured in Hong Kong and is the winner of the 1988 prestigious Hong Kong New Product of the Year Award, measures 35mm x 131mm x 189mm.

It is available from leading retail electronic equipment outlets throughout Australia at a new recommended retail price of $328.00.



Universal programmer

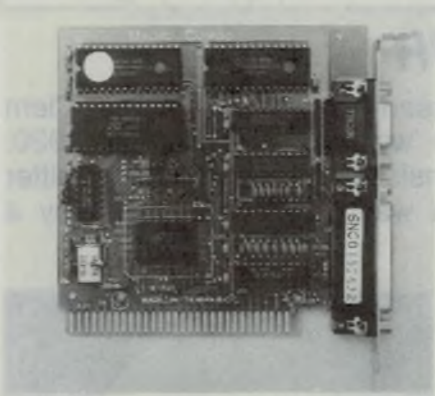
Dynamic Component Sales has announced the release of a new upgraded version of Sprint, a PC-driven universal IC device programmer which offers system designers high productivity in programming.

Sprint now supports a total of 1150 PROMs and PALs, GALs and RALs from just about every manufacturer, which is claimed to make the most complete programming system yet released. This does not include variations in speed package of temperature options for any particular part or brand.

All major devices are supported, and adaptors are also available for Hitachi and Intel Controllers and for the 4MB EPROMS, PLCC and surface mount packages.

The system is designed to be used with logic design tools such as LOG/iC, ABEL or CUPL. It can also handle the Texas Instructions TMS320 range of Digital Signal Processors, with the relevant DIP or LCC adaptor.

For further information contact Dynamic Component Sales, Showroom 1, 17 Heatherdale Road, Ringwood 3134 or phone (03) 873 4755.



CGA/HGA 'combo card'

Electronic Solutions has released the 'Magic Combo Card' which provides, on the one card, a monochrome graphics adaptor with colour graphics adaptor (CGA) compatibility using levels of grey to simulate colours (640 x 200 pixels) as well as a monochrome display adaptor with Hercules graphics (720 x 348 pixels).

Together, these standards are said to cover 97% of graphics applications ever written, in the fields of business, games and general PC graphics. So there's no need to put up with gritty CGA graphics for your text – switch instead to high quality 720 x 348 pixel MDA/Hercules. Nor do you have to miss out on all the games software, because you can't run CGA graphics.

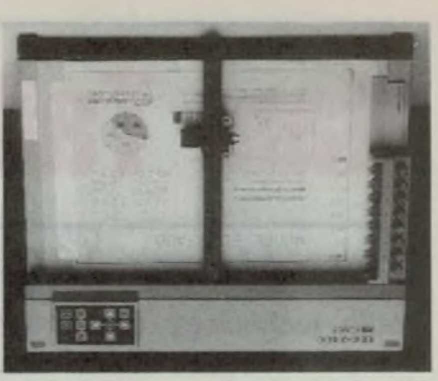
The card comes with a custom LSI and driver software.

For further information call Electronic Solutions, 5 Waltham Street, Artarmon 2064 or phone (02) 906 6666.

Low cost plotter

GFS Electronics has announced the release of a new low cost high quality professional A3/A4 flat bed plotter claimed to be very similar to a Roland plotter.

Manufactured in Korea, the new EDG-2400 is selling for $1350 plus sales tax. It is an 8-pen colour plotter (using easily obtainable HP-type pens) capable of plotting on a wide range of different material including overhead projector film. Because it is compatible with both HP-GL and RD-GL languages it may be used with a wide range of



CAD/CAM software packages. A fully configurable RS-232 port as well as a Centronics parallel port are provided.

A 2.5K byte buffer is standard with the EDG-2400. Maximum plotting speed is 232mm/s (9.13in/s). Resolution is 0.05mm/step with a repeatable accuracy of 0.1mm or less. Paper is held using a magnetic plate.

Accessories supplied as standard include eight 0.3mm coloured fibre tip pens, plastic dust cover, quick reference sheet, instruction manual, RS-232 cable and 240 volt AC adaptor.

Further information is available from GFS Electronics, 17 McKeon Road, Mitcham 3132 or phone (03) 873 3777.

Industrial grade RS485 adaptor

Microconsultants have announced their ICU889 industrial style RS232 to RS485 interface adaptor (base band modem). The device is specifically designed with industrial control systems in mind, and includes a number of features aimed at enhancing overall system reliability. It is especially useful where an existing system design with RS232 ports is being upgraded to multipoint or wide area operation, with for example a PC type central controller.

The ICU889 is powered off 12V-40V DC or 12V-24V AC, and has three-way electrical isolation between power, RS232 and RS485 ports. A transmit time limiter protects against a stuck Request to Send (RTS) input which could disable a complete system, and a relay on the RS485 port, controlled from Data Terminal Ready (DTR) on the RS232 port, allows fail safe isolation and self-test schemes to be implemented.

The Australian manufactured unit also has circuitry which allows an RS232 device which lacks an RTS output to nevertheless operate in a true RS485 2-wire, half duplex multidrop mode.

For further details contact Microconsultants, 72 Dernya Drive, Frankston 3199 or phone (03) 787 7700.

Ham Talk

Clem Henry, VK2UR

Radio technology has progressed enormously since Clem Henry first became interested in 'wireless', back around 1920. His first amateur radio 'rig' consisted of a spark transmitter using a Ford spark coil, which was joined soon after by a one-valve receiver.

"I remember it was my father who first got me interested in wireless, as it was called then", Clem Henry recalls. "He brought back a magazine, when he went down to Sydney for a trip. I was about 15 at the time, and he thought it would keep me out of mischief!"

Clem grew up in the Northern NSW town of Uralla, near Armidale. His father was originally a joiner and cabinet maker, but very progressive when it came to new technology. He had bought the town's first motor car, and also built and ran Uralla's electricity generating station – powered from an internal combustion engine running on 'suction gas'. Like many early plants the station produced 240 volts DC.

The signals from Clem's first crude spark transmitter were heard by his friend E. Barlow 2GQ, in nearby Armidale. But at that stage he had no receiver, so he couldn't hear 2GQ's own signals.

Soon after he built his first receiver, a one-valve job using a V24 valve and other parts bought by mail from Colville-Moore and similar dealers in Sydney. The tuning capacitor was bought as a collection of stamped-out plates and other parts, and assembled himself.

The valve heater ran from a small lead-acid accumulator, charged up when necessary from his father's DC power main via a dropping resistor. For the 'B' supply he made up a wet-cell battery using carbon and zinc rods, in test tubes filled with sal-ammoniac solution.

With this receiver he was able to hear 2CG, L.V. Todd's station 2CR in Tamworth, and also Charles Maclurcan's station 2CM in Strathfield, Sydney.

This was in 1920-21, when experimental 'broadcasting' was just beginning. Soon some of the townspeople, hearing of his experiments, asked him to build *them* wireless receivers too. Before long he found himself running a small business, building up and selling receivers

for a growing clientele. His father produced the cabinets, and needless to say they were also in a good position to recharge the customers' filament batteries, when required!

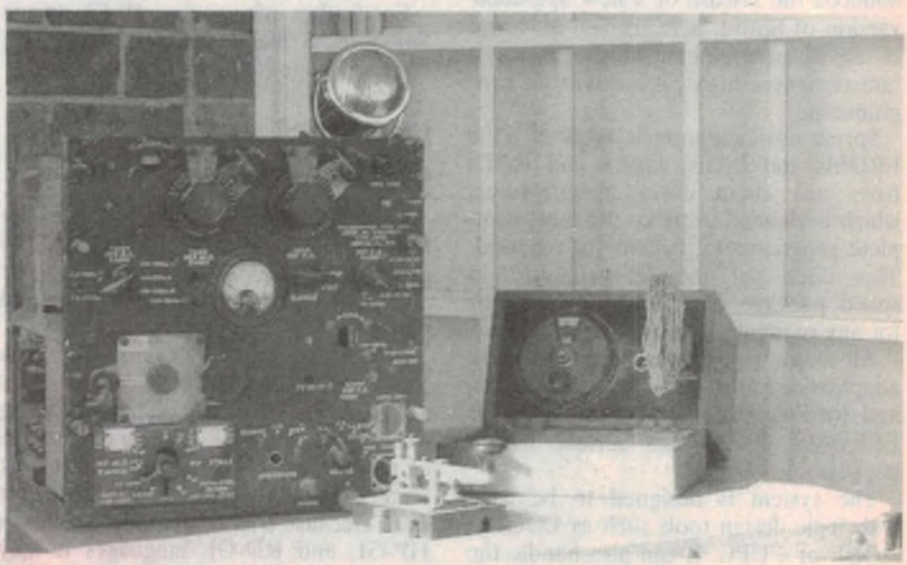
The radio receiver business grew so rapidly that soon they were Uralla's first licensed 'radio dealer', and selling the famous Atwater Kent receivers as well as those young Clem built himself.

But amateur radio wasn't forgotten for long. The town's Methodist minister also happened to be a ham, and with his encouragement Clem applied for – and gained – his transmitting licence in late 1922. It was licence number 3382, and his initial callsign was 2CH. This was replaced by his current callsign VK2UR in the later 20's, and the 2CH call was given to Sydney's Council of Churches broadcasting station when it opened in early 1932.

His first valve transmitter had an output of 5-10 watts, and used type 202 valves. Like most experimenters in the 1920's he used the broadcast band at first, then moved to the 80m and 40m bands. This was not only because of the growing 'competition' from commercial broadcasters, but because of the more reliable DX available with the shorter wavelengths.

To check his operating frequencies he built an absorption wavemeter, which was calibrated for him in Sydney by the chief engineer of the Water Board. It's still in his 'shack', although long since retired from service as a wavemeter.

Needless to say, his receivers and transmitters soon grew in size and complexity – spurred on by the steady stream of designs appearing in *Wireless Weekly* and other local magazines. Before long he had a four-valve receiver, with an RF amplifier and regenerative detector followed by two audio stages. Similarly the transmitter soon developed more 'steam', with the help of a Marconi output valve capable of producing 40 watts. A Ford spark coil was pressed into service as a modulation transformer, for grid modulation.



Clem's original wavemeter from the 1920's, to the right of his Morse key.

His first antenna was a long wire strung between a 40′ pole and the family's water tank stand. But this was soon replaced by a 'cage' antenna between two higher masts, each consisting of 36′ telegraph poles with lengths of stout oregon bolted to the top.

By this time he had served his time in training and was now a licensed electrician, earning his living with installation, repair and inspection work around Uralla and the surrounding areas.

In the early 1930's he built a very husky 250W phone transmitter for the broadcast band, with the idea that he might 'go commercial'. The transmitter was based on two Mullard transmitting valves, an SW1 as the RF final and an MB2 as the modulator. A motor-generator running from the 240V DC main was used to produce the 2000V/500mA needed for the plate supply, with a separate dynamotor for the filaments. He even made his own transmitting capacitors, with well-dried maple as the dielectric.

The modulation choke had a value of 80 henries at 500mA, he recalls, and weighed about "a quarter of a hundredweight"! He had it made in Sydney, and shipped up.

The new transmitter worked well, and while running on an Experimenter's Permit Clem's programmes were well received in the town. However he decided that commercial operation involved too many problems with things like copyright, and opted for amateur radio instead – although the modulator did find itself pressed into use as a public address system, at the town's showground and at other functions!

During the 1930's he made many contacts on the 80m and 40m bands. His first overseas contacts were with amateurs in New Zealand, and then Ellis Island in the Pacific. These mightn't sound all that exciting nowadays, in the era of 400 watts plus, beams and SSB, but back then they were quite an achievement using the modest technology available.

As Clem says, "This was in many ways the most exciting era for amateur radio, with new circuits coming out all the time. Every improvement brought with it the chance to make contacts over a longer distance."

Towards the end of the 1930's the state's AC mains network finally reached the Uralla area, and Clem's father closed down his local power station. But Clem himself then became very busy, installing new power consumption meters and converting everyone's services over to the AC 'multiple earth neutral' system.

At the onset of World War 2, Clem joined the Air Force as an electrical fitter, and served six years at bases in Richmond, Wagga, Tocumwal, Darwin and Moritai.

Like other amateurs his ham radio activities had to be suspended for the duration. But following the war, he soon became active again – mainly on 2 metres, and with converted disposals gear.

After the war he also moved to the Sydney area, and began a new career with Telecom, or the 'Postmaster-General's Department' (PMG) as it was then called. It was from Telecom that he retired in 1970, when he was awarded the Imperial Service Medal by the Queen for his long and valued service.

Now a very alert 84, Clem Henry is currently recovering from a bout of bad health. But he still retains a strong interest in amateur radio, and is currently planning a new antenna system to allow operation from his Sydney home unit.

I very much enjoyed my talks with him, in preparation for this story. You can read about the early days of amateur radio, but nothing really compares with hearing about it from someone like Clem, who was there and working in it at the time! (J.R.) EA

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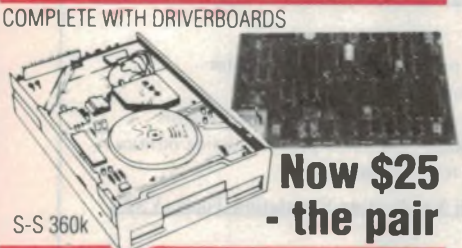

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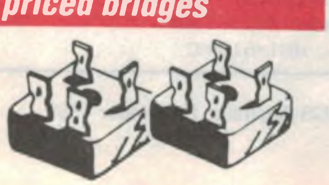

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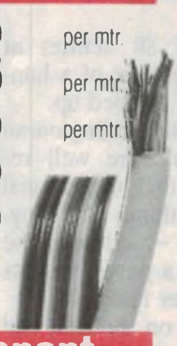

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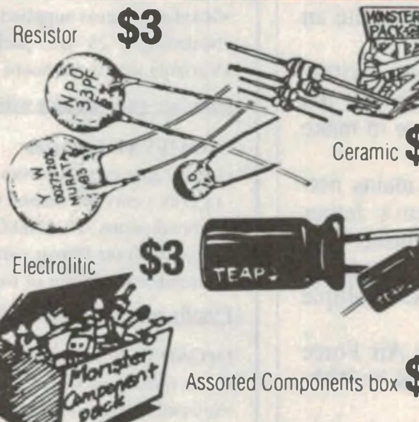

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74LS92	10	for	$3.75
74LS113	10	for	$3.00
74LS114	10	for	$3.00
74LS123	10	for	$4.00
74LS161	10	for	$4.20
74LS163	10	for	$4.00
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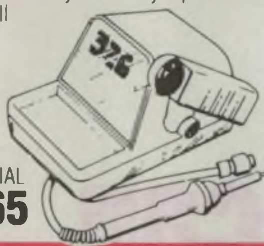

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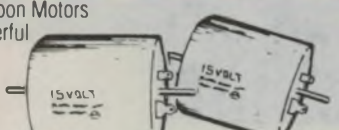

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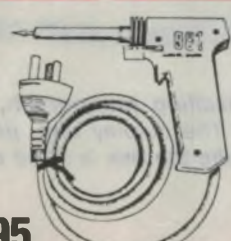

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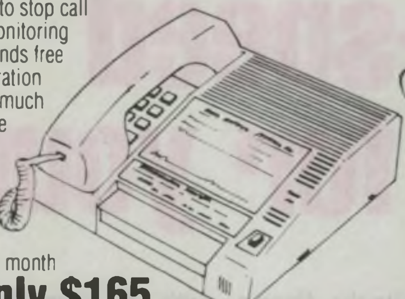

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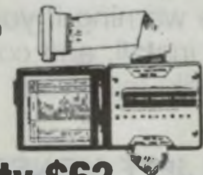

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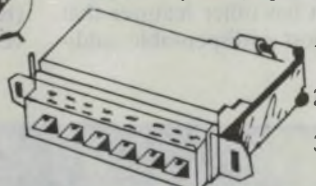

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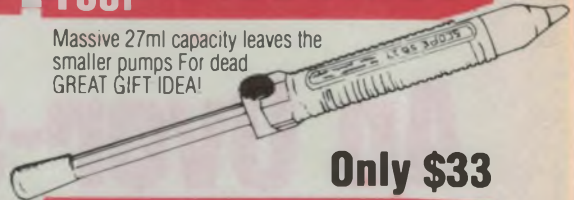

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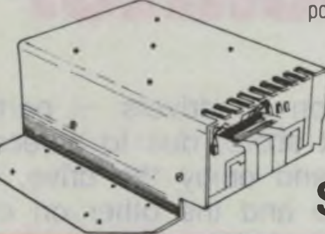

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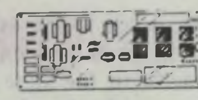

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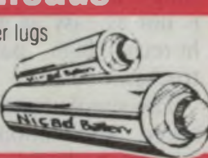

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An Over-speed Monitor for your car

Attention all drivers – particularly those with a less than perfect score, due to a recent speeding fine! Now you can relax and enjoy the drive, without having one eye on the speedo and the other on everything else. Build our speed monitor, and get visual and audible warning if you exceed the speed limit. It's simple to build and install, and could save you many times its cost. Put fun back into your driving, and maybe even live a bit longer...

by BRANCO JUSTIC and JEFF MONEGAL

Speeding, according to the experts, is a large factor in road accidents. It is also a large factor in the state budget, and not being caught by the hi-tech radar systems is now more a game of chance than ever before. Of course, the simple answer is – don't speed. But this is not as easy as it seems, given today's hi-tech, high performance cars and trucks.

The simple fact is that many motorists speed unintentionally, particularly on country highways or on inter-urban six lane arterial roads. Slowing down from the highway limit to a town limit is often difficult, as adjusting to a 40km difference in speed requires a lot of concentration. Similarly, maintaining the city speed limit on a good arterial road requires considerable monitoring of the speedo, often at a time when your senses are required to keep track of all the other distractions.

No doubt the police have heard the story many times "Sorry officer, I didn't realise..."

Maybe you are one of those who tend to be a little 'lead-footed' at times. At best you will be caught and fined, at worst, well – you know what can happen.

Some cars have a cruise control, which takes care of highway motoring. Just set the control to the required speed and settle back, as the car maintains a fixed speed all the way to your destination. Unfortunately, cruise controls are both expensive and relatively useless in city driving. But not so our new speed monitor.

The unit presented in this article is simple in concept - adjust a dash mounted potentiometer to light the centre LED of a seven LED display, when you are at the required speed, and thereafter it will indicate any variations from the preset value. If the speed is higher than the preset value, a buzzer will sound.

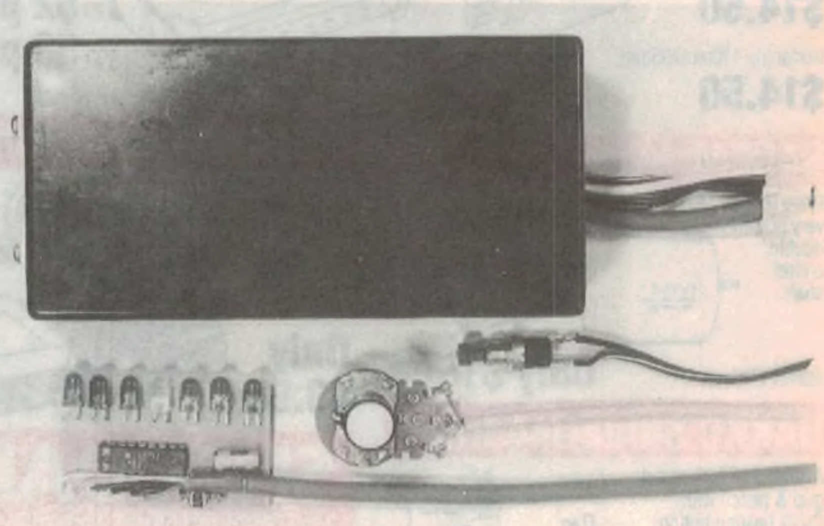
That's a basic overview of its operation, but the unit has other features that make it an almost indispensable addition to any vehicle. Now for a more detailed description.

What it does

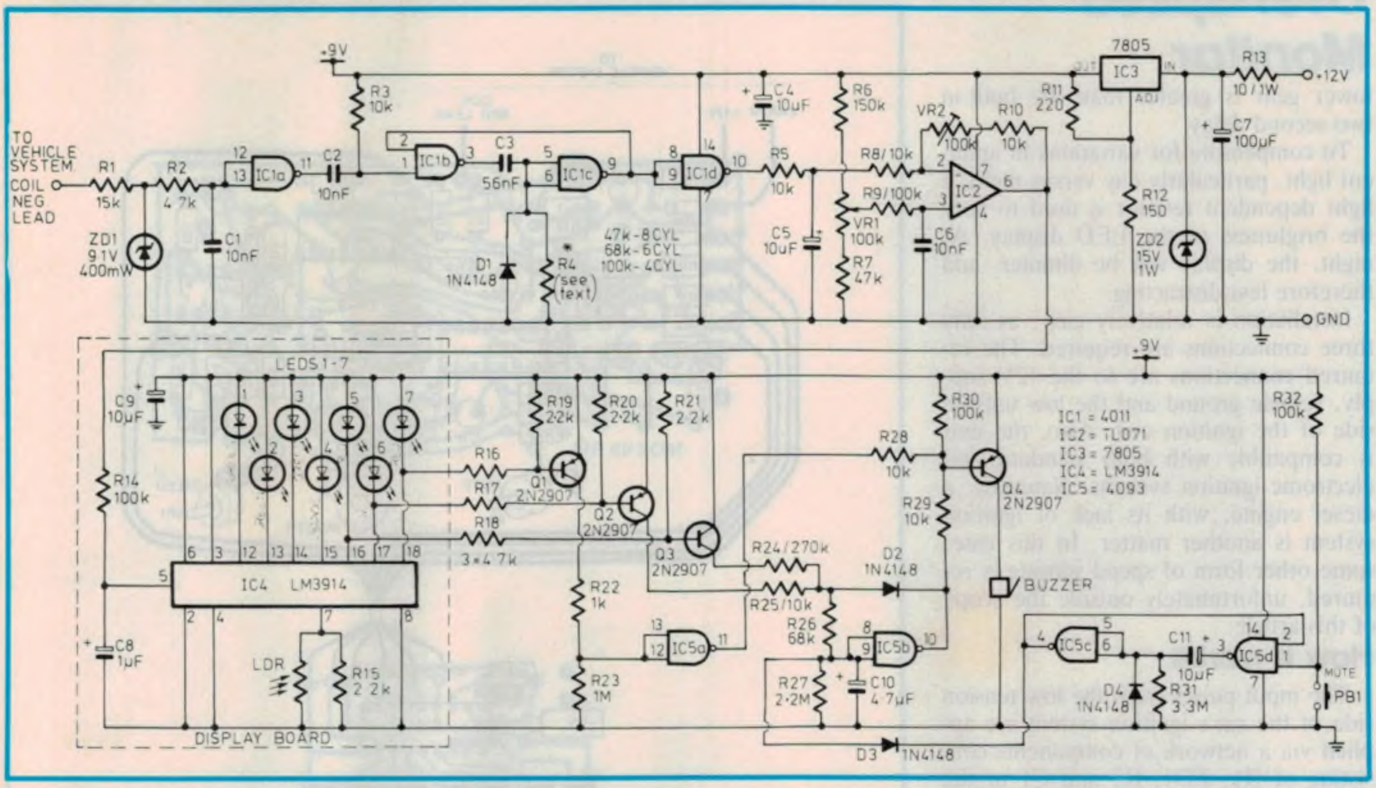
The unit is in two sections: the sensing electronics and a visual indicator. A row of seven LEDs is used in the indicator and these display, in step form, the car's speed relative to the selected speed. As already described, in use, the potentiometer is adjusted to set the unit so that the centre (orange) LED is lit when the vehicle is travelling at the correct speed.

The remaining LEDs, three above and three below the centre LED, will light if the speed varies by a preset amount from the centre value. The amount of variation to light each LED is preset during commissioning, and can be set from around 2km/hour to 10km/-hour.

This means, for example, that if you set the step value to 5km/hour, the first (red) LED on the right will light if the vehicle speed increases from, say 60km/-



The speed monitor does not take an exciting photograph, as most of the electronics is contained within the box. The display unit, potentiometer and pushbutton are mounted on the dash, while the box is fitted out of sight.



The circuit diagram. The circuit is contained on two PCBs, and the display section is shown outlined by dotted lines.

hour to 65km/hour. The second LED will turn on (others turn off) when the speed is 70km/hour and the third LED shows a speed deviation of 15km/hour, or a speed of 75km/hour.

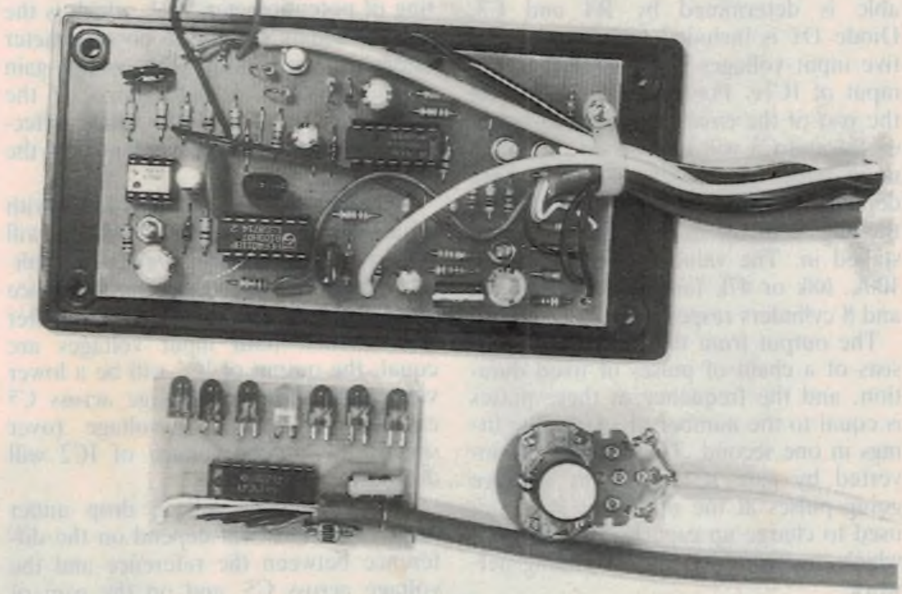
Similarly, a speed reduction will be indicated in the same way, but this time by the LEDs (green) to the left of the reference LED.

While a visual indication is useful, the real strength of the unit is its ability to give an audible warning. The buzzer, attached to the box containing the sensing electronics, will be silent while the car is travelling below and at the preset speed. When the preset speed is exceeded by the first step the buzzer will sound occasionally, giving a gentle reminder.

The buzzer will become more 'excited' as the speed increases away from the reference, giving a tone consisting of a more rapid series of beeps. If you still don't take any notice, and let the speed rise so that the third LED is on, the buzzer will emit a continuous tone. (By now you may also be hearing that well known siren, that is accompanied with flashing blue lights!).

But to make the unit a bit more friendly, and to allow for the odd occasion where a speed increase is essential, (though probably still not legal), you can press the 'mute' button. When this button is pressed, a timer will prevent the buzzer from sounding for a period of around 30 seconds. This is useful, for example, during overtaking or if the engine revs, due to a gear change, to suggest that the speed is higher than the reference.

As well, because the unit senses engine revolutions, rather than wheel revolutions for its input, the circuit has been designed so that the buzzer starts sounding only when the preset is exceeded for more than two seconds. This allows higher than normal revs when the vehicle is being accelerated from rest, or for a change down when climbing a hill. Of course, the mute button can also be used if the time spent in a



This photo shows both PCBs for the speed monitor. The cable between the two PCBs contains six wires, and a wire clamp is used to secure the cable to the display PCB. Note how the main PCB is attached to the lid of the box, and the clamp arrangement used for its wires.

lower gear is greater than the built-in two second delay.

To compensate for variations in ambient light, particularly day versus night, a light dependent resistor is used to vary the brightness of the LED display. At night, the display will be dimmer, and therefore less distracting.

Installation is relatively easy, as only three connections are required. The required connections are to the 12V supply, vehicle ground and the low tension side of the ignition coil. Also, the unit is compatible with both standard and electronic ignition systems. Naturally, a diesel engine, with its lack of ignition system is another matter. In this case, some other form of speed sensing is required, unfortunately outside the scope of this article.

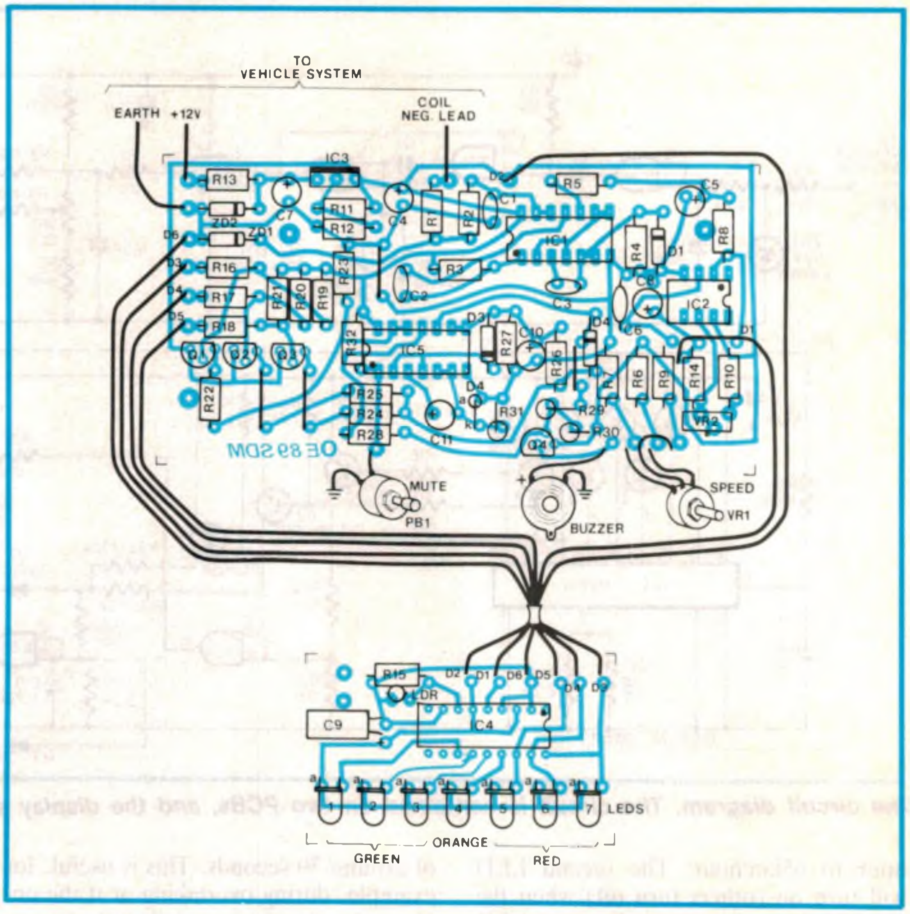
How it works

The input pulses from the low tension side of the car's ignition system are applied via a network of components consisting of R1, ZD1, R2 and C1 to the NAND gate (IC1a) which is configured as an inverter. Resistor R1 in conjunction with zener diode ZD1 limits the input pulses, while R2 and C1 form a low pass filter which effectively debounces the points, thus minimising multiple input pulses. The pulses at the output of IC1a are differentiated by C2 and R3 to produce short trigger pulses for the following monostable, made up from IC1b and IC1c.

The actual 'on' time for the monostable is determined by R4 and C3. Diode D1 is included to prevent negative input voltages being applied to the input of IC1c. For proper operation of the rest of the circuit, the time constant of R4 and C3 will depend on the maximum pulse trigger rate, which in turn depends on the number of cylinders in the engine of the car that the unit is installed in. The values of R4 should be 100k, 68k or 47k for engines with 4, 6, and 8 cylinders respectively.

The output from the monostable consists of a chain of pulses of fixed duration, and the frequency of these pulses is equal to the number of spark plug firings in one second. These pulses are inverted by gate IC1d and the positive going pulses at the output of IC1d are used to charge up capacitor C5, via R5, which together form an integrating network.

The resultant DC voltage across C5 is therefore proportional to the engine speed and this voltage is fed to the inverting input of IC2, which is connected



The layout diagram. The ground wires of the push button and the buzzer can be connected either to the vehicle ground or, as in the prototype, to a ground point on the PCB. Check carefully that the six interconnecting wires between the two boards are correctly connected.

as a differential amplifier. The DC voltage at the non-inverting input of the differential amplifier depends on the setting of potentiometer VR1, which is the dash-mounted speed set potentiometer referred to previously. The voltage gain of the amplifier is determined by the setting of trimpot VR2, which effectively sets the 'step' values that light the LEDs.

IC2 operates like a comparator with adjustable gain. Its output voltage will be close to rail potential when the voltage across C5 is below the reference voltage set by the speed potentiometer VR1. When both input voltages are equal, the output of IC2 will be a lower value and when the voltage across C5 exceeds the reference voltage (over speed) the output voltage of IC2 will drop even further.

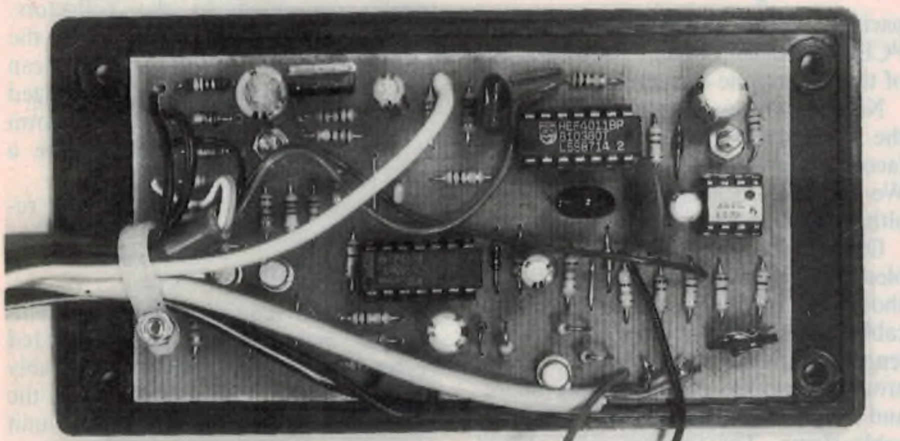
The amount of voltage drop under these conditions will depend on the difference between the reference and the voltage across C5, and on the gain of the stage, as set by VR2. Resistor R9 and capacitor C6 filter any noise that may otherwise be added to the speed reference voltage.

Resistor R14 and capacitor C8 form another low pass filter and ensure a noise free input voltage to the LED driver IC4. This IC can drive up to 10 LEDs, although in this application only seven are being used; three green, one orange (reference) and three red LEDs.

IC4, an LM3914, is a dot/bar display driver device that contains a comparator/driver stage for each LED. In this application, the IC is wired to give a 'travelling dot' display, in which only one LED is on at a time. Which LED is illuminated will depend on the input voltage (at pin 5) and the reference voltage applied to IC4.

Here the reference voltage is provided by the 9V rail, supplied to IC4 via pin 6. The brightness of the display is determined by the value of resistance between pin 7 of IC4 and ground. The lower the resistance the higher the LED current, giving a correspondingly brighter display.

The brightness is determined by the parallel combination of R15 and the LDR. The higher the ambient brightness the lower the resistance of the LDR and therefore the brighter the dis-



This photo shows the prototype PCB of the speed monitor. The op amp IC faces the opposite way to the other ICs. Also, watch that the wiring doesn't cause the three transistors (one is hidden under the wiring) to contact each other, as the transistor case is also the collector.

play. The minimum brightness level is largely determined by the value of R15, as the LDR will have a resistance value of over 1M when it is in darkness.

The rest of the circuit operates the buzzer. The three PNP transistors Q1, Q2 and Q3 are connected to LEDs 5, 6 and 7, which are those LEDs operated when the speed exceeds the reference. When a LED is turned on, it will have approximately 1.8V across it, sufficient to operate the particular transistor connected across it.

The transistor that is turned on will depend on how much the speed exceeds the reference as set by VR1. For example exceeding the reference speed by one 'step' causes Q3 to be turned on via R18. If the speed rises to operate LED 6, (the second step), Q2 will operate, driven through R17, and if the third step is reached (LED 7 on), Q1 will be turned on. Note that only one transistor is on at a time, as driven by the LED display.

If Q3 is on (first step above the reference speed), C10 will charge via the series combination of resistors R24 and R26. It will take about 2 seconds for C10 to charge up to the threshold voltage of the inverter gate IC5b. It is this delay that allows higher engine revs during the period the vehicle is being accelerated from rest, as previously mentioned.

When the voltage across C10 rises to a value recognised as a logic 1 by the Schmitt input NAND gate of IC5b, the output of IC5b will fall to zero, supplying base current to Q4 via R29, turning both Q4, and the buzzer on. However the low voltage at the output of IC5b will also forward bias diode D2 and capacitor C10 will begin to discharge via resistor R26.

Because IC5 has Schmitt inputs, as soon as the voltage across C10 falls to the lower threshold value (logic 0), the output of IC5b will return to a high, turning off Q4 and the buzzer, allowing C10 to recharge through R24 and R26 as before. Since the discharge resistance for C10 through R26 (68k) is less than the charge resistance through the series combination of R24 and R26, (338k) the cycle time will have an uneven mark space ratio and as a result the buzzer will produce relatively widely spaced short 'beeps'.

We have to admit this is a rather unusual oscillator circuit, but it is one that works very well!

If the reference speed is being exceeded by two steps, Q2 is turned on through R17, causing C10 to charge via the series combination of resistors R25 and R26. The lower total resistance of R25 and R26 compared to that of R24 and R26 causes the buzzer to sound more frequently compared to the operation just described, although the oscillator works in the same way.

If the reference speed is being exceeded by three 'steps', Q1 is turned on via resistor R16. Under these conditions, the inverter of IC5a will be operated, in which the logic 1 supplied by Q1 causes the output of IC5a to become a low. This in turn operates Q4 through resistor R28, and the buzzer will sound continuously. Note that there is no delay under these conditions, as C10 is no longer involved.

In summary, the first speed step operates Q3, giving a two-second delay followed by a short burst of sound, repeated at relatively long intervals. The next step operates Q2, again giving bursts of sound, but at shorter intervals, and step three turns on Q1, which operates IC5a, causing the buzzer to sound continuously.

The remaining two gates IC5c and IC5d and associated components make up a monostable (timer). Normally the output of IC5c (pin 4) is at a logic 1, equal to the supply voltage of 9V. In this instance, D3 will be reverse biased, preventing it from interfering with the action of the oscillator circuit already described.

However when the 'mute' button is pressed momentarily, the monostable will be triggered into its unstable state, remaining there for a period determined by C11 and R31. This period is set to approximately 30 seconds, and during this time the output from IC5c will be zero volts. This will forward bias diode D3, preventing C10 from charging if either Q2 or Q3 are turned on. Thus, until the monostable has timed out, the buzzer will not sound for either of the first two excess speed steps.

If the speed reaches the third step, the buzzer will sound, regardless of the state of the monostable. It was found in practice that this arrangement works well, in which audible feedback is always available to some extent.

The voltage to the unit is regulated by IC3, which is connected to the vehicle's 12V supply via the protection circuit consisting of R13 and ZD2. R13 limits the zener current and the 15V zener (ZD2) protects IC3 from possible excessive voltage spikes.

IC3, a 5V regulator, functions as a 9V regulator by the addition of resistors R11 and R12, which hold the reference input of IC3 at approximately 4.5V. Filtering of the 9V supply is provided by the electrolytic capacitors C4 and C9.

Construction

Kits of parts for this project are available from Oatley Electronics, who also provide a back up service for repair and fault finding. The kit includes all the components listed in the parts list, except for the three wires which are needed to connect it into a vehicle. The length of these depend on the vehicle and actual placement of the unit.

Begin construction by cutting the PCB to separate the main board from the display board. Cut the board using a hacksaw, or by scribing a line and breaking the board along the line. Next assemble and solder all the resistors, ca-

Over-speed Monitor for your car

PARTS LIST

1 PCB coded OE89SDM
1 plastic box, 130 x 68 x 41mm
1 buzzer
1 LDR

Resistors

All 1/4W, 5%: 1 x 150 ohm, 1 x 220 ohm, 1 x 1k, 4 x 2.2k, 4 x 4.7k, 7 x 10k, 1 x 15k, 2 x 47k, 2 x 68k, 4 x 100k, 1 x 150k, 1 x 270k, 1 x 1M, 1 x 2.2M, 1 x 3.3M.1 10 ohm 1 watt
1 100k ohm linear, panel mount potentiometer with knob to suit
1 100k vertical mount miniature trimpot

Capacitors

3 10nF ceramic
1 56nF polyester
1 1uF low leakage electrolytic
1 4.7uF low leakage electrolytic
4 10uF 16V low leakage electrolytic
1 100uF 16V low leakage electrolytic

Semiconductors

4 1N914 diodes
1 9.1V/400mW zener diode
1 15V/1W zener diode
3 5mm green LEDs
3 5mm red LEDs
1 5mm orange LED
4 2N2907 PNP transistor
1 7805 voltage regulator
1 TL071 operational amplifier IC
1 4093 quad Schmitt trigger NAND IC
1 4011 quad NAND gate IC
1 LM3914 LED driver IC

Miscellaneous

1.5 metres six core cable, nuts, bolts, hookup cable

Kits of parts for this project are available from:

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985

Postal address (mail orders):

PO Box 89, Oatley West NSW 2223.

complete kit as per prototype .. $37.90

partial kit, including PCB and all PCB components $29.90
Post & Packing charge........... $2.50

Note that the PCB artwork for this project is copyright to Oatley Electronics.

pacitors and the two wire links on the PCBs. As usual, watch the orientation of the electrolytic capacitors.

Next insert the diodes, transistors and the ICs into the PCBs. Note that IC2 faces the opposite way to the other ICs. We used IC sockets on the prototype, although these are optional.

Once all the parts have been assembled on the two PCBs, the two boards should be interconnected using 6 core cable, as supplied in the kit. A short length of tinned copper wire is looped around the cable on the display board, and soldered to the PCB to act as a cable clamp. The six core cable should also be clamped to the main PCB using a plastic clamp. A strip of plastic cut from a cable tie was used for this purpose in the prototype.

The potentiometer, mute button and the vehicle connecting wires should now be added and the pushbutton and the potentiometer connected.

The main PCB is designed to fit inside a plastic jiffy box (130 x 68 x 41mm). As shown in the photographs, the PCB should be attached to the lid of the box with three fixing bolts. One of these bolts can be used to hold the cable clamp, by the way. The buzzer is attached to the outside of the box with two bolts, and is mounted at the opposite end to the exit point for the wires. File a slot in the box sufficiently deep to accommodate the passage of the wiring.

Testing

Before installation, it is possible to bench test the unit if you have access to a 12V power supply and an audio generator capable of delivering a peak to peak output voltage of around 10 to 12V.

First check your work for any errors, then connect the power supply, set to 12V. The current consumption should be around 40mA, and the first green LED should light. Also, measure the supply voltage, which should be close to 9V.

Set the signal generator to 100Hz or so, (square or sine wave) and test to see that the centre LED can be turned on by adjusting the potentiometer. You should find that varying the frequency of the signal generator then causes the remaining LEDs to operate, depending on the input frequency. As well, the buzzer should sound in the manner described when either of the three red LEDs are on.

One point to watch is that the metal cased transistors do not make contact with each other, as their cases are electrically connected to the collectors. These transistors are mounted near the cable clamp, and moving the wiring can cause the transistors to be dislodged from their correct position. Some form of insulation between them may be a good idea if this is a problem.

If the unit tests correctly so far, it remains to install it.

Installation

Installation requires the box containing the main electronics to be fixed somewhere within the car, probably under the dash, then attachment of the potentiometer and the LED display unit in a convenient location on the dash. The display PCB will fit inside a 'Tic Tac' box, and some form of filter may be useful to make the LEDs more prominent.

The best location for the display unit is a matter of personal choice, but ideally it should be located so it can be easily viewed, but positioned where the ambient light is not too high to make the LEDs difficult to discern. The LDR will reduce the brightness under night time conditions, and obviously the chosen location should be such that the LDR is not in continual darkness.

To connect the unit into the vehicle, three connections are required. Firstly, the ground wire should be connected to a good electrical ground on the car chassis or metal work. The 12V supply should then be derived, from a point that is live only when the car's ignition is on – preferably from a fused point from the car's main distribution block. Finally, the ignition wire should be connected to the negative (points) side of the ignition coil. Proper automotive wire should be used and the three wires should be tied around existing looms where possible.

Before the main box is fitted, the unit should be road tested to allow the best setting of trimpot VR2 to be obtained. On the prototype, the trimpot was set to mid-position, but component variations and your own requirements could result in some other setting. One point to consider is that if the speed of the car is *above* the third step, no LEDs are lit, and the buzzer will be silent. In other words, set VR2 to give steps that make speeding above the third step fairly unlikely.

Once the unit is adjusted, complete the installation and relax – in the knowledge that now you have a 'back seat driver' which gets agitated if you speed. Just don't forget to use it of course!

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Vintage Radio

by PETER LANKSHEAR

Previously we have looked at the earliest type of loudspeaker, the horn type, which had evolved from the headphone. The shortcomings of the horn speaker soon became apparent, and other developments followed rapidly. Here we look at the next development: the so-called 'magnetic' speakers.

A horn speaker has the advantage of high efficiency, but if it is to have an adequate bass response, its dimensions become so large as to be domestically unacceptable.

Before long it was found that the use of a horn could be avoided by increasing the area of the driver unit diaphragm, and although efficiency was lost, there was a noticeable improvement in sound quality. However, large diaphragms needed to have low mass combined with rigidity.

The material most commonly used was paper, generally shaped in the form of a cone to achieve the necessary stiffness. But other materials, such as doped linen were sometimes used.

Headphone-type drivers using reed mounted iron armatures were the first development. However these gave high distortion as a result of the one-sided operation of the magnetic system. Reed resonance also caused poor tonal quality, and so better drivers were soon sought.

Expensive solution

One method developed was the use of a moving coil in a strong magnetic field, first patented by Siemens in 1877. In 1925 Chester Rice and Edward Kellogg of the American General Electric company developed what is generally regarded as the first successful moving coil loudspeaker. Together with a mains powered 1.0 watt amplifier, this was marketed by RCA in 1926 – but was very expensive.

Although it had superior reproduction, the new speaker was insensitive and needed a powerful magnetic field, which could not be provided by the carbon steel permanent magnets available at the time. The only practical method was to use a massive mains-energised electromagnet, but mains powering of receivers was very much in its infancy at the time and universal acceptance of the superior moving coil speaker had to wait for receiver technology to catch up.

Immediate answer

As battery powered receivers produced only a few dozen milliwatts of audio power, sensitive loudspeakers incorporating the available permanent magnets were essential.

The efficient moving iron speaker was improved with a balanced armature system, magnetically polarised by a horseshoe magnet and surrounded by a winding of fine wire. One end of the armature was centred by a reed and the other end drove the cone through a rod and a reduction lever. This is illustrated in Fig.1, which is reproduced from *Drakes Radio Cyclopedia* of 1931.

Signal currents through the winding caused the armature to move between the pole pieces and the motion was transferred to the cone through a drive rod and lever. The balanced armature movement eliminated some of the worst features of the traditional headphone, with the result that some headphones and even a few horn speakers still being made at the time, used the improved system.

Similarity of the balanced armature movement to a polarised telegraph relay led it to being known originally in Britain as a relay speaker. The earlier unbalanced magnetic reed moving iron loudspeaker soon became obsolete, but old advertisements can be confusing because eventually the balanced armature type became known also as the magnetic or moving iron speaker.

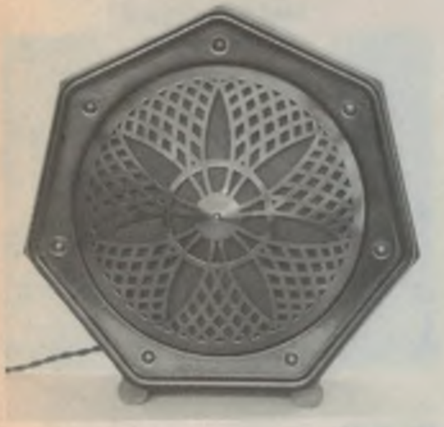
Various stages

Although the circular cone was by far the most common shape, some experiments included off centre mounting and square or rectangular cones. In one model, the diaphragm took the form of a cylinder, with the driver unit working between the edges of a lengthwise slot.

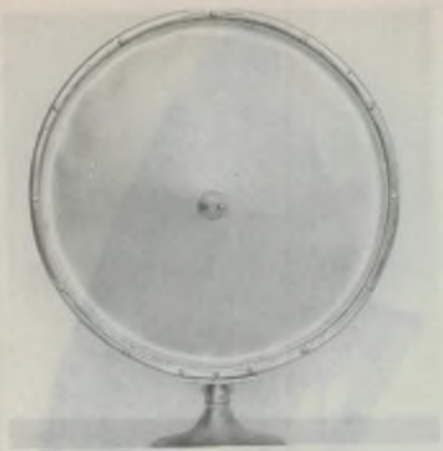
Initially, speakers were free standing, with drive units mounted inside the cone. But eventually the familiar rear

A 1927 Western Electric model 650 professional balanced armature speaker with 24" diameter cone.

A 1927 RCA model 103 with tapestry cloth cover. Missing is a small composition base.



A Philips 'Sevenette' model of 1930, well made in a 12" high Bakelite case with bronze fret.



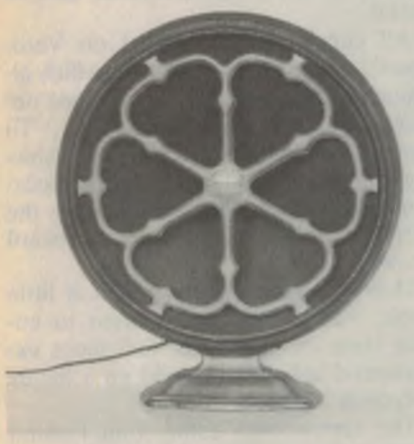
A French 'Sferavox' with 11" diameter fabric cone doped with aluminium paint.

An American Bremer Tully balanced armature unit of 1928, measuring 12" x 10" and with a chamois leather cone surround. The cabinet contains flock-filled pads to reduce internal resonances.

mounted driver and basket chassis suitable for cabinet installation became general. Various methods of cone suspension were used. The free standing speakers had rigidly mounted cone edges, but some free edge cones were used. Moving coil speaker design had an influence with cloth, leather and corrugated paper surrounds all being tried.

The impedance of the winding varied enormously over the audio range, making matching to the output stage a compromise. Matching transformers were not often used, and it will be seen that direct current through the windings would bias the armature. A degree of compensation could be made with the adjusting screw, but generally receivers with output valves drawing more than a few milliamperes were fitted with output chokes, and fed the audio to the speaker via a series coupling capacitor of a microfarad or more.

To improve the sound by damping down some of the more strident high frequencies, some speakers had a small choke and a capacitor connected in series with the armature winding.



An Atwater Kent type 'E' balanced armature unit of 1927. The 11" diameter cone is a free-edge type, without a surround.

Various disguises

The balanced armature loudspeaker was very successful, and was produced in large numbers. Radio was still establishing itself and appearance was an important acceptance factor. Conservative households were catered for by making speakers as decorative as possible, or disguising them to look like something else.

A common method was to make a paper cone look like a shield, either free standing or wall hanging. Another was to conceal the speaker behind a tapestry screen.

Exposed paper cones are vulnerable to damage, and metal or Bakelite cases became common. Eventually, speakers were built into the receiver cabinets or given their own separate wooden cabinets.

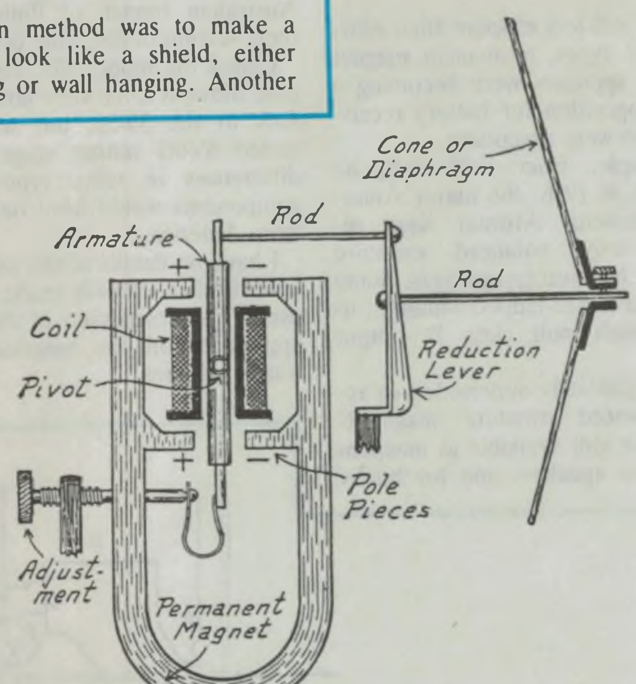


Fig.1: The essentials of a balanced-armature 'magnetic' loudspeaker. Large excursions resulted in the armature hitting the pole pieces.

Balanced-armature speakers like this 'Blue Spot' unit were sold through the 1930's to hobbyists, as inexpensive alternatives to moving-coil speakers.

Still limited

As the quality of receivers and transmissions improved, and mains powered receivers – many fitted with moving coil speakers – became available, the limitations of the balanced armature speaker became more apparent.

The stiffness of the armature suspension and inadequate baffling limited the bass response to 100Hz or more, and the small movement of the armature between the pole pieces restricted the power handling ability.

An improvement was the 'Inductor' derivative of the balanced armature system (Fig.2). Here the lateral movement of the armature was changed to a fore and aft motion, greatly increasing the range of travel and consequently, the power handling ability. These inductor speakers are similar in appearance to the moving coil type, but can often be recognised by a pair of large horse shoe magnets projecting to the rear.

Eventual decline

By 1930, the success of the moving coil speaker was assured. Mains powered receivers could produce adequate audio power, and energising of electromagnetic fields was no longer a problem.

Although still less efficient than moving armature types, permanent magnet moving coil speakers were becoming a practical proposition for battery receivers, but there were exceptions.

For example, from 1934 until he closed down in 1936, the major American manufacturer Atwater Kent reverted to using balanced armature speakers for his battery receivers. Some of these used centre-tapped windings, to cater for push pull class B output stages.

Although generally superseded in receivers, balanced armature 'magnetic' speakers were still available as inexpensive extension speakers and for hobby projects right up to the outbreak of World War II.

Australian Philco

After sending off my last column, describing the American Philco 39-55 receiver with its 'Mystery' wireless remote control, I discovered important additional information. This was that the Australian branch of Philco produced their version of the same design.

Called the model 930, the data available shows it to be very similar in essentials to the 39-55, but with a single ended 6V6G output stage and minor differences in valve types. Specialist components would have been imported from America.

I have no details of the cabinet, but it is likely that a locally made console was used. The description of the controller applies to both the American and Australian versions.

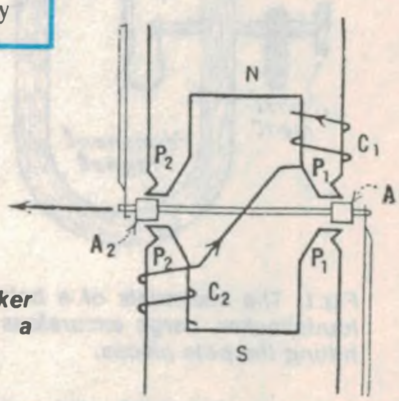
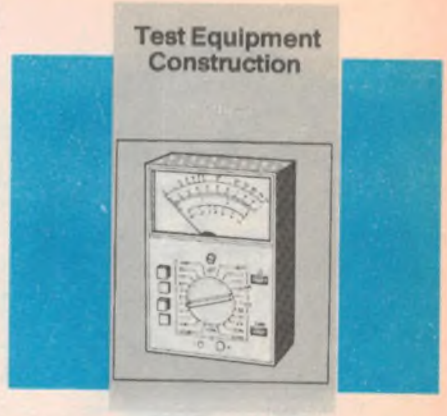


Fig.2: The 'inductor' type speaker drove the armature with a fore-and-aft motion.



Building test gear

TEST EQUIPMENT CONSTRUCTION, by R.A. Penfold. Published by Bernard Babani, 1989. Soft covers, 178 x 112mm, 104 pages. ISBN 0-85934-193-3. Recommended retail price $11.

Another release in the attractively priced Babani imprint, and yet another title written by well-known technical author Robert Penfold. The man must have written more books and articles than anyone over there, I suspect – he must be at it day and night!

In this latest book he describes some 10 different items of simple test equipment for the home constructor and electronics student. There's an audio oscillator, a bench amplifier, an audio millivoltmeter, a high resistance electronic voltmeter, a transistor tester, a capacitance meter, an audio frequency meter, an analog 'voltmeter' probe, and both CMOS and TTL logic probes.

The designs are all quite straightforward, and use ICs and transistors which should be just as readily obtainable here as they are in the UK. The author explains circuit operation quite well, making the designs educational as well as useful.

All circuits are assembled on Veroboard, rather than PC boards, which although a little messier does at least obviate any PCB supply problems. To make it easier there are diagrams showing the layout and track cutting locations, as well as diagrams showing the wiring of switches and other off-board items.

Overall it seems a very practical little book, with enough information to enable both the newcomer and more experienced hobbyist to build up a handy collection of simple test gear.

The review copy came from Federal Marketing, which is offering the book directly to readers of *EA* via mail order – see the advertisement elsewhere in this issue. (J.R.)

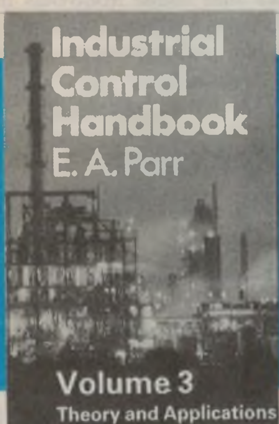
Books & Literature

Control theory

INDUSTRIAL CONTROL HANDBOOK, Volume 3, by E.A. Parr. Published by BSP Professional Books, 1989. Hard covers, 240 x 160mm, 400 pages. ISBN 0-632-01859-3. Recommended retail price $160.

This is the third and final volume in a series on industrial control, for engineers and technicians. Volume 1 dealt with transducers, while Volume 2 dealt with the various main techniques and equipment such as DC amplifiers, rotating machines, display devices and data loggers. This one follows up with the background theory, plus a look at some typical applications.

Topics covered include analytical methods and system modelling, stability, controllers, complex systems, and



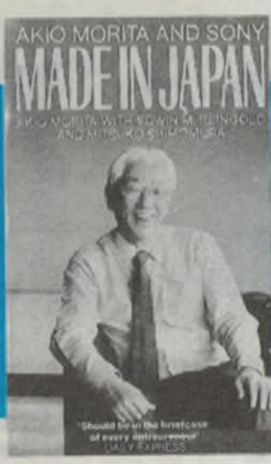
the transmission of signals, data and noise. The applications at the end cover a steel works, a chemical plant and a power system.

The author has been an electrical engineer at Sheerness Steel in the UK for seven years, and has also written some six other books. His aim here has been to present control theory in a more practical, readable manner than it is presented in many texts, linking it to real-world applications as much as possible in order to increase its accessibility and value to working engineers.

From my examination, it appears very much as if the author has achieved his aim. He starts right from the beginning in terms of basic control concepts, and gives many practical examples and illustrations to flesh out the theory. As a result it would seem not only an excellent reference for practising engineers and technicians, but also a readable and helpful reference text for engineering students.

I suppose the only problem for this latter group – and perhaps the former group as well – is the price. At a solid $160 it isn't exactly a bargain, even by today's standards. Sadly many would-be readers may well have to wait until it's acquired by their local college library, or hopefully a soft cover version is released.

The review copy came from distributor Blackwell Scientific Publications, of 107 Barry Street, Carlton 3053, which can no doubt assist in the event of any supply difficulties. (J.R.)



Sony insights

MADE IN JAPAN: Akio Morita and Japan, by Akio Morita with Edwin M. Reingold and Mitsuko Shimomura. Published by Fontana/Collins, 1987. Soft covers, 178 x 107mm, 309 pages. ISBN 0-00-637234-1. Recommended retail price $10.95.

I remember meeting Sony's co-founder and current chairman Akio Morita quite a few years ago, when he visited Australia – I think it was for the launch of Sony Australia. He struck me even then as a most impressive man, disarmingly frank and much more outgoing than any Japanese businessman I'd ever met by that stage (or since, as it happens). In fact he seemed to be Japan's direct equivalent to National Semiconductor's famous president Charlie Sporck, with the same drive, enthusiasm, flamboyance and even the same habit of smoking large Havana cigars.

Since then my respect has continued to grow, not only for the man himself but for the way he has almost unerringly guided Sony from success to success – generally two steps ahead of the competition in terms of technological innovation, even in Japan. That's no mean feat.

So I have to confess to being a long-time admirer of both Morita and Sony. But even so, it wasn't until I read this book that I realised how little I knew about either. And having now read it, I'm much more impressed again.

Ostensibly, it's Morita's autobiography. But in fact it's much more than that: the story of Sony's origin, its development, its philosophy in R&D and business, its successes and occasional failures. It's also remarkable for giving an insight into the way the Japanese electronics industry works, and how it compares with 'Western' industry.

But Morita is no ordinary Japanese businessman, of course, and that's why Sony has had a global impact far larger than its modest absolute size (in Japanese terms). By any yardstick, he must be ranked as one of the most outstanding entrepreneurs of this half of the century, with exceptional vision, intuition and management skill. And a lot of his personal insights and philosophy are conveyed in this book, lifting it well above the usual run of 'how Japan works' books or normal biographies of successful business people.

In short, it was one of the most rewarding books I've read for some time. If like me you enjoy trying to learn what makes a really brilliant entrepreneur 'tick', I can thoroughly recommend it. (J.R.)

SPECTRUM

Communications News & Comment

Conducted by
DAVID FLYNN

Mobile data system growing

Mobitex, the UHF digital mobile data system designed and marketed by Ericsson, continues to move towards becoming a *de facto* world standard, with recent contracts being awarded for networks in the USA, Canada and the UK.

Industry observers believe that mobile data is set to become a major growth area in telecommunications, with widespread applications in any fleet situation – emergency services, transport, taxi and courier companies are typical Mobitex users.

Through a cellular-like infrastructure of multiple base sites and digital exchanges, Mobitex uses packet data transmission which is not only extremely efficient for the short duration of most messages, but also can give each terminal mailbox facilities and allow for retransmission of a message if undelivered.

Mobitex commenced service in Sweden in 1986, with Scandanavian neighbours Norway and Finland soon following. Now Canada has decided to use Mobitex as the basis of a new network covering all major centres, and a $55m order has been placed for a similar American venture. The UK has also established a Mobitex network at 440MHz, which will begin as a closed user group service but may later offer public access.

Thin-film batteries?

Although the increasing use of ICs, surface-mount componentry and advanced construction techniques have shrunk most handheld transceivers to a true 'pocket size', an eternally-limiting factor is the size of the battery pack – which now tends to equal, if not exceed the transceiver itself.

But a solution may be close to hand, with the development of 'thin-film' batteries based on electrolytes made from solid conductive polymers, instead of conventional liquid electrolytes.

Moltech, the American company behind the development, claims that polymer batteries would have numerous advantages both in size and longevity.

Their predictions are that polymer batteries would lose only 1% of their power capacity every month, compared to a maximum figure of 30% for conventional cells.

Icom's new flagship communications receiver, the R-9000. It offers continuous reception from 100kHz to no less than 2GHz, and with almost every conceivable feature including multiple reception modes, digital tuning, scanning and spectrum analyser display.

And with a predicted 10-year shelf life, the batteries could even outlast most of the devices they power.

The cells would be manufactured in polymer sheets according to Moltech, which can be divided into small squares for low-drain devices such as calculators or watches or rolled up to provide greater capacity – yet still weigh only one-fifth as much as current batteries.

DXers guide to computing

Edition 3.0 of the popular *DXers Guide To Computing* is now available from Radio Sweden, and should prove of great interest to anyone interested in the many possibilities of using a PC in the radio shack.

Many radio hobbyists, from SWLs and amateurs through to CBers and scanner users, have discovered the usefulness of a personal computer. A recent survey by Australia's *CB Action* magazine showed that some 30% of their readers owned a PC, which compares well to overseas estimates of 60% in the UK, 55% in North America, and only 23% in Japan.

Noting this trend, Radio Sweden released their first *DXers Guide To Computing* in 1986, with details on various commercial and public domain programs for communications, receiver interfaces, details on bulletin boards and other areas of interest.

The latest update of the guide costs 7 IRCs, and can be obtained by writing to Radio Sweden, S-105 10, Stockholm, Sweden.

A number of useful program utilities for SWLs and radio hobbyists are also available from Sydney's 'Shortwave Possums' public bulletin board, on (02) 651 3055 – parameters are *-N-1, with speeds from 300 to 2400 baud.

OTC sponsors comms exhibition

OTC Australia will sponsor a $500,000 communications exhibition at Canberra's National Science and Technology Centre, due to open next year.

The exhibition will consist of interactive displays through which visitors can experience and appreciate the day-to-day role and future of communications.

The sponsorship was announced by the Minister for Telecomunications and Aviation Support, Ros Kelly, who said it was appropriate that OTC, "a high-tech international organisation with long term plans taking it into the next century", should assist Australians in understanding the many changes taking place in world communications.

The display will show how communications fits into and shapes our lives, with models and simulations covering many individual applications of the spectrum. Telecommunications of the future – videotelephone and optical fibre among them – will be major areas of public interest.

Other key isues will be the basis of

communications itself – language – and the impact of language and culture on our ability to communicate over long distances.

'Green' approach has benefits

One of the less-publicised aspects of the recent 'green' trend towards environmental consciousness, especially on a local level, is a new consideration of the aesthetics of communications towers.

Perhaps the future will see retired engineers reminiscing about the good old days, when the siting and construction of towers and antenna masts was a matter for themselves and a few government bureaucrats. For the current scene is quite different, with community groups, environmental impact statements, lobbyists, local councils and never-ending consultation being the order of the day.

One service which seems to have gone through all the hoops is the UHF TV relay facility at Forresters Beach, on the NSW central coast. The translator was officially opened in October and provides an estimated 90,000 homes with six television services on UHF (Sydney's three commercial networks, NBN-TV Newcastle, SBS and the ABC).

The blame for the three-year delay it suffered before becoming operational may be argued into anyone's court, but the resulting tower indicates a future direction for relay sites, which will become more numerous as the Band II clearance and 'equalisation' programs develop.

The Forresters Beach tower has been designed along the lines of a small lighthouse – cylindrical in shape, with white steel sheets replacing the bare angular lattice construction used in similar towers. And with the UHF antenna panels being so compact the structure could probably pass for a lighthouse, except for the microwave dish and VHF yagis used to feed the station with off-air signals.

But most impressive is the approach used to house the transmitters themselves. Rather than erect a small brick hut at the foot of the tower and then surround the whole enclosure by wire mesh, the equipment dwells in a 'bunker' built into the incline of the site itself. Not only is this far more pleasing to the eye (especially since the bunker is built from sand-coloured brick instead of the traditional red brick), but the roof of the hut has been paved and now serves as an excellent tourist look-out – offering attractive coastal views southwards along Wamberal, Terrigal and Copacabana.

Television takes up ACS

Ancillary Communications Services, formerly considered the domain of broadcast radio stations, are now moving into the television industry.

Australia's first TV 'datacasts' will be seen through the ABC, using financial information from the Australian Stock Exchange via their agent, Citibank.

Other television networks are also said to be considering the datacast option, which uses the vertical blanking interval of the TV signal to piggy-back additional data channels onto the carrier. These signals are then decoded to provide information for the public, as is the case with Austext, or for private groups, who hire decoders from the service provider.

The ABC intends the ASX info to be the first of up to six possible services which they can offer on either a statewide or national basis, which could earn the ABC up to $10m in the first five years of operation. Service providers will be charged $100,000 per year for access to a single ACS datacast channel.

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Construction Projects

Hifi Reviews

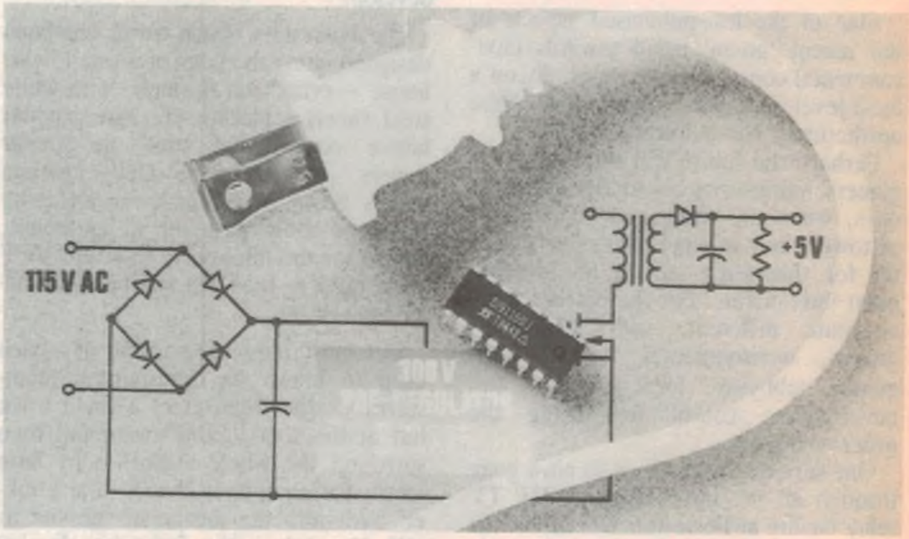
Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Switchmode controller

To accommodate off-line applications, Siliconix has expanded its popular Si91XX family of SMARTPOWER CMOS switchmode ICs to include the Si9115 and Si9116 – increasing the input voltage range to 300V.

Designed for reliable, high performance from 5 to 250W, the new controllers operate from rectified, filtered AC power lines. Unlike their bipolar counterparts, which are limited to 60V input capability, these high-voltage CMOS ICs allow a reduction in parts and greater reliability in high-performance DC-to-DC converter applications, such as medical equipment, instrumentation, military systems and oil well logging equipment.



In most applications the need for an external resistor and capacitor is eliminated and, in many cases, the step-down transformer and linear regulator are also eliminated.

The Si9115 and Si9116 include high-voltage start-up circuitry, and oscillator, an error amplifier and a voltage reference. The Si9115, ideal in the 1 to 50W range, includes an inverted output which directly drives an external MOSFET. The Si9116, which includes a non-inverted output is designed to use with an external driver (such as the Si9950DY half-bridge) to drive a large power MOSFET, and is aimed for 150 to 250W applications. In these high-power circuits, the fast current-limiting delay of the Si9116, typically 100n, provides improved short-circuit protection over equivalent bipolar controllers.

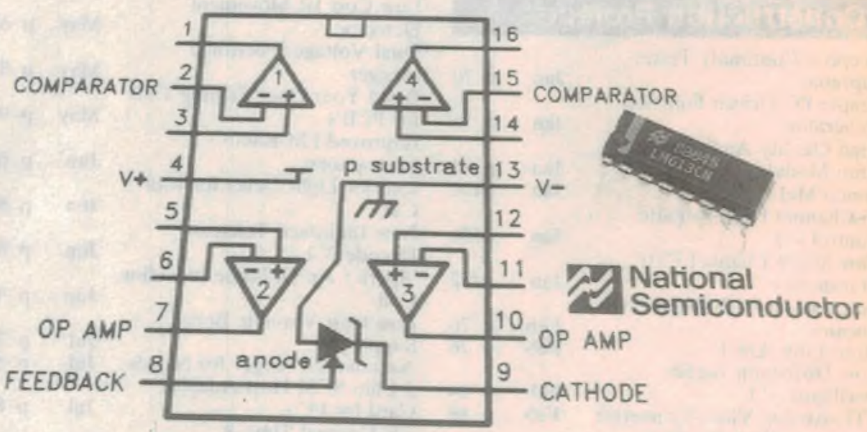
Further information from Anitech, 1-5 Carter Street, Lidcombe 2141 or phone (02) 748 1711.

High-performance op-amp/comparator

The LM613 is a member of National Semiconductor's new Super-Block family of high performance analog IC's. It combines dual operational amplifiers, dual comparators and an adjustable reference on a single chip.

The dual op-amps in the LM613 are like the LM324 series, but with improved slew rate, wide power bandwidth, reduced crossover distortion and low input current for large differential input voltages and swings of +/-36V. The voltage reference has an accuracy of +/-0.4% and temperature coefficient drift of +/-20ppm/°C.

Further information is available from National Distributors or phone (03) 267 5000.



Fast 12-bit A-D converter

The Micro MN674A (15us max conversion time) is a faster version of the standard 574A microprocessor-interfaced, 12-bit A to D converter. It is a complete, successive-approximation A/D with internal buried-zener reference (+10V), clock, and control logic.

The MN674A is packaged in a 28-pin DIP and contains all the interface logic necessary to directly mate to most popular 8 and 16-bit microprocessors. The 3-state output buffer connects directly to the uP's data bus, and can be read either as one 12-bit word or as two 8-bit bytes. Chip select, chip enable, address encode (short cycle), and read/write (read/convert) control inputs enable MN674A to connect directly to system address bus and control lines and operate totally under processor control.

MN674A's combination of bipolar and CMOS technologies is said to represent the latest advances in 574A/674A evolution. At 450mW max, power consumption is almost half that of competing devices.

For application engineering information contact Priority Electronics at Suite 7, 23-25 Melrose Street, Sandringham 3191 or phone (03) 521 0266.

Current-controlled 6-18GHz attenuator

Narda has introduced a 6 to 18GHz current-controlled attenuator/modulator which provides a 3:1 bandwidth of operation.

Model 4806-40 VVA provides a 40dB minimum attenuation, with rise and fall times of 50ns maximum. Laser welded and hermetically sealed, it is equipped with removable SMA connectors for drop-in applications and satisfies the leak rate specifications of MIL-STD-883.

Applications for Model 4806-40 include amplitude or pulse modulation, level setting, and high speed switching.

For further information contact Anitech, 1-5 Carter Street, Lidcombe 2141 or phone (02) 648 4088.

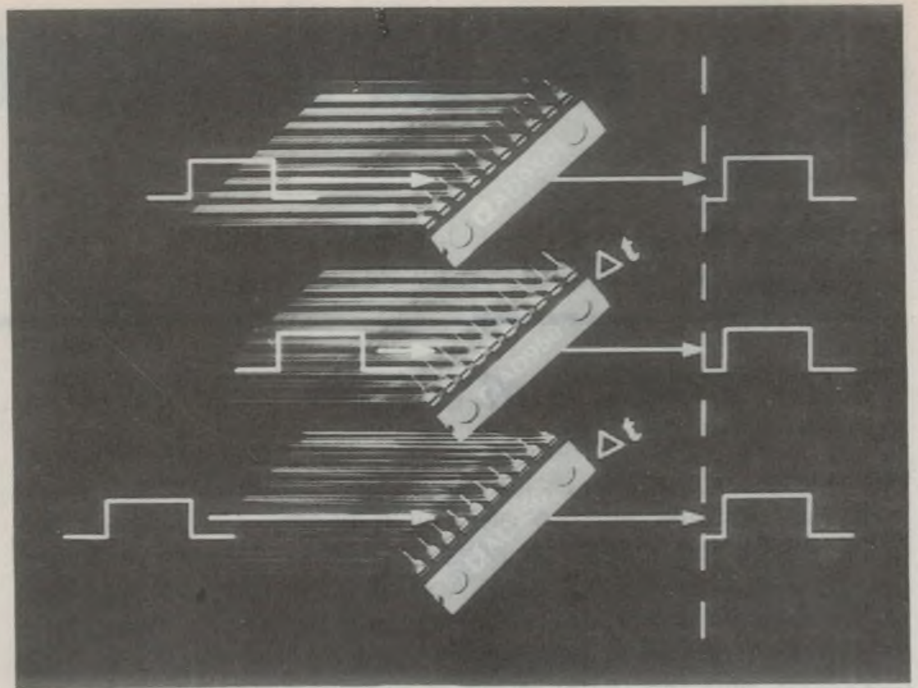
Echo cancelling DSP chip

SGS-Thomson has introduced a new device to provide a solution to the problem of echo cancelling. The DSP chip TS75320CP is well suited for high performance low cost integrated V32 modems.

The principal operation of the TS75320CP is the determination, by means of adaptive algorithms, of the coefficients of digital filters and phasing processors that will generate a (modem) receiver input free of near and far and echoes.

Features of the device include near end cancellation greater than 55dB. The far end echo channel delay can be as long as 1.14s and the hardware and firmware have been designed for ease of interface with a general purpose DSP or microprocessor.

For more information contact Promark Electronics (Australia), 104 Reserve Road, Artarmon 2064 or phone (02) 439 6477.



Programmable delay generator

Programmed with an 8-bit code, Analog Devices' AD9501 delay generator provides precise time delays of digital pulse edges. A TTL/CMOS-compatible alternative to existing ECL-compatible components which require ECL-to-TTL level shifting circuitry, the AD9501 needs just a single +5V supply. (For ECL designs, the similar but faster AD9500 is available.)

With a full-scale range of 2.5ns to 10us – with 10ps resolution – this monolithic device is designed for pulse deskewing and clock timing adjustments. Applications include automatic test equipment (ATE), disk drive, data communications, video, and radar applications.

Featuring trigger rates of up to 50MHz, this IC is suitable for both high and low-speed designs. The full-scale delay range is established simply by a user-supplied external resistor and capacitor; the delay value in that range is then precisely set by a single byte. For a full-scale range of 2.5ns, the incremental timing delay can be set to 10-ps resolution. Triggered by the rising edge of an input pulse, the AD9501 output is a pulse edge that is delayed and then retransmitted by the set time delay (plus short internal propagation delay).

For further information, contact Avisun, 11-15 Alexander Street, Crows Nest 2065 or phone (02) 438 3900.

Triac optocoupler has 2A rating

Siemens has expanded its range of triac optocouplers with the IL-428. With a 2A rating, the new coupler can directly switch almost 10 times as much current as conventional devices of this type. The IL-428's novel single inline package (SIP) also requires no additional cooling when operated at 2A and a maximum of 55°C.

With its high current capacity, the IL-428 is expected to help electronics gain increased application in AC-powered load-switching equipment, and replace more and more mechanical parts.

The IL-428 consists of a GaAs infrared LED optically coupled to phototriac without a zero voltage switch. The chips are housed in a 4-pin SIP power package measuring only 23 x 20 x 5mm.

The phototriac's sensitivity is so high that very low currents of less than 8mA (typically 4mA) are sufficient to switch a maximum of 2A efficiently. The 600V repetitive peak forward off state voltage permits operation at 230V AC power systems with a safety factor better than two. Additional features include the ability to handle dV/dt ratios as high as 10,000V/microsecond and to withstand a 7.5kV insulation test voltage.

For further details contact The Communications Equipment Department of Siemens, 544 Church Street, Richmond 3121 or phone (03) 420 7314.

Information centre

Conducted by Peter Phillips

Tesla, Dolby and others

There have been numerous topics that have mushroomed within these columns, including the greenhouse effect, plant watering systems and so on. But it seems Tesla takes the cake, and I now have two piles of letters – those on Tesla, and those on everything else. And all from a simple question: 'Who invented radio?' The 'everything else' pile includes a dissertation on noise reduction techniques employed in tape recorders, plus the usual round of enquiries and answers.

Letters are also still arriving to give assistance to those reader questions I posed in the August edition. For example, there's the letter from D.C. of Katoomba (NSW), who suggests that a suitable way to measure humidity is with a human hair. This is in response to B.S. of Bungendore, who asked for help in regard to an automatic misting system for his greenhouse.

The main point made by D.C. is that the best hair for use in this application is one from a female human who is a natural blonde. Forget those whose blonding is 'assisted', it ruins the hygroscopic (expansion in length when moist) properties of the hair. He also suggests a solenoid valve from an old washing machine, to control the water flow, and a brass hose nozzle screwed almost shut as the atomiser. A budget priced misting system, providing you can find a natural blonde!

But the main topic, as I've already mentioned, is Tesla. I'll have to keep it short, as space is limited, and we have already explored the topic of who invented radio last month.

Nikola Tesla

The question 'Who invented radio?', posed by a correspondent in the August edition, has generated an amazing amount of mail. I presented some of these last month, but the letters are still coming in, mainly in support of Nikola Tesla.

It seems Tesla is regarded by many readers as the unsung hero of electrotechnology. I have to agree, and during my teaching career, I often showed a video of Tesla's life, from a film broadcast some years ago on the SBS network.

Some of the letters have given suggestions regarding the title of the book about Tesla I mentioned as 'having a lingering memory of.' Correspondent P.H. from Broadbeach (Qld) suggests it could be either *The Prodigal Genius*, by John O'Neill, or *The Man Who Invented the 20th Century*, author's name unknown. Another writer, M.B. of Frankston (Vic), suggests it might be *Nikola Tesla – A Man Out of Time*. Another correspondent (B.R. from Melbourne) makes reference to *My Inventions – Nikola Tesla*, although not suggesting it may the book I referred to.

But the thrust of all the letters is pro-Tesla, anti-Marconi. In fact, B.R. writes 'In 1943, the United States Supreme Court voided Marconi's fundamental US wireless patent because of prior work by Nikola Tesla, Oliver Lodge and John Stone.'

More in context with the original question is a letter giving a sequence of events on the development of radio. Here's the letter, which you might like to compare with a similar letter published last month:

In reply to a query in EA August 1989, about who invented radio, I offer the following:
1845: Michael Faraday described his theory of the relationship between light and electromagnetic lines of force. 1862: Maxwell presented a mathematical basis for the theory that light waves are electromagnetic in nature. 1879: Hughes noted that when an electric spark was produced anywhere in his house, he heard a noise in his telephone receiver. 1882: Dolbear used a spark coil for generating waves and a mass of carbon granules for detecting them. 1888: Hertz and Lodge used a spark coil for generating waves and a slotted ring of wire for detecting them. 1892: Tesla demonstrated the first electronic tube designed for use as a detector in a radio system. 1897: On the 2/9/1897, Tesla was issued US patents 645,576 and 649,621 for a tuned transmitter and tuned receiver. (A.L., Carrum Downs Vic)

Interesting, don't you think, that Marconi's name is not even mentioned in the above letter? Correspondent B.R. suggests it is time *EA* presented an article on Tesla, and from the correspondence I have received, I must agree.

(*Editor's Note: We published a three-part series on Tesla in the issues for September-November 1983. Photocopies of the series are available via the Reader Information Service, for $10.)*

That original and apparently simple question certainly created a lot of interest. And while on the subject of radio...

UHF transmitter

I have been advised by Oatley Electronics of an erratum to solve a rather obscure problem with the single-channel UHF transmitter design published in January, 1989.

It seems some users have been experiencing an apparent lack of reliability with the unit, particularly in long bouts of wet weather. This also explains why this problem has not come to the attention of the designers until fairly recently – that is, not until the wet spell Sydney experienced during the winter months.

The problem is caused by leakage between pins of the trinary encoder IC, across the case, no less. The result is the transmission of an incorrect code, and then only occasionally. The solution is to connect a 1M resistor across the power supply to this IC, at pins 16 and 8. This resistor provides a path to earth when the pushbutton is released, and prevents the leakage across the case from affecting the operation of the IC. That's CMOS for you!

Dolby A, B and C

A question was aired in the August issue concerning the differences in the Dolby A, B and C noise reduction systems. The following extract is from a letter I have received, in which the correspondent provides a most succinct and authoritative explanation:

There are two main types of audio companders (compression – expansion units), these being the frequency dependent types such as Dolby and JVC's ANRS and the frequency independent types such as dbx, ADRES (Toshiba) and HICOM (Telefunken, Nakamichi).

Both systems are based around the fact that the dynamic range available from a cassette tape is in most cases less than the dynamic range of the music to be recorded. This means the quietest sections get lost in random tape noise (hiss) while the loudest peaks get flattened due to saturation of the magnetic particles. The dbx (dynamic band expansion) system combats both problems and one can expect around a 110dB signal to noise ratio (S/N) from this system.

This system works by expanding those signals below the 0dB reference point and compressing signals above the reference point. On playback, the signals are processed in the reverse way, in which signals below the reference point are compressed, reducing tape hiss into the bargain, and signals above the reference point are expanded. The other frequency independent systems work in a similar manner.

The Dolby A, B and C systems (developed by Ray Dolby in the USA) and JVC's ANRS system are both frequency dependent and have a degree of compatibility, despite their technical differences.

Dolby A is used with studio/professional gear, and is not available on domestic equipment. Dolby B is the usual system employed on almost all tape decks and on pre-recorded tapes. Some up-market models use Dolby C and/or Dolby HX.

Like dbx, the Dolby system is a compander system designed to keep the audio signals below the tape saturation ceiling, but above the noise floor level, and then to fully restore the signal with decoding on playback. However, the Dolby system compands according to the frequency and level of the signal, whereas dbx operates on all frequencies equally.

With Dolby B, during recording, the signals above about 2.5kHz are boosted by 10dB. Signals below 250Hz are left unchanged and frequencies in between are amplified along a slope between the two points. The higher the frequency, the more boost, with 10dB at 2.5kHz being the maximum. On playback, without decoding, the effect is similar to having the treble boost set too high.

The amount of 'compansion' is also dependent on the signal level. A +10dB signal receives no compansion, while a –50dB signal will receive the full 10dB kick. The term 'magic –60dB S/N ratio' used by various companies in the 70's came from these figures. Today's tape formulations allow even better specifications, in which the 0dB reference corresponds to the tape magnetism from a 200Wb/m field.

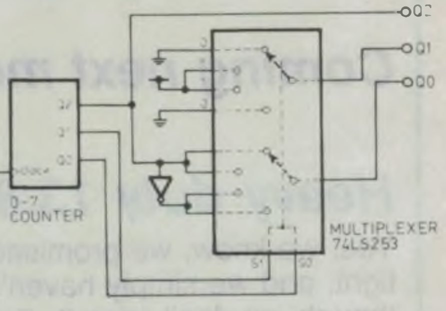
Dolby C is essentially two cascaded Dolby B circuits in which the first section is almost identical to a Dolby B system. The second stage is known as the 'low level stage' because it only acts on signals at least 20dB less than the level at which the first stage applies full compansion. Basically, stage one gives a 10dB compansion to signals in the –15dB to –35dB range (with respect to 0dB), and the second stage gives an extra 10dB to signals in the –35dB to –55dB range, giving an overall 20dB action on low level signals.

While Dolby B starts working at 250Hz and increases to a maximum of 10dB at around 3.5kHz, Dolby C starts at the lower frequency of 100Hz, and gives the full effect of 20dB at about 2kHz. However, whereas the top end frequency response is flat, (linear) for Dolby B, Dolby C has a high frequency roll-off above 10kHz, such that only 10dB of drive is performed at 15kHz, the same as Dolby B. To compensate for this droop, top-end boost is applied on playback. This would seem to defeat the purpose, and in fact it does produce more residual noise at high frequencies, but it sounds as though it is less, due to the nature of human hearing.

The Dolby A system is similar to Dolby B, except it acts on the entire frequency spectrum. This system is used on master tapes in sound studios. The Dolby HX Pro (headroom extension professional) system uses the previously mentioned stages, but adjusts the record head bias according to the level of high

What??

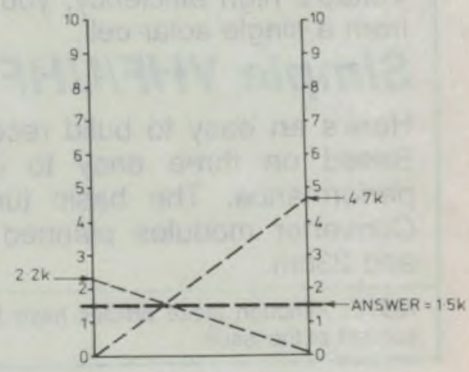
We've never had a digital question, and I thought this little circuit might prove interesting. It is one that I developed for a need, but since solved another way, leaving a beaut little circuit with nowhere to go. The circuit has a 0 to 7 counter connected to a dual, 4 bit multiplexer. To make things a bit simpler, I've drawn the equivalent internals of the multiplexer, which shows two, single-pole four position switches. The position of each switch is determined by the code applied to the select inputs, S0 and S1. S0 is the least significant bit, and the switches are shown for a position code of 00. The counter has Q0 as the least significant bit.



The question is, assuming the input code is BCD, from 000 to 111, determine the output code and the name generally applied to this type of code.

Answer to last month's What??

The answer to last month's teaser is 1.5k, as anyone with a calculator can verify. More to the point is how to use the nomogram. The diagram shows this fairly clearly, in which each scale is assumed to represent the decade encompassing 1k to 10k. Note that both sides must be for the same decade. The point of intersection for lines representing both resistors (2.2k and 4.7k in the example) is the parallel combination of the pair. Neat one, eh!



frequency content in the audio signal. This greatly reduces intermodulation distortion and does not need decoding (the HX section only) since the bias is only a function of recording.

Dolby B can often be played back without any decoding, perhaps with treble cut, and Dolby C can achieve 'acceptable' results if decoded on playback with a Dolby B system. The dbx system suffers a 'breathing' effect without suitable decoding, but does have the edge when it comes to performance. Ultimately, the user has to make the choice as to which system is best for their needs. Then again, there's always VHS HiFi, DAT, recordable CDs or – who knows what's next.

Thanks to S.McB. of Townsville, Qld for this informative summary of the operation of these systems.

Pager problems

The next question is unusual, and one that probably quite a few hand held pager users may have asked. Here's the letter first:

I have an alpha-numeric display pager, which I use in my work – which involves travelling all over Northern NSW. However, the pager does not always pick up a page, in places like Walcha, Armidale and Taree, although it's set up to receive in these areas.

I would like to know if it is possible to make a small device to pick up the signal, with say an antenna operating into an RF amplifier that is then coupled inductively to the pager. In other words, I could then sit the pager next to a coil being driven from the RF amp, and hopefully improve the performance as a result of the extra amplification. (A.H., Hamilton NSW)

Pagers are one of those technological innovations that seem to be understood by very few. However, I have been able to obtain the following information.

First, it seems Telecom would like to know of any difficulties users experience with pagers. According to my source of information, Telecom is anxious to perfect their network and any communications problems should be passed on, so that they can rectify (if possible) any gaps in the network.

The idea of inductively coupling an external aerial into a pager is apparently not new, and I have been advised that others have attempted this, with little success. Apparently, the increased gain causes instability and other problems. So, while the idea is fundamentally sound, it has practical problems associated with the peculiar design of electronic pagers. Sorry B.H., it seems Telecom may be the only answer.

TV picture tube

While these pages are not normally intended as a wanted column, perhaps someone may be able to help our next correspondent. It seems he has the TV set, all he needs now is the tube to go with it:

I have recently purchased a mint condition Philips K11 colour TV set from a local serviceman. Unfortunately, the tube is faulty, and because of a crack in the neck, cannot be exchanged for a re-gunned tube. The tube is an in-line type, number A66-500X. Apparently these tubes are fairly rare. If anyone can help me, I would be most appreciative. (J. Commisso, PO Box 14, Lemnos, Vic, 3631)

NOTES & ERRATA

TIMER/CONTROLLER FOR GARDEN SPRINKLERS (October 1989): The parts list and schematic show voltage regulator VR1 incorrectly as a 7815. It should be a 7812, as described in the text.

Coming next month in Electronics Australia

Heavy duty 13.8V/25A power supply for mobiles

Yes, we know, we promised this project a couple of months ago. But space has been very tight, and we simply haven't been able to fit it in yet! It has top priority now for next month, though, so don't miss it. Easy to build, it will deliver no less than 25 AMPS continuously – and will cost you much less than a comparable commercial supply.

High efficiency 1.5V/9V converter

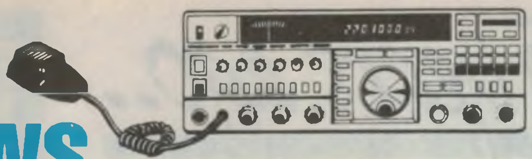
Like to cut the cost of running electronic gear which operates from a 9V battery? It's easy with our Voltup project, which lets you operate from a 'D' size 1.5V cell instead. Thanks to Voltup's high efficiency, you can get many times the battery life – or even run your gear from a single solar cell.

Simple VHF/UHF FM receiver

Here's an easy to build receiver for the VHF and UHF amateur bands, in modular form. Based on three easy to get ICs, it uses double conversion to provide impressive performance. The basic tuning range is 50-54MHz, to cover the full 6 metre band. Converter modules planned for the future will extend its coverage to 2 metres, 70cm and 23cm.

NOTE: Although these articles have been, or are being prepared for publication, circumstances may change the final content of the issue.

Amateur Radio News



Gosford Field Day

Next year's Gosford Field Day, traditionally the country's largest gathering of amateur radio and electronics enthusiasts, will be held at the Gosford Showground on Sunday 18th February 1990. More than 1400 people attended the last Field Day, and this time the attendance is expected to be even higher.

The tradition of the Gosford Field Day began in the early days of radio experimentation, to provide a meeting place where enthusiasts and hobbyists could trade both ideas and equipment.

At the 1932 Gosford Field Day, 150 people sat down to a hot dinner at VK2OC's house in Toowoon Bay. (Courtesy CCARC, Inc.)

The first field days were organised in the 1930's by four amateurs from neighbouring Wyong: Phil Levenspiel VK2TX, Geoff Warner VK2CK, Jeff Thompson VK2XP and Owen Chapman VK2OC. In 1931 the highlight of the event was a cricket match held on Wyong Race Course, while at the 1932 event some 150 people sat down to a hot dinner at VK2OC's house in Toowoon Bay. Fox hunts on 40m were a feature of both events.

The 1990 field day is planned to include lectures and seminars on technical subjects, trade displays, disposals stands and a flea market, a home brew contest, a display of vintage radio equipment and bus tours to the nearby Ferneries.

There will be plenty of off-street parking at the Gosford Showground. A courtesy bus will also convey passengers between the Showground and Gosford Railway Station. Tea, coffee and biscuits will be available at no charge between 8am and 3pm, and take-away food will also be on sale.

Further information on the field day is available from the Central Coast Amateur Radio Club, Inc., PO Box 252, Gosford 2250 or phone (043) 92 2244 (after hours only).

Aeronautical tests on 23cm

On September 13, members of LADARC and RAG carried out aeronautical tests on 23cm, using Rockwell Commander aircraft VH-MNZ flying from Sydney to Wollongong. The aircraft was fitted with a vertical co-linear antenna, coupled to a Yaesu FT2311R transceiver.

Pilot Bob Clark, VK2YOD was accompanied by Garry VK2QQ, Jim VK4ZML (who travelled down from Brisbane for the event) and observer Richard. They logged contacts with Steve VK2KSR, Brad VK2ZBG, Ross VK2ZRU, Dick VK2BDN, Allan VK2AXA and Julie VK2XBR, with 5x9 signals while travelling at 300kph (165kts).

Signals were excellent until the aircraft descended below the escarpment and overflew Wollongong, when signals from Sydney became noisy. No significant changes in antenna SWR were observed due to wind loading.

The joint exercise lasted 1.5 hours. The two clubs have been aligned for several years, to aid and promote technical development.

Operation when visiting New Zealand

The New Zealand Radio Frequency Service, NZ equivalent of Australia's DoTC, has just issued a policy statement regarding short-term amateur visitors to that country – and it amounts to good news for amateurs planning a visit.

In future, providing the visiting amateur is the holder of a current amateur licence issued by their own country's administration, and has a copy of their current licence with them, they may use VHF/UHF handheld transceivers on frequencies of 144MHz and above without applying to NZRFS. For operation over a period of no longer than four weeks, no fee will be payable; however usage of the transceiver must conform with the NZ Radio Regulations 1987, and the general terms and conditions shown on the amateur licence schedule. The visiting amateur must use their home callsign, suffixed by ZL1, 2, 3, 4 or 5 as appropriate.

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.

RADIO, TELEVISION and HOBBIES

December 1964

Ultrasonic Measuring: A British developed ultrasonic technique can be used to measure the level of liquid in a sealed container, or to constantly record the rise and fall of the tide.

The concept is simple. An ultrasonic pulse – a pencil of 'silent sound' at a frequency (150kc) many times higher than the human ear can accept – is projected into the container. The pulse is reflected from the surface of the liquid, and the time interval between transmission of the pulse and reception of the echo is measured by an all-transistor circuit, which is claimed to give an accuracy of 99.8%.

Tiros Anniversary: TIROS 1, the world's first meteorological satellite, recently celebrated its fourth anniversary. Launched on April 1, 1960, TIROS was the first spacecraft to transmit a television picture from space. Since then, seven additional TIROS satellites have been successfully orbited. All eight have worked in space and have met or exceeded their mission requirements.

During their time in space, the eight satellites, orbiting the earth at 17,000 miles an hour, have televised more than 330,000 pictures of weather events around the globe.

RADIO AND HOBBIES IN AUSTRALIA

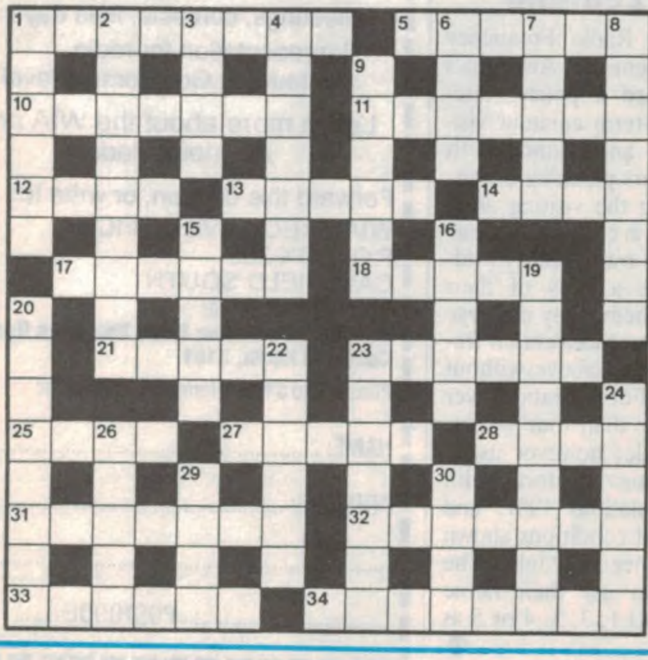
December 1939

New Speakers in Action at USA World Fair: One of the features of the New York and San Francisco World Fairs was the elaborate sound system in use. In every part of the grounds, loudspeakers did their part in informing and instructing visitors.

Mounted atop the Railroad Building at the New York Fair was a 60" Langevin (Western Electric) loudspeaker, consisting of a co-axial combination of a high frequency multi-cellular horn unit with permanent magnet driver, plus a re-entrant low frequency horn with a 15" electrodynamic driver and a mouth area of 5 feet on each side.

A similar 31" unit was used backstage in the 'Railroads on Parade' exhibit used a WE type 551-W HF unit with multi-cellular horn, and a low frequency horn driven by an 18" Jensen dynamic speaker.

EA Crossword



Across

1. Juxtaposition of wiring of two electrical systems. (8)
5. Things for storing wire. (6)
10. Device for facilitating connections. (7)
11. Said of wire on an armature. (7)
12. Four-core wire could be called two ----. (4)
13. Size of wire. (5)
14. Controlling unit in a live cell. (4)
17. Type of wire format: ----eight. (6)
18. Reference level, the ---- plane. (5)
21. Wire to ground. (5)
23. Such is the adequacy of a minimally stripped wire. (6)
25. Solder wires lightly or temporarily. (4)
27. Device with the wire of 11 across. (5)
28. Specialised wired connection for a musical instrument. (4)
31. Constant-value region of an electronic device's characteristics. (7)
32. A failure to read a bit. (4-3)
33. Part of a typical wire of the 19-down kind. (6)
34. Professional expert in electronics, etc. (8)

Down

1. Devices for securing wires. (6)
2. The radioactive ore, pitchblende. (9)
3. To avoid the skin effect, multistrand ----wire is used. (4)
4. Circuit item responding to low inputs. (3,4)
6. Male connectors. (4)
7. Type of compound to which quartz belongs. (5)
8. Insulated elements of a commutator. (8)
9. Pressed a wire fitting. (6)
15. Prefix signifying copper. (5)
16. Occasion when 27 uses more current. (5)
19. Said of wire with several conductors. (9)
20. Varieties of an atom (8)
22. Type of wire commonly used in simple circuits. (4-2)
23. Extend in scope. (7)
24. Device that passes selected frequencies. (6)
26. The electric ---- is terminal in some parts of USA. (5)
29. Head of a faculty. (4)
30. Regions of concentrated radiation. (4)

November Solution

EA marketplace EA marketplace

ADVERTISING RATES FOR THIS PAGE

SMALL ADDS: 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 $25 a centimetre. CLASSIFIEDS: $4 for 40 letters. Just count the letters divide by 40 and multiply by $4, ROUND UP TO NEAREST WHOLE NUMBER. CLOSING DATE: Ads may be accepted up to the 18th of the month two months prior to issue date. PAYMENT: Please enclose payment with your advertisment. Address your letter to THE ADVERTISING MANAGER, ELECTRONICS AUSTRALIA, PO BOX 227, WATERLOO, NSW 2017.

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Specialists in electronics and electronics security
10 Bouverie Place, Epping 3076 (03) 401-1393

EA Directory of suppliers

Which of our many advertisers is most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA reades, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
All Electronic Components	Vic	•	•	•	•	•		
Altronics	WA,NSW	•	•	•	•	•	•	•
Acetronics	NSW			•				
Dick Smith Electronics	All	•	•	•	•	•	•	•
Electronic Brokers	Vic						•	
Electronic Component Shop	Vic	•		•	•	•	•	
Emona Instruments	NSW						•	
Geoff Wood Electronics	NSW	•	•	•	•	•	•	
George Brown Group	All		•		•	•	•	
Jaycar Electronics	Eastern	•	•	•	•	•	•	•
Pre-Pak Electronics	NSW		•		•	•		
Preston Electronics	Vic	•	•	•		•		•
RCS Radio	NSW			•				
Rod Irving Electronics	Vic	•	•	•	•	•	•	•
Scientific Devices	Vic						•	
Sheridan Electronics	NSW		•	•	•	•		
Tandy Electronics	All		•		•	•	•	•
Wagner Electronics	NSW		•		•	•	•	

KEY TO CODING
A Kits & modules
B Tools
C PC boards and supplies
D Components
E IC chips & semiconductors
F Test & measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

"Electronics Australia" provides the following services:

Subscriptions: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Co, PO Box 227, Waterloo 2017. Phone: (02) 693 6666

BACK ISSUES: Available only until stocks are exhausted. Price: $4.50

PHOTOSTAT COPIES: When back issues are exhausted, photocopies of articles can be supplied. Price: $4.50 per project or $9 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for printed circuit boards and front panels are available. Price: $5 for boards up to 100 square centimetres; $10 for larger boards. Please specify positive or negative.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only, and to projects less than five years old. Price: $5. Please note that we cannot undertake special research or advise on project modifications. Members of our technical staff are not available to discuss technical problems by telephone.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post", or submitted without fee, may be answered in the "Information Centre" pages at the discretion of the Editor.

PAYMENT: Must be negotiable in Australia and made payable to "Electronics Australia". Send cheque, money order or credit card number (American Express, Bankcard, Mastercard, or Visa Card), name and address (see form). All prices include postage within Australia and to New Zealand.

ADDRESS: Send all correspondence to The Secretary, "Electronics Australia", PO Box 227, Waterloo, NSW 2017.

Please note that we are unable to supply back issues, photocopies or PCB artwork over the counter.

Back Issues ....

Photostat copies ....

Total price of magazines/photocopies, including postage and handling.

No off issues req .... x$4.50 = $..............

Cheque* Money Order [ ] Please tick box to indicate method of payment

*Please make payable to the Federal Publishing Company Pty Ltd

Mastercard [ ] American Express [ ] Visa [ ] Bankcard [ ] Tick ✓

Card Expiry Date

Credit Card No

Signature
(Unsigned Orders cannot be accepted)

NAME ....

ADDRESS ....

.... POSTCODE ....

ADVERTISING INDEX

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

From Europe, Home of the Mercedes Benz and BMW comes...

The Metrix 50 Series Multimeters

5000 Count Display with Comprehensive Function & Unit Indication

High Resolution 50 point Bargraph

Fully Sealed to IP66

Separate Battery and Fuse Compartment

Multi-Mode Bargraph
Normal - 50 point linear trend indication
Centre zero - ideal for adjusting bridges, FM detectors etc.
Zoom mode - magnifies input variations five times to increase resolution to 0.4%. Automatically tracks any shift in input within span of digital range.

Patented "Live Trend Mode"
When Memory, Peak-Hold, Relative, or Surveillance modes are selected, the bar graph continuously displays instantaneous values, digital display follows the selected mode

Logic Function - display plus two tone beeper distinguishes between "LO", "HI" and "OPEN" .

Relative Mode (MX51 & MX52) After recording a reference value, the display then shows the difference from this value, while the bargraph shows the actual value.

Surveillance Mode (MX51 & MX52) Memorises the measured MIN and MAX values while the display shows the current value. Surveillance continues even while MAX/MIN values are being examined.

Memory Mode (MX51 & MX52) Stores and recalls up to 5 values and their settings (range, polarity etc) for subsequent analysis. (Can be same or different types)

True RMS & dB Measurement (MX52) covers the range from -40dB to +60dB with 0.1% db resolution

Frequency Meter (MX52) covers 10Hz to 500kHz autoranging with a maximum resolution of 0.1Hz.

ITT metrix

4 Year Warranty

Europe's Favourite Multimeter

QUICK SPECS *(Accuracy figures are given as (% of reading + digits)*

Range		MX50	MX51	MX52
Vdc	500mV-1000V	0.5%+1	0.1%+1	0.1%+1
Vac	500mV-750V	1.2%+2	0.75%+2	0.75%+2
Idc	500µA-10A	1.2%+1	1%+1	1%+1
Iac	500µA-10A	2%+2	1.5%+2	1.5%+2
Ω	500Ω-40MΩ	0.7%+2	0.3%+2	0.3%+2
Level	-40 to +60dB	—	—	±0.3dB
Frequency	10Hz - 500kHz	—	—	0.05%+1
Diode Test	500mV/1mA	3	3	3
Continuity	R<20Ω	3	3	3
Dimensions	40 x 82 x 189mm			
Battery Life	1 year approx	$275	$320	$399

Now Available Ex-Stock from

ELMEASCO Instruments Pty. Ltd.

NEW SOUTH WALES
18 Hilly Street,
MORTLAKE
P.O.Box 30, CONCORD
NSW 2137
Tel : (02) 736 2888
Telex : AA25887
Fax : (02) 736 3005

VICTORIA
12 Maroondah Highway,
RINGWOOD
P.O.Box 623, RINGWOOD
VIC 3134
Tel : (03) 879 2322
Telex : AA30418
Fax : (03) 879 4310

QUEENSLAND
192 Evans Road,
SALISBURY
P.O.Box 274 SALISBURY
QLD 4107
Tel : (07) 875 1444
Telex : AA44062
Fax : (07) 277 3753

SOUTH AUSTRALIA
241 Churchill Road,
PROSPECT
P.O.Box 154 PROSPECT
SA 5082
Tel : (08) 344 9000
Telex : AA87519
Fax : (08) 269 6411

W. AUSTRALIA
32 Teddington Road,
VICTORIA PARK,
W.A. 6100
Tel: (09) 470 1855
Fax: (09) 470 3173

Any prices quoted do not include Sales Tax and are subject to change without notice