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Electronics Australia

JANUARY 1988

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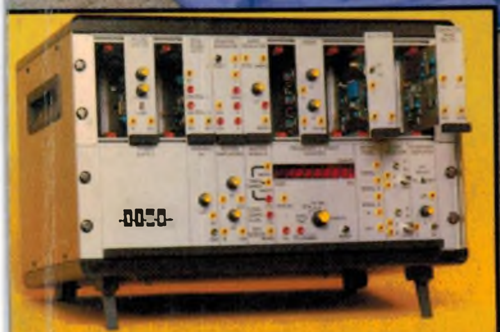

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1 The competition is open only to Australian Residents authorising a new renewal subscription before last mail March 31, 1988. Entries received after closing date will not be included. Employees of the Federal Publishing Company, Pioneer Australia and their families are not eligible to enter. To be valid for drawing, subscription must be signed against a nominated valid credit card, or, if paid by cheque, cleared for payment.

2 South Australian residents need not purchase a subscription to enter, but may enter only once by submitting their name, address, and a hand-drawn facsimile of the subscription to The Federal Publishing Company, PO Box 227, Waterloo, NSW 2017.

3 Prizes are not transferrable or exchangeable and may not be converted to cash.

4 The judges decision is final and no correspondence will be entered into.

5 Description of the competition and instructions on how to enter form a part of the competition conditions.

6 The competition commences on January 1, 1988 and closes with last mail on March 31, 1988. The draw will take place in Sydney on April 4, 1988 and the winner will be notified by telephone, and letter. The winner will also be announced in The Australian on April 6, 1988 and a later issue of this magazine.

7 The prize is: (1st) A Pioneer stereo hi-fi system; (2nd) a Pioneer car stereo system; and (3rd) a Pioneer programmable 6-disc compact disc player. Total value $10,099.

8 The promoter is The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW 2015. Permit No. TC 87/3356 issued under the Lotteries and Art Unions Act 1901; Raffles and Bingo permits Board Permit No. 87/2149 issued on 18/11/87; ACT Permit No. TP87/978 issued under the Lotteries Ordinance, 1964.

A Pioneer home stereo hi-fi system, including an A717 "Reference Series" amplifier and twin power transformers; an F717L "Reference Series" digital quartz AM/FM stereo tuner, with 16-station preset frequency synthesis tuning; a top-of-the-range CT1380WR twin programmable stereo cassette deck, with cordless remote control; a PD-M60 Compact Disc player, with 6-disc multiple play and cordless remote control; a PL-L70 programmable linear tracking turntable, with quartz PLL direct drive motor; two S-701 "Digital Realism" 3-way speakers with 32" woofers and beryllium ribbon tweeters; a pair of matching CP-500 speaker stands; and a CB-C900 deluxe system cabinet. A complete ready-to-go system, valued at $7,762!

A powerful Pioneer car stereo system, comprising a top-of-the-line KEH8080B quick-release AM/FM radio cassette player, with quartz-PLL synthesiser tuning, music search and automatic "best station memory", bass and treble controls, Dolby-B noise reduction and twin 20W outputs; a GM203 add-on booster amplifier; a pair of TS1609 160mm 3-way speakers; and a pair of TS1080 100mm 2-way car, van, boat or recreational vehicle, this top-quality system is valued at $1,532!

A Pioneer PD-M60 multiplay Compact Disc player, with 6-disc magazine, cordless remote control, random programming for up to 32 tracks, digital filtering, 2-speed manual search and built-in headphone amplifier. An excellent addition to any hi-fi system, and valued at $899!

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the second prize winner, of a Pioneer car stereo system worth over **$1,500.**

the third prize winner of a Pioneer programmable 6-disc compact disc player with cordless remote control, worth **$899**

Regular readers of Electronics Australia know it's the one that gives you best value for money. We already give you the best news, the best construction projects, the best feature stories to keep you abreast of the latest developments — in short, the most interesting and valuable electronics reading every month.

By subscribing, you make sure of getting Electronics Australia every month — delivered right to your mail box. And automatically enter the draw to win one of the 3 Pioneer hi-fi prizes!

As well as entering the competition you'll also receive a free pair of high quality ARISTA lightweight stereo headphones — ideal for a portable cassette player, radio, CD player or even your home stereo or TV. **Valued at over $10.**

Simply fill out the enclosed self-sealing, postage-paid envelope/coupon and mail or if missing send name, address, telephone no. and cheque/money order to: Pioneer Hi-Fi Competition, Freepost No. 4, P.O. Box 227, Waterloo, NSW 2017. No stamp required
For any enquiries Ph: (02) 693-9515 or (02) 693-9517.

Electronics Australia '88

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

The latest music keyboards

Have you heard the latest low-cost keyboards? We checked them out, and were amazed at just what they can do. Synthesis, digital sampling, memories — read all about it, in our story starting on page 12 . . .

4 great projects!

This month there's an easy to build three-transistor radio, a temperature probe for your multimeter, an infra-red link for stereo headphones and an Omega-derived clock. Plenty to keep you busy during your holidays and beyond!

State of the Art

Our products survey sections starting on pages 8, 126 and 138 should give you a good idea of the current state of the electronics art, here at the beginning of 1988.

ON THE COVER

If you take out a new subscription to EA (or renew) in the next three months, you have a good chance of winning this great Pioneer hi-fi system worth over $7500. There's also a Pioneer car system and CD player to be won, but the young lady is not included! See page 74. (Courtesy Pioneer Electronics Aust.)

Features

Entertainment Electronics

News and Comment

Volume 50, No.1
January 1988

ANNUAL DIGEST

Projects and Technical

Departments

Inside Midi

The Midi system allows synthesisers, drum synths and other electronic musical instruments to be hooked together, and controlled by sequencers. Find out how it works, in our easy to read article starting on page 122.

Alfred Traeger

Almost every Aussie knows the story of Rev. John Flynn and his Flying Doctor Service. But here's the story of the man who made it all possible, by developing the pedal-powered radio. See page 148.

Making your own electrostatic speakers

Ever thought of making your own electrostatic speakers? There's a new book out that provides all the info — see our review on page 162.

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Letters to the editor

Counter promised

Enclosed is a photocopy of page 133 from your September 1986 issue promising a 1.6GHz frequency counter project "next month". To be sarcastic I could suggest that twelve months plus hardly justifies the "coming soon" heading.

Is it still intended to publish the design? The oven crystal oscillator and Omega frequency reference could both be seen as adjuncts to the frequency meter but no mention has been made of this.

As another project idea, a comprehensive transistor/diode tester would be very useful. There have been several transistor gain testers but something along the lines of that published in 1968 would be desirable.

W.M. Moore,
Wellington, NZ.

Comment: The prediction concerned was made by a previous EA editor, unfortunately and we don't know why it didn't appear. However a very similar project has now appeared in one of our competitors. We're working on a new transistor-diode tester right now, and this WILL appear very shortly.

Copycode reaction

Your EA Editorial for November 1987 is most intriguing. What a way to go about trying to prevent copying of CD records with a DAT unit — purchasers of CD would never stand for it! In any event, I do not think such extraordinary action will ever be necessary for the reason outlined below.

In my book, "Australian Radio — The Technical Story, 1923/1983", I suggested that this whole exercise of digital audio might have been simplified considerably if the end product had used tape rather than a disc. I also indicated that a prime requirement for this alternative approach would be a very good high-resolution fine-particle tape.

Suitable tape has now been available for some time; it is widely used in video camera-recorders of 8mm format, for example. Such tape is, however, quite expensive — so much so that the tape required to copy a CD on to DAT might well cost as much or more than another copy of the disc, particularly in view of the large price reductions announced recently on some CD's.

Under these circumstances, the incentive to make copies on DAT would largely disappear and, with it, the potential for infringement of copyright.

Another point: Even with the greatest of care, all tapes and most tape-reading devices are subject to some wear, CD's generally are not. I am enthusiastically backing the CD and I don't expect it to suffer much commercial interference from DAT, in the short term, at least.

Winston T. Muscio,
Leumeah, NSW.

Comment: Our views entirely, Winston. Thanks for taking the trouble to write.

GPO wiring

I would like to point out an error which although I realise is probably only in drawing, it could be misleading for anyone not familiar with the standards.

I am referring to the diagram drawn at the bottom of page 90 of the November 1987 issue, which represents the setup and path taken in the ill-fated prototype of the voltage/continuity checker. In this diagram the probe is shown connected to the right hand pin of the mains outlet, which as we all (should) know is the neutral pin and therefore would not have produced the described pyrotechnics unless the socket was incorrectly wired.

In general I find your magazine very good and informative and I have been reading it since I purchased my first copy whilst still in primary school in February 1962.

Eric van de Weyer VK2KUR,
Vaucluse, NSW.

Comment: Thanks for the reminder, Eric. It was only a minor "liberty" taken in the drawing . . .

Amplifier earthing

Thank you for reviewing one of our latest products, the Pioneer A441 Integrated Amplifier in your December 1987 edition.

When reading through the review, we noticed that you deliberated on the earthing methods used in this amplifier, and inferred that it was potentially unsafe.

I must take this opportunity to advise you and your readers that the unit which was reviewed by yourself was in fact a European version of the A441 which is double insulated and as such must not be earthed in accordance with the Standards Association of Australia regulations. In other words, all A441 Amplifiers marketed in Australia are *totally* safe to use.

The screw terminal you mention on the rear panel of the amplifier is only for Turntable grounding which is a hum (earth loop) reducing provision, not for electrical safety.

I believe that it was necessary to write to you and point this out to your readers, and in fact, to reassure existing A441 owners in Australia.

Paul Clarke,
Divisional Manager,
HiFi/Video Products,
Pioneer Electronics Australia,
Braeside, Vic.

Comment: Thanks for your letter, Paul. It's an interesting matter, which affects a lot of modern amplifiers — not so much in terms of safety, perhaps, but possibly performance. We'll try to explore this further soon.

Vintage radio info

Good to see those articles on early radio.

I have most if not all radio circuits from 1937 to 1955, and can help if readers wish to contact me on (08) 390 3382, or write to me.

Keep up the good work.

Steve Jarrett,
C/- Post Office,
Summertown SA 5141.

Comment: Thanks for the offer, Steve. We hope you don't get swamped!

Opera House organ

Some goodly time ago you published an article on the Sydney Opera House grand organ.

Although I often listen to concerts originating from the Sydney Opera House, I have never again heard mention of the organ. Could you please say if the organ is in regular use?

Perhaps other readers, as remote from Sydney as I, may also be interested.

J.R. Bennett,
City Beach, WA.

Comment: Yes, the Opera House Organ is in regular use — but organ recitals don't seem to make the news headlines too often! It's been acknowledged as a world-class instrument, and highly praised by Peter Hurford and other leading players.

Editorial Viewpoint

Welcome to our first Annual Digest issue!

Well, here it is, folks. *EA's* first ever Annual Digest issue, and our biggest, brightest and meatiest issue for many, many years. It's been something of a marathon effort to get it all together for you, but I think you'll be impressed with the results.

We've particularly tried to give you plenty of interesting holiday reading. Up front there's a story about the latest low-cost electronic music keyboards and what they can do, plus a look at Aussat 3, Australia's latest communications satellite. You'll also find a story on IBM's automated computer factory in Wangaratta, Victoria, plus the second part of Neville Williams' interesting story of the magazine's early days.

Nearer the back, in honour of the Bicentennial we've included a special story on Alfred Traeger, inventor of the original "pedal radio" that made possible the Royal Flying Doctor Service. There's also a look at the latest developments in scanning electron microscopes, to allow them to look at living organisms without killing them in the process.

On the technical side, you'll find four interesting construction projects: an easy to build three transistor radio, an infra-red link for driving stereo 'phones without messy cables, a low-cost temperature measuring probe for multimeters, and a clock driver for the Omega-derived Frequency Reference. There's also an easy-to-read but informative article on the Midi interface system for musical instruments, and the next instalment of our series on Principles of Logic Analysis.

For the many service technicians and home service people who follow our popular Serviceman column, there's a special index to the stories that have been published in the column over the last 12 years — prepared by our regular contributor Jim Lawler. Very handy for tracking down that story on a particular brand and model of equipment!

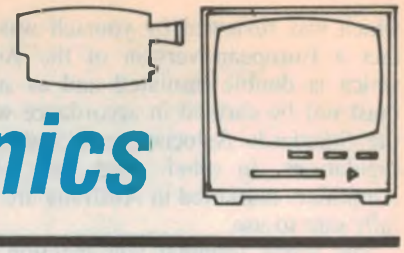
In addition, we've prepared special expanded Entertainment Electronics, Solid State Update and New Products sections, to give you a much better idea of the current state of the electronics art.

So all in all, this *EA Electronics Digest '88* is a pretty special issue, and one that we hope is a fitting way to mark the start of a new electronics year.

Jim Rowe

PS: Sorry about the higher than normal cover price for this special issue. With so much extra paper and printing required, we really needed to recoup a little more than usual. The price will be back to normal with the February issue . . .

What's New In
Entertainment Electronics



Developments to expect in the coming year

There are plenty of things brewing in the entertainment and consumer electronics area, and at least some of these are likely to reach the Australian market during 1988. Here's an idea of the things you can expect to see . . .

Perhaps the hottest area in consumer electronics at the moment is DAT — digital audio tape, released in Japan more than 12 months ago. At this stage it still hasn't been sold anywhere else, although magazines like *EA* and others in various countries have been able to play with samples and publish "previews" (see our December issue).

There's a lot of pressure from the CD industry to prevent it being released outside Japan, but the Japanese manufacturers are getting very insistent. Already Akai and Sony have announced plans to release DAT in Europe, and even European firms like Grundig and Ortofon are reputed to be negotiating with Japanese makers to produce models.

It now seems very likely that the DAT floodgates will open before the middle of the year — although whether DAT will make much impact initially on the typical consumer remains to be seen. Prices are likely to be quite high (around $3000), and because DAT is quite sophisticated technology, they aren't likely to come down for quite some time.

Still, almost every major Japanese manufacturer now has at least one DAT recorder, and some now have a range of models. Apart from the basic record/play decks to integrate with home hifi systems, compact portable models have just started to appear. For example Matsushita (National/Technics) has just released a portable recorder, the RQ-MD1, measuring 210 x 40 x 122mm and weighing only 1450g including batteries. Sony has also released the TCD-D10, measuring 238 x 53.6 x 175mm. As with the larger models, both offer performance equal to or better than CD. Prices in Japan are the equivalent of $3000 and $2500 respectively.

On the CD front itself, you can expect to see more car players and car radio/CD player combinations. The Japanese manufacturers have been steadily simplifying and compacting the basic CD player mechanisms, and they're now at the point where it can be built into a standard dash-mounting module in place of the traditional cassette player.

You can expect to see CD players appear in quite a few more "ghetto blaster" portable music units and compact "midi" integrated stereo systems, too. Already these are appearing on the local market, and more seem likely. Current models are pretty big and ungainly, but smaller and more elegant versions are probably only six months or so away.

CD technology itself is also being continuously improved. Sony has just released a model in Japan with an 18-bit digital filter and 8-times oversampling at 352.8kHz, for higher clarity and resolution of low signal levels. Matsushita has also released two models with 18-bit D/A converters. You're likely to see quite a few of these "next generation" CD players before long.

Allied to CD is the new audio-visual combination technology pioneered by Philips and Sony, CD-Video or "CD-V", which allows you to play both high-quality video and CD-quality audio from the same discs. Just about all of the major Japanese manufacturers have either released CD-V players, or have announced that they are about to do so. Sony has three, Pioneer has two, Aiwa has one.

Philips itself has also demonstrated models at various shows throughout the world, and the word is that its CD players manufacturing plant in Belgium is also ready to crank out CD-V players almost any time now. Philips' software subsidiary Polygram apparently has quite a few CD-V discs ready to roll, too.

So don't be at all surprised if you're being encouraged to buy a CD-V player and discs quite soon — probably again before June. By the way, a CD-V player will still play ordinary audio-only CD discs, as well as the new video-too variety. Some even play the original 12" video Laserdiscs as well.

On the VCR front, you can probably expect to see models of the improved "super VHS" (S-VHS) recorders shortly. These have been available for some time in Japan and elsewhere, at least in NSTC versions. PAL versions seem to be taking a little longer, possibly due to relatively slow market acceptance of the S-VHS development. Although it apparently gives noticeably better results, it's only partly compatible with existing VHS: S-VHS machines will play existing tapes, but not vice-versa.

There's even S-VHS camcorders now appearing in Japan, from manufacturers like Hitachi.

Certainly you can also expect further growth in the 8mm video area, with more models appearing and prices slowly nudging downwards.

In the area of TV sets, the trend seems to be towards extending the picture size in both directions. Firms like Mitsubishi seem to be pushing ever upwards — not satisfied with the 92.5cm (37") monitor it released recently (as reported in our November issue), it has now released both 50" and 100" rear projection models in Japan. These are reputed to give much brighter pictures than previous models, thanks to high-current projection CRTs and more efficient optics.

Whether we'll see these monster models in Australia is probably unlikely. Traditionally large-screen projection sets have been pretty poor sellers, partly because of ho-hum picture quality with 625 or fewer-line systems, and partly because of the generally rather off-putting price tag. And this still seems likely to be a major problem: Mitsubishi's 50" set is priced at about $8000, while the 100" set is a staggering $200,000.

Down at the other end, firms like Casio are starting to release tiny sets with full-colour LCD screens. These have pictures around 3" on the diagonal, and quite good resolution: around 90,000 pixels. You might well see these or similar sets here, before very long.

How about digital and high-definition TV? Well, things still seem to be proceeding very slowly in this area. It now looks unlikely that you'll see these developments until at least the early

1990s. Perhaps in view of all the other developments, it's just as well.

Of course the digital revolution is still quietly going on, but behind the scenes. Various sections inside normal "analog" TV receivers, cameras and VCRs are gradually being replaced by digital technology, giving either better performance, more features or both. This seems likely to continue in the coming year or two, with more TV sets starting to offer things like multiple picture windowing, freeze frame and so on.

The same things are likely to happen with VCRs, which are also going digital "quietly".

So that's a basic idea of what to expect in the main areas of consumer electronics during 1988. On the following pages, you'll find a survey of the latest products that have already just been released, just to round out the picture. (J.R.)

CD portable component system

The built-in CD player is what makes JVC's PC-V1 special, but it's also equipped with many advanced features including an infrared remote control unit. A convenient CD-Synchro Start editing feature is also provided.

The JVC-developed precision 3-beam laser pickup is accurate, sensitive, responsive and resistant to vibration and shock.

To effectively reproduce CD clarity and the wide dynamic range, PC-V1 is equipped with detachable speaker units housing a 12-cm ARC (acrylic resin composite) Hi-Carbon full-range speaker and a 10 x 4.5cm oval passive radiator. The ARC cone speakers are coated with a special acrylic resin which increases the rigidity and acoustic characteristics of the cone.

PC-V1's digital clock/timer allows many convenient functions such as timer recording, timer playback, repeated timer (snooze) and sleep. Information is displayed digitally on a LCD.

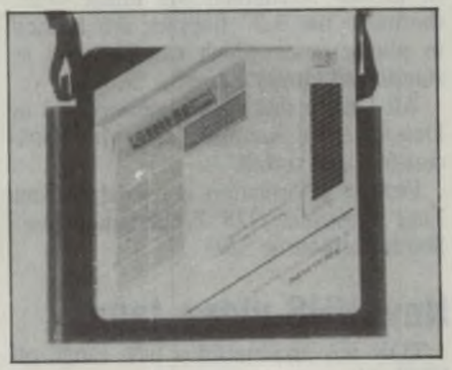
The double cassette decks make possible Synchro Start high-speed tape editing, so that customised tapes can be created.

Other features include: 16-track random access program play; repeat play; intro scan; track skip; search; auto-reverse (rec/play: Deck A0: 5-element SEA graphic equaliser; music scan (Deck A); Dolby-B noise reduction; metal and chrome tape playback; and an FM/MW/LW/SW radio with fine tuning.

Compact CD portable

The new Realistic CD-3100 from Tandy is designed for convenient listening on the go. It measures only 165 x 140 x 33mm, and features soft-touch controls with an audible "beep" indication as well as the usual LCD display for track and playing time.

Other features include auto search, 2-speed forward/reverse, and an audio cable for connection to a home stereo system. It provides a standard 3.5mm stereo headphone jack, and comes complete with shoulder strap.



The CD-3100 is priced at $499.95 (RRP), and is available from all Tandy outlets.

Enclosed dynamic 'phones

Sennheiser Electronics has announced the release of its new hifi stereo headphone, the HD250 Linear.

The HD250 Linear boasts many technological innovations in headphone design. The use of new metal alloys in the magnetic system produces a much stronger magnetic field, ensuring closer coupling with the diaphragm thus lessening the undesired resonance found in conventional diaphragm systems. The drive coil is made from lightweight aluminium, reducing the moving mass of the diaphragm and resulting in improved pulse behaviour.

The overall affect of this complex

process of mechanical harmonization is a clear, natural sound balanced over the entire frequency range, known simply as the "Linear Effect".

Weighing 25% less than most standard enclosed headphones this model is also very comfortable to wear, and can easily be worn for long periods without fatigue.

Computer-controlled FM tuner

Onkyo Corporation has released a new top of the range FM tuner. The T-9090 MKII Integra tuner is the successor to the long running and well regarded T-9090. It features AMIC (anti-microphonic circuit), designed to eliminate distortion caused by microphony, and a computerised control system to elevate reception precision and convenience.

The tuner is fully remote controlled using a 31-key remote control unit, included with the tuner.

The T-9090 MkII has a retail price of $1499.

Graphic equaliser/booster for cars

Pioneer's sleek new BP650 graphic equaliser booster is designed to provide the strongest and clearest possible sound.

The BP650, with a recommended retail price of $259, features 25 watts per channel, or 6.5 watts per channel when using four speakers.

The compact unit also features a fader control to allow a correct balance mix between the front and rear speakers, and a 7-band equalisation to tailor-make the sound for the individual listener.

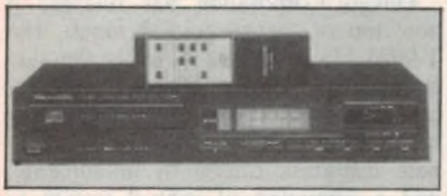
The BP650's illuminated controls allow for easy adjustment at night, while its three-way input provides simple, inexpensive connection to any brand of car sound equipment. The equaliser also has variable input gain for optimum performance when used with other brands.

Double cassette deck

Onkyo has announced a new double cassette deck. The TA-RW490 Double Auto Reverse cassette deck features computer controlled high speed dubbing, double auto reverse and double recording. It is also equipped with Dolby HX-Pro as well as Dolby B and C noise reduction systems.

Recordings can be made on both cassettes independently either simultaneously or one after the other. Full integration with a remote control system can be achieved through a serial port on the rear of the machine.

The retail price for the TA-RW490 is $1199.



CD with remote control, 24-selection memory

Tandy's new Realistic CD-1500 compact disc player features a cordless remote control unit which can be used to program the extended 24-selection random play memory, scan tracks, repeat tracks and so on.

Other features include a "floating" disc tray and three-beam laser pickup for excellent tracking. The deck also provides a two-speed manual track search function, and a switchable 4-second gap between tracks.

The CD-1500 is available from all Tandy outlets and is priced at $529.95 (RRP).

New Audio cassettes, floppy disks

Denon is set to release a new range of audio tapes and enter the floppy disk market.

Totally new is Denon's HD8 CRO_2-position cassette tape, which is available for the first time in a C100 length. Realising that many popular CD recordings average about 50 minutes, Denon has released this new length in response to requests from countless audiophiles. Of note is the fact that the tape is the same thickness as that used in C60 and C90 lengths. It is a high tech formulation based on metal powder and cobalt, giving performance which is virtually on par with metal tapes.

Also new in Denon's cassette lineup are new versions of the Metal position HDM and HD6 CRO_2-position tape, along with a new low cost/high performance tape known as DX which joins the normal position DX3.

Since the image of Denon has been built on its reputaton in magnetic technology and digital recording, Denon has released its floppy disk lineup in appealing bright packaging. Inside, each 5.25" floppy sports a brilliant white hub ring to further strengthen the image. Furthermore the 3.5" floppies are housed in plastic cases which can be used as stands and library boxes.

All Denon disks are manufactured in Denon's own factories and are 100% certified and tested.

Further information is available from Teac Australia, 115 Whiteman Street, South Melbourne 3205.

New VHS video tapes

TDK has announced a new range of VHS video tapes.

The new lineup of both VHS and VHS-C video tape was designed to meet the very high demands of the HQ-VCRs (high quality). The increase in white clip level of HQ-VHS from 160 to 200% with HQ demanded the most stringent characteristics from a video tape. The video tape must also possess sufficient low frequency sensitivity for the accurate reproduction of the lower sideband frequencies, a few MHz below the carrier frequency. This is most important to reproduce faithfully the abrupt surges in picture brightness.

TDK has strived for a good balance between high and low frequency response. It claims not to have done this by increasing coercivity, but by improving magnetic particle size, packing densities, tape layer uniformity and surface smoothness.

The new range comprises of four grades in VHS, starting with HS (high quality) with a BET value of $25m^2/g$; E-HG (extra high grade), BET value $35m^2/g$; HD (high definition), BET value $45m^2/g$; and HD-XPRO (high definition — excellent grade) BET value $50m^2/g$. TDK is also introducing two grades in the VHS-C format, E-HG (extra high grade) and HD-XPRO (high definition — excellent grade).

The term "BET value" expresses the magnetic particles' degree of fineness. The higher the value, the finer the particles. For example, the abovementioned BET value of $50m^2/g$ (HD-XPRO) means that 1 gram of magnetic particles possess a combined surface area of 50 square metres.

Compact AM/FM radio, CD & cassette combination

Tandy's new Realistic CD-3300 portable music centre adds a digital compact disc to the usual AM/FM radio/stereo cassette deck combination. It also includes a built-in three-band equaliser and Dolby noise reduction for cassette recordings.

The built-in two-way speakers feature 100mm woofers and piezo tweeters, while the CD function features an auto-search music facility. Includes jacks for external microphones, headphones and line inputs/outputs.

Priced at $699.95 (RRP), the CD-3300 is available from all Tandy outlets.

Three-way tower speaker system

The Boston Acoustics T830 is a three-way system in an acoustic suspension floor-standing tower design. Its design goal was to provide outstanding performance while using a minimum of floor space. The 830's footprint is only 10x9-3/4", and the cabinet is only 32-1/2" high. Overall, the cabinet occupies

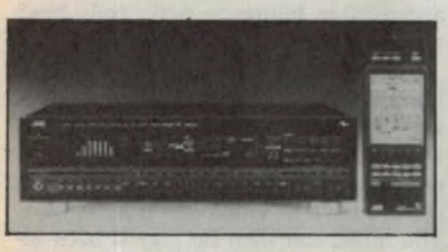
less floor space than a typical bookshelf system on a stand.

The interior dimensions of the cabinet — and the woofer's position relative to the floor — were designed to assure clean, deep bass response. The woofer's carefully calculated height above the floor avoids reflective cancellation and allows it to deliver its full bass potential without exaggeration.

The mid and high frequencies that provide the crucial directional cues are radiated from a single area at ear level for precise stereo imaging.

Copolymer material is used for the midrange and woofer because of its structural uniformity and immunity to changes in ambient humidity. These qualities are claimed to allow the diaphragms to follow the incoming musical waveform more accurately than other materials typically used.

Price at $1299/pair, the T830 speakers are available from Falk Electrosound, 28 King Street, Rockdale 2216.



"Audio-visual" receiver with touch-screen remote

JVC has announced the first of its new-generation receivers: the RX-950VBK audio/video receiver. It comes standard with a cordless remote control that has a touch-sensitive LCD (liquid crystal display) panel.

The remote control has several layers of "menus," one for each function or input; as the user selects an input or function, the display shows an appropriate menu from which the desired operation can be performed. Moreover, the displayed items also serve as touch-sensitive switches.

The remote operates not only the RX-950VBK receiver and the connected JVC Compu Link audio components (CD players, cassette decks and turntables), but also selected JVC video cassette recorders and TVs. So using the remote, the user can perform operations such as recording and playing videotapes, selecting video inputs to view, and changing TV channels.

Three other features are built into the RX-950VBK. One is the "Sound Selector", which lets the user match any audio program with any video program routed to the receiver. This means it's possible to record simulcast broadcasts — stereo FM for sound and TV for picture — on the same videotape. To improve mono soundtracks, the "Acoustic Expander" simulates stereo-like sound. There are also terminals at the back for preamp output and main-amp input for patching in a surround sound processor.

Computer control is used extensively in the RX-950VBK, especially in its tuner and graphics equaliser section. Up to 16 FM and 16 AM stations can be preset and recalled at a touch.

"Digital" headphones

Arista Electronics has just released a new series of "Digital Audio" headphones.

The range includes the lightweight model "CDS-16" designed for comfort as well as high quality sound reproduction. Weighing only 95 grams, this headphone should remain comfortable for long listening periods.

The "MHD-12" headphone, also designed for digital, has individual left and right volume controls.

Next in the range are the "HD-1000" closed back type "CD" headphones. These are designed to totally cover the ears to keep out all extraneous background noise, which makes them suitable for both domestic and commercial use (DJ's, sound engineers etc.).

The top of the range in the Arista lineup is the model "CDS-17". This headphone combines comfort with excellent frequency response at 20Hz to 23kHz and low distortion characteristics, making them suitable for the most discerning CD listener.

Starting at a Recommended Retail Price of $39.95, up to $56.95, the Arista CD headphone range is well worth auditioning before making a decision in the medium price range.

For further information and the name of your nearest stockist contact Arista Electronics, 57 Vore Street, Silverwater 2141.

EA checks out the latest

Portable electronic music keyboards

Have you heard what the latest portable music keyboards can do? The kinds of things that until a short time ago were only available to the well heeled owners of full-blown digital music synthesisers. Now these musical wonders can be yours, for only a few hundred dollars!

by JIM ROWE

I've just had the opportunity to play with some of the latest portable music keyboards — the kinds of things you can buy for anything from about $200 up to about $500. And frankly, I've been flabbergasted at just what they can do.

Last time I looked and listened, they were pretty crude little things that could only play one note at a time and had a very limited range of tone colours and other facilities. Little more than toys, in fact, compared with the much more elaborate (and very much more expensive) keyboards available for professional musicians.

But now, they've acquired the ability to play many notes at once, to synthesise tones and envelopes, to provide all sorts of fancy built-in rhythms, and even let you digitally sample almost any kind of real-world sound — and use it to play any tune you like, on the keyboard. These are the kind of features that a few short years ago were only available on gee-whizz digital music synthesisers costing literally tens of thousands of dollars!

The new keyboards that I've been checking out are the Realistic "Concertmate" models 500, 650 and 700, by courtesy of Tandy Electronics — or as they're now known, Intertan.

The Concertmate series of keyboards is made for Intertan in Japan, and I gather that a very similar series is also sold under the Casio brand. Intertan isn't saying, but I suspect their keyboards may be made by Casio too. Not that it matters; whoever makes 'em, they're little beauties . . .

Smallest in this range of latest-generation keyboards is the Concertmate 500, but while it's the baby of the trio it certainly doesn't lack features.

Measuring 461 x 155 x 44mm, the 500 provides a keyboard with 32 keys — 2-1/2 octaves. They're smaller keys than on your piano, with the white keys measuring 73mm long by 17mm wide and spaced on a pitch of about 19mm (compared with about 24mm), but still quite playable.

As a basic "press a button and play" keyboard the 500 provides eight preset tones. Three of these have tone colours produced by harmonic synthesis: flute, pipe organ and jazz organ. The other five are sampled from real-life sounds, using digital sampling: piano, brass ensemble, trumpet, synth drums and human voice.

The model 500 uses an 8-bit PCM digital sampling system, with a sampling rate of 9.34kHz, and those preset sample tones are surprisingly good. The piano is really quite exceptional, and the trumpet very lifelike. Even the human voice sounds disconcertingly realistic (sorry, I couldn't resist the Tandy pun, folks); it sounds rather like someone saying "how!", pitched at whatever note you play.

There are two effects, each available at the touch of a button: vibrato and portamento or glide.

The 500 is four-note polyphonic, meaning that it can produce up to four notes simultaneously — enough for a lot of fairly simple music with 4-note chords. So as a basic keyboard, it's quite respectable. But that's just the start of its repertoire.

There's a built in auto-rhythm section, for example, with 11 preset rhythms: disco, rock, pops, march, samba, bossa nova, rhumba, 4-beat, swing, slow rock and waltz. These are all available at the touch of a "Rhythm select" button and then one of the centre 11 white keys. There's also two buttons to adjust the tempo of the rhythm, and a fill-in button to add "frilly bits" when you want.

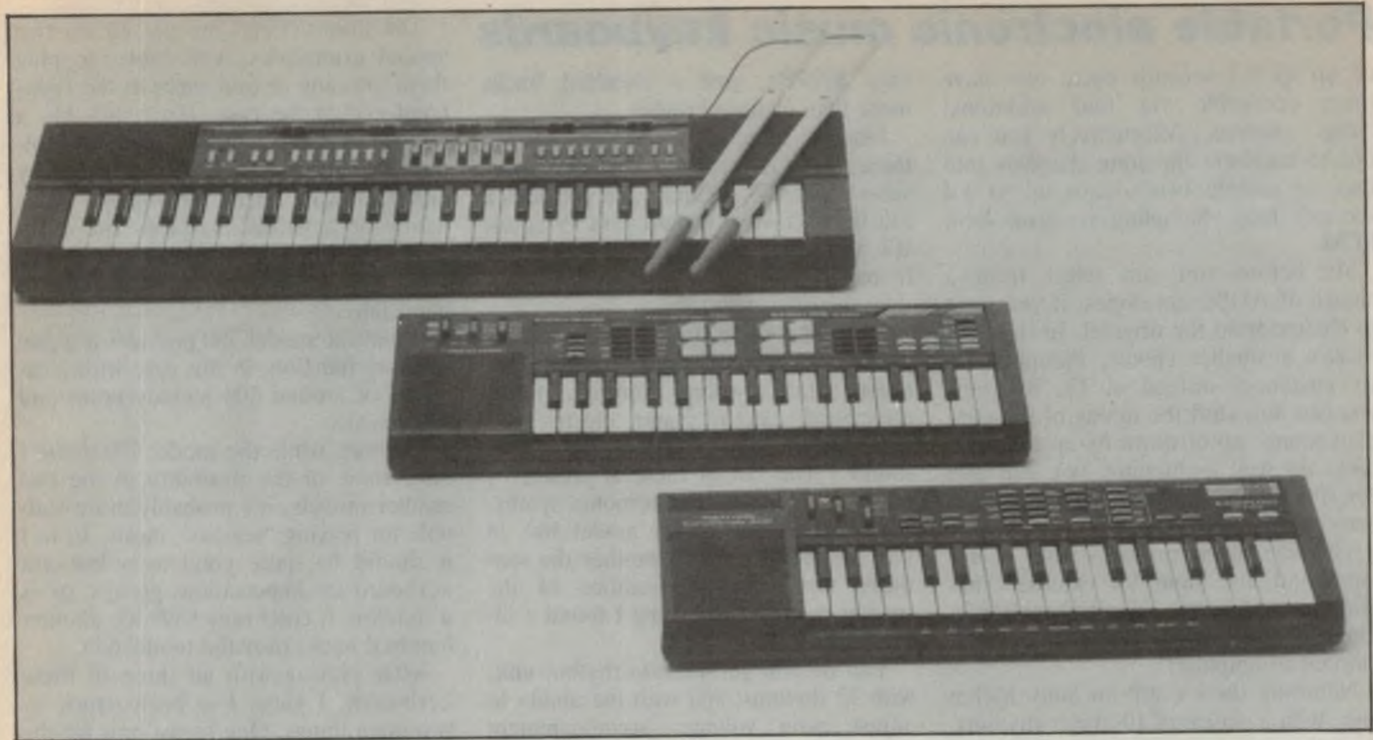
Then there's a music memory function, capable of storing either a one-note melody line or four-note harmony, with up to 400 steps. The note lengths can be stored as well, by the way, so it doesn't have to sound like a music box. The music can then be played back either a note at a time (but only the basic melody in this case), or automatically.

Alternatively you can store two separate parts and accompanying chords, which the 500 can provide automatically if you wish. In this mode its memory can store approximately 198 notes and 99 chords — quite impressive!

But there's still more to come. The 500 also provides a "synthesised" voice, separate from the other preset tones, which you can program in terms of both tone colour and envelope. The tonal synthesis is by harmonic, and it provides nine labelled according to conventional pipe organ footages: 16', 8', 5-1/3', 4', 2-2/3', 2', 1-3/5', 1-1/3' and 1'. These can each be adjusted to one of 14 different levels, giving a very wide range of possible tone colours.

At the same time you can select from 13 different attack-decay-sustain-release envelopes, for the dynamic of your synthesised tone colour. These vary from the slow-attack envelope of a stringed instrument to the fast-attack, damped quick-release envelope of wood blocks — again a very wide range of possibilities.

By the way, the same choice of envelopes is available with any of the



The model 700 with its drumsticks is at top, the model 650 in the centre and the model 500 at the bottom.

500's preset tones, if you want to change their preset envelopes . . .

Finally we come to the digital sampling. Yes, although it's the baby of the trio, the Concertmate 500 still provides sampling. You can sample approximately 1.4 seconds worth of real-world sound, and then use that sound as the 500's tenth tone colour to play tunes on the keyboard.

The sound can be sampled via an inbuilt electret mic, or via an external mic or line input for probably rather better results. The external mic input is a 3.5mm jack, while line input is via a 6.5mm jack. Both jacks are "stereo", although wired for mono.

As before, the envelope of the sampled sound can be changed to any of the 13 inbuilt envelopes, so you're not stuck with the original. So if you want to have a smashing-glass sound with an envelope like a bowed violin, or a mooing-cow sound with the envelope of wood blocks, no problem! Obviously the possibilities are enormous.

There's also the ability to "loop" the sampled sound, so it is played repetitively while the keys are depressed.

What else does the 500 provide? Well, if you're short of ideas or feeling a little lazy, there's a built-in demo tune that will endlessly repeat and cycle through the 500's range of tone colour combinations. The tune is Mozart's poor old *Toy Symphony*, and while it certainly shows off the 500's capabilities, it can get just a teensy bit irritating after the umpteenth variation — especially if you like the original, as I do (Wolfie would turn in his grave!)

There's also a fine tuning control hidden underneath, to let you match the 500's tuning up with other instruments for ensemble playing. It has a range of +/- 30 cents.

By the way, the 500 has an inbuilt 80mm speaker, but there's also a 3.5mm stereo output jack so you can connect it to an external amplifier, or use headphones for privacy. When you plug into the jack it disconnects the internal speaker.

It runs from either five AA penlight cells (preferably alkaline), or an external 7.5V DC battery eliminator supply (not supplied). Total power consumption is only 1.8 watts. If you don't play it for around seven minutes, it automatically shuts down to conserve the batteries.

OK now, what would you expect to pay for this little marvel — $500? More? You're in for a pleasant surprise, because it's yours for only $199.95. That's right, only *two hundred bucks*!

If you needed any evidence to show how far electronic music technology has come in the last year or so, that's surely it.

Just before we leave the 500, I opened up the sample and took a peek inside. As I expected, there's a pretty fancy looking VLSI chip in there, in a 100-pin surface-mount package; probably a micro. Apart from that there's three memory chips, a handful of smaller chips and a few dozen passive components. But it's all very nicely made, and obviously well designed.

The next model in the range is the Concertmate 650, which is physically only a whisker bigger than the 500: it measures 470 x 169 x 47mm. Like the 500 it has a 32-note keyboard, and is still basically a 4-note polyphonic instrument. It too operates from five inbuilt AA cells, or an external 7.5V DC supply.

Perhaps surprisingly, the emphasis with the 650 seems to be more on "fun" than musical flexibility. Of the eight preset tones built into the machine, two are definitely fun: dog-bark and surf sound. Very realistic they sound, too, with the dog-bark tone giving you a choice of everything from a bonzai peke to the hound of the Baskervilles. But there's a limit to tunes you can play with a chorus of pooches, and even more so with surf sounds. Great for atmosphere and sound effects, though . . .

The other tone colours available are piano, vibraphone, trumpet, pipe organ, chorus and flute. To my ear they're not quite as good as those on the 500, but that's probably a matter of personal choice. However this time there's no "roll your own" harmonic synthesis tone.

On the other hand, there's not just one, but *four* digital sampling channels. So you can take four separate samples

Portable electronic music keyboards

of up to 0.7 seconds each, and have them accessible via four additional "stop" buttons. Alternatively you can opt to combine the four channels into two, to sample two sounds up to 1.4 seconds long. Sampling is again 8-bit PCM.

As before you can select from a choice of ADSR envelopes, if you want to change from the original. In this case there's a smaller choice, though: only six envelopes instead of 13. But now you can now shift the tuning of the sampled sound, up or down by up to an octave. As well as looping, you can also get the 650 to play the samples in reverse, for special effects.

The 650 again provides both a mic input and line input for external sampling, as well as the inbuilt electret mic. There's also an output for external 'phones or amplifier.

Naturally there's still an auto-rhythm unit, with a choice of 10 preset rhythms. And you now get four special rhythm pads — just tap them with your finger, and you get hi or low bongos, a lion's roar or a lazer gun zap (right out of Star Wars). Just the thing to add that extra touch of sparkle!

When it comes to demo tunes, the 650 certainly runs rings around its smaller brother. This time there's not just one, but seven: *Turkish Tune* and *Eine kleine Nachtmusik* by Mozart, *Claire de Lune* by Debussy, Haydn's *Surprise Symphony*, Meacham's *American Patrol*, the English folksong *Picnic* and *Jingle Bells*. And just for good measure, you can program in your own choice of tone colours for the melody, obbligato and accompaniment parts of each tune, if you don't like the way they come!

The cost of the Concertmate 650 is only $299.95, just a hundred bucks more than its little brother.

Finally, there's the biggest of the three, the Concertmate 700. This measures 660 x 200 x 63mm, and provides a full four-octave keyboard with 49 notes. It's also eight-note polyphonic, making it more suitable for "serious" music than the other two.

This time there are 12 preset tones: piano, vibraphone, jazz organ, pipe organ, flute, violin, trumpet, funky clavichord, electric piano, electric guitar, human voice and "synthesised sound". The last of these is preset, by the way, not like the harmonic synthesised tone colour on the model 500. In fact the model 700 has neither the synthesis nor sampling facilities of the smaller models, something I found a little disappointing.

You do still get an auto-rhythm unit, with 12 rhythms, and with the ability to adjust main volume, accompaniment volume and rhythm volume independently. There's also a Start/Stop button, to let you make synchronised starts, a Synchro/Ending button which gives each rhythm a fancy ending, and an Intro/Fill-in button for fancy intros and frilly bits. You can also adjust the tempo over a fairly wide range.

To make simple two-finger playing sound even more impressive, the model 700 also provides optional automatic chord accompaniment, or "Concert-Chord". This lets you use either one, or two fingers of the left hand to produce major, minor, seventh or minor seventh chords as desired.

Another feature of the model 700 is a "Super Drums" section, capable of letting either you or someone else play manual drums and effects along with the keyboard itself.

The drums/effects are played via two special drumsticks, with cables to plug them into any of four jacks at the right-hand end of the case. Each stick has a button, to let you flip between two alternative effects. You use the sticks by either shaking them, or tapping them lightly on a hardish surface. The available effects are bass drum, snare, rim shot, high hat, cymbal, hi/lo bongo and handclap.

Again the model 700 provides a music memory function, in this case with a capacity of around 500 melody notes and 670 chords.

In short, while the model 700 doesn't have some of the flexibility of the two smaller models, it's probably more suitable for playing "serious" music. In fact it should be quite good as a low-cost keyboard for impecunious groups, or as a standby. It costs only $399.95, another hundred bucks over the model 650.

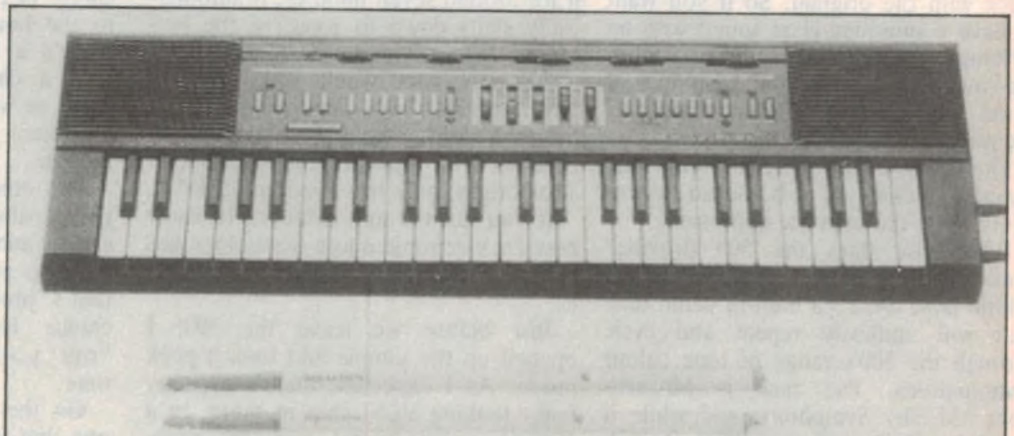
After playing with all three of these keyboards, I guess I've been struck by two main things. One is just how far the technology has come in the last year or so, and how many exciting features can now be provided so cheaply.

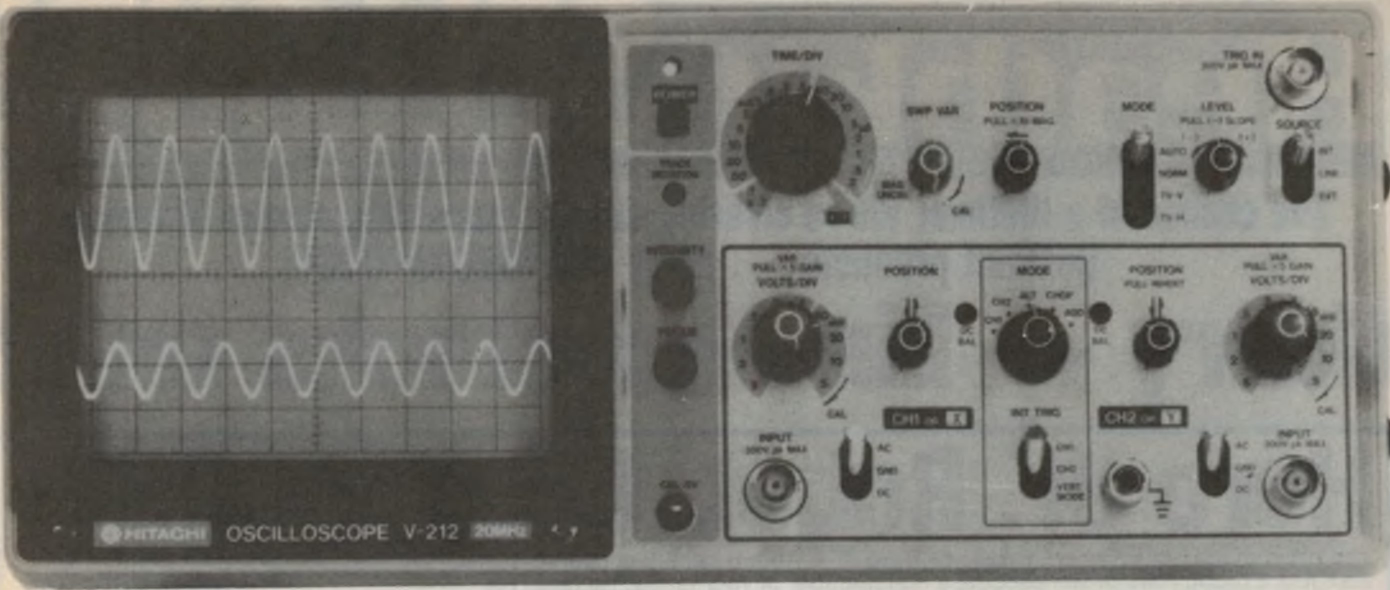
The other thing is how easy to drive these new keyboards are, even for functions like digital sampling. Some of the earlier professional keyboards were quite complex in operation, and took a fair bit of getting used to. These new low cost machines are very much more "user friendly", and have obviously been designed for use by mere mortals rather than synthesiser experts.

All in all, I'm very impressed with the Intertan Concertmate series. They're very flexible, and a tremendous amount of fun. Not only that, but they'd make an excellent training keyboard for junior musicians.

You can hear one for yourself at any Tandy Electronics store or dealer.

Another view of the model 700, which has a full 4-octave keyboard, "Super Drums" section and a more elaborate auto-rhythm unit.





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Display	
CRT	6-inch rectangular.
Graticule	Internal, 8 x 10 div (1 div = 1 cm). Horizontal and vertical center lines further marked in 0.2 div increments, marking for measurement of rise time
Accelerating Potential	2 kV.
External Intensity Modulation	Voltage: 5V or more. Effective bandwidth: DC to 2 MHz. Max. input voltage: 30V (DC + AC peak).
Vertical Deflection	
Sensitivity	5mV/div to 5V/div in 10 calibrated steps ±3%. 1mV/div, 2mV/div ±5% when using x5 magnifier. Uncalibrated continuous control between steps 1 : < 2.5.
Bandwidth	DC to 20 MHz (−3 dB). DC to 7 MHz (−3 dB) when using x5 magnifier.
Rise Time	17.5 ns. 50 ns when using x5 magnifier.
MAX. Input Voltage	300V (DC + AC peak) or 500Vp-p AC at 1 kHz.
Input Coupling	AC, GND, DC.
Input Impedance	1MΩ approx. 25 pF.
Display Mode	CH1, CH2 (normal or invert), ALT, CHOP, ADD
CH1 Vertical Signal Output	Voltage: approx. 20mV/div into 50Ω. Bandwidth: 50 Hz to 5 MHz (−3 dB) into 50Ω.
X-Y Operation	CH1: X-axis. CH2: Y-axis.
Sensitivity	5mV/div to 5V/div. 1mV/div, 2mV/div when using x5 magnifier.
Bandwidth	DC to 500 kHz (−3 dB).
Phase Difference	3° or less from DC to 50 kHz.
Horizontal Deflection	
Sweep Time Range	0.2 μs/div to 0.2s/div in 19 calibrated steps ±3%. 100 ns ±5% when using x10 magnifier (20 ns and 50 ns uncalibrated). Uncalibrated continuous control between steps 1 : < 2.5.
Trigger	
Trigger Mode	Automatic (sweep runs in absence of a triggering signal and for signal below 30 Hz), Normal (sweep runs when triggered), TV-V, TV-H.
Trigger Source	CH1, CH2, V-MODE, External, Line.
Trigger Sensitivity	see table below
Trigger Coupling	AC
Trigger Slope	+ or −
Calibrator	Square wave. Voltage: 0.5V ±3%. Frequency: Approx. 1kHz.
Power Supply	Voltage: 100/120/220/240 V ±10%. Frequency: 50/60/400 Hz. Power consumption: approx. 30 W.
Ambient Temperature	Rated range of use: +10 to 35°C. Limits of operation: 0 to 50°C. Storage and transport: −20 to 70°C.
Dimensions	310(W) x 130(H) x 370(D) mm. 12.2 x 5.1 x 14.6 in.
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Accessories Supplied	Two AT-10AJ1.5 probes, Fuse, Power cable, Operation manual.

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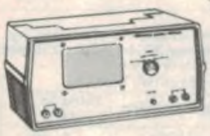

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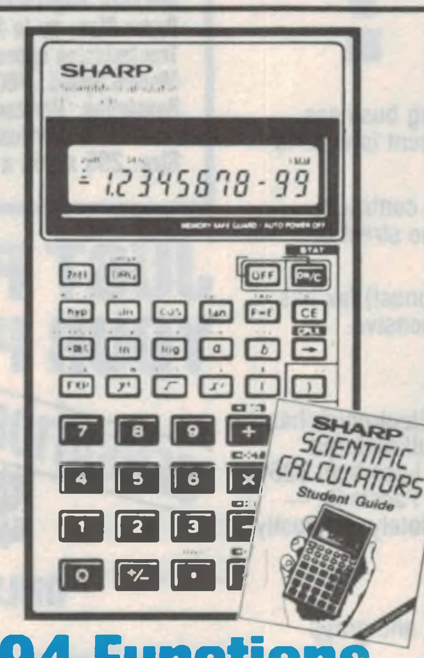

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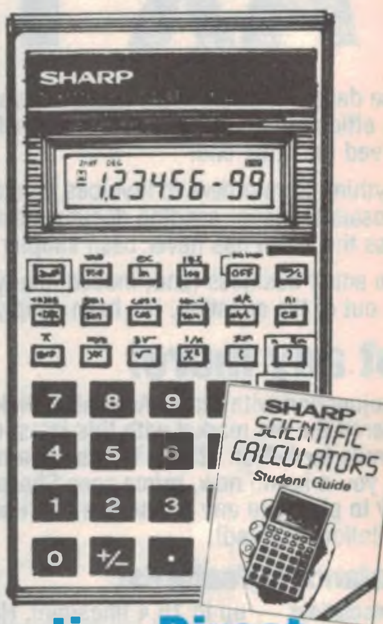

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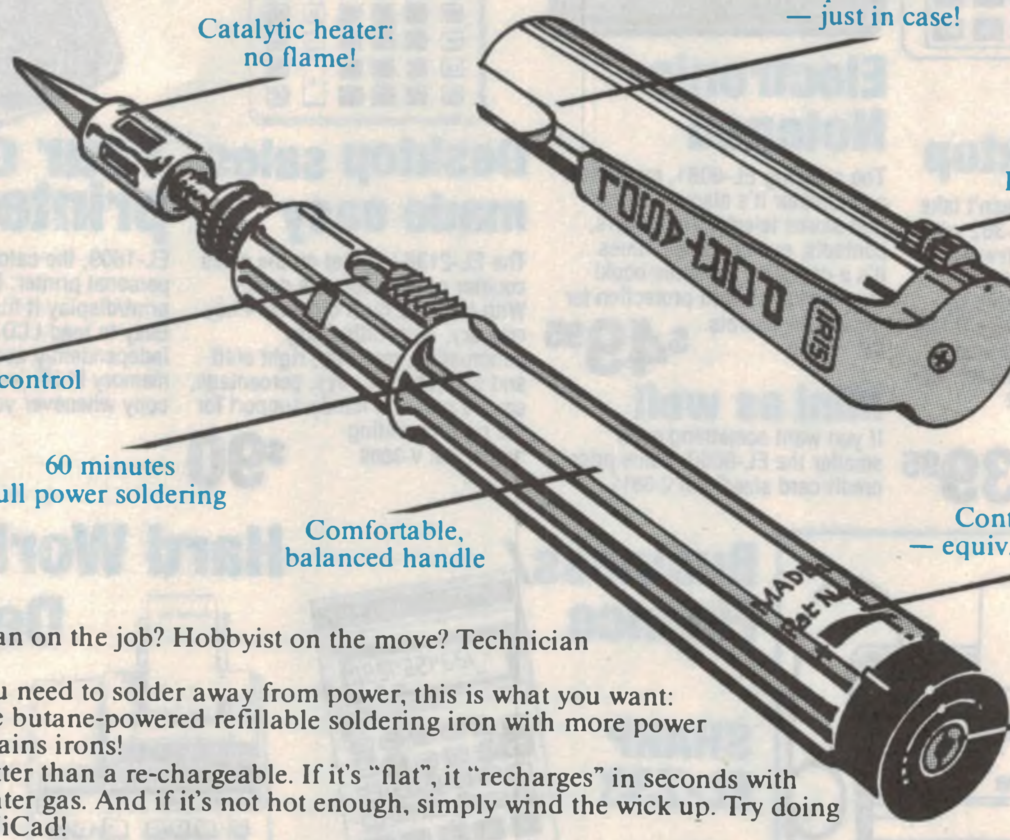

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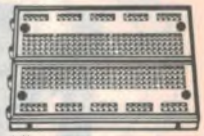

80 x 60 x 8mm board with 58 groups of 5 connected terminal points. Grid is laid out in alpha-numeric format for simple "track" identification, and the board is supplied with a pad of overlays so you can mark out circuitry for later use or for transferring to pcb/matrix board. Cat P-4614

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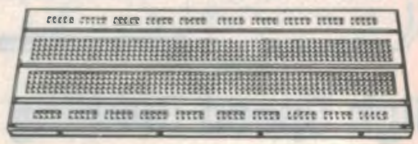
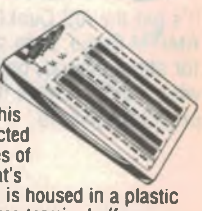


Project Boards PLUS!



A complete mini work bench! This one has 256 groups of 5 connected terminal points plus 16 bus lines of 25 connected terminals. But that's not all: the 130 x 170mm board is housed in a plastic "work bench" complete with three terminals (for power connection, input/output, etc). Overall size is 150 x 225 x 20mm. **Bonus**: Work pad included for circuit working. Cat P-4616

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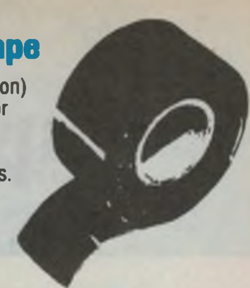

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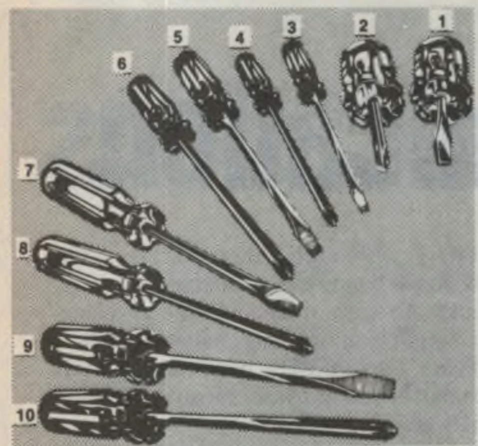

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Aussat 3:

A great boost to Australian communications

With three functioning Aussat satellites now hovering above in geostationary orbit, any private home, anywhere in Australia, is within reach of radio and TV broadcasts, in spite of the country's size and the remoteness of some of its communities.

by PAUL GRAD

Australia's third communications satellite, Aussat 3, now in geostationary orbit like its companions Aussats 1 and 2, has greatly increased the capacity of the country's satellite communications system. It has also extended the system's coverage to encompass New Zealand and the southwest Pacific.

Aussat 3 was launched by a rocket manufactured by the European consortium Arianespace. This launch was radically different from the shuttle-deployment of Aussats 1 and 2. Australia contracted for the Ariane rocket for the Aussat 3 launch, partly due to the temporary suspension of the American space shuttle program. The choice of Arianespace followed the consideration of various economic factors, including the longer life expectancy of a rocket-launched satellite compared with that of a shuttle-deployed satellite.

The technically impeccable launch of Aussat 3, last September, was an important event, not only for Australia but for Europe and the West in general. The success of the launch was specially gratifying because it followed the failure of a previous Arianespace launch, in May 1986, and of the failure of some other launches, including American. It was significant, also, because space has become a very competitive and very big business, with the Soviets having joined the race and making a big marketing effort on behalf of their own, very advanced, rockets and satellites.

The design of the Aussats and of their beam configuration allows for the provision of broadcast services for radio and TV, as well as program distribution and interchange and for a range of telecommunications services such as voice, video, telex, data and telephony.

Aussat 3, like its two predecessors, was manufactured by Hughes Communications International at Los Angeles. They all work on the Ku band of frequencies, receiving signals of 14GHz to 14.5GHz, and transmitting at frequencies from 12.25GHz to 12.75GHz.

Each satellite has three active receivers and two spares. Each receiver consists of a wideband bandpass filter for out-of-band signal rejection, a low-noise front end amplifier, a single-stage downconverter, and postamplification of the output signal in the 12.25GHz to 12.75GHz band.

The frequency change from the uplink to the downlink is, of course, essential to avoid interference between the received and transmitted signals in the vicinity of the satellites.

To provide the necessary effective bandwidth, the incoming beams are polarised in two mutually perpendicular planes. The polarised signals do not interfere with each other and thus the available bandwidth is doubled. The uplinks are then routed via the receivers to input multiplexing networks which divide the 500MHz band into 45MHz channels and provide adequate spacing between channels.

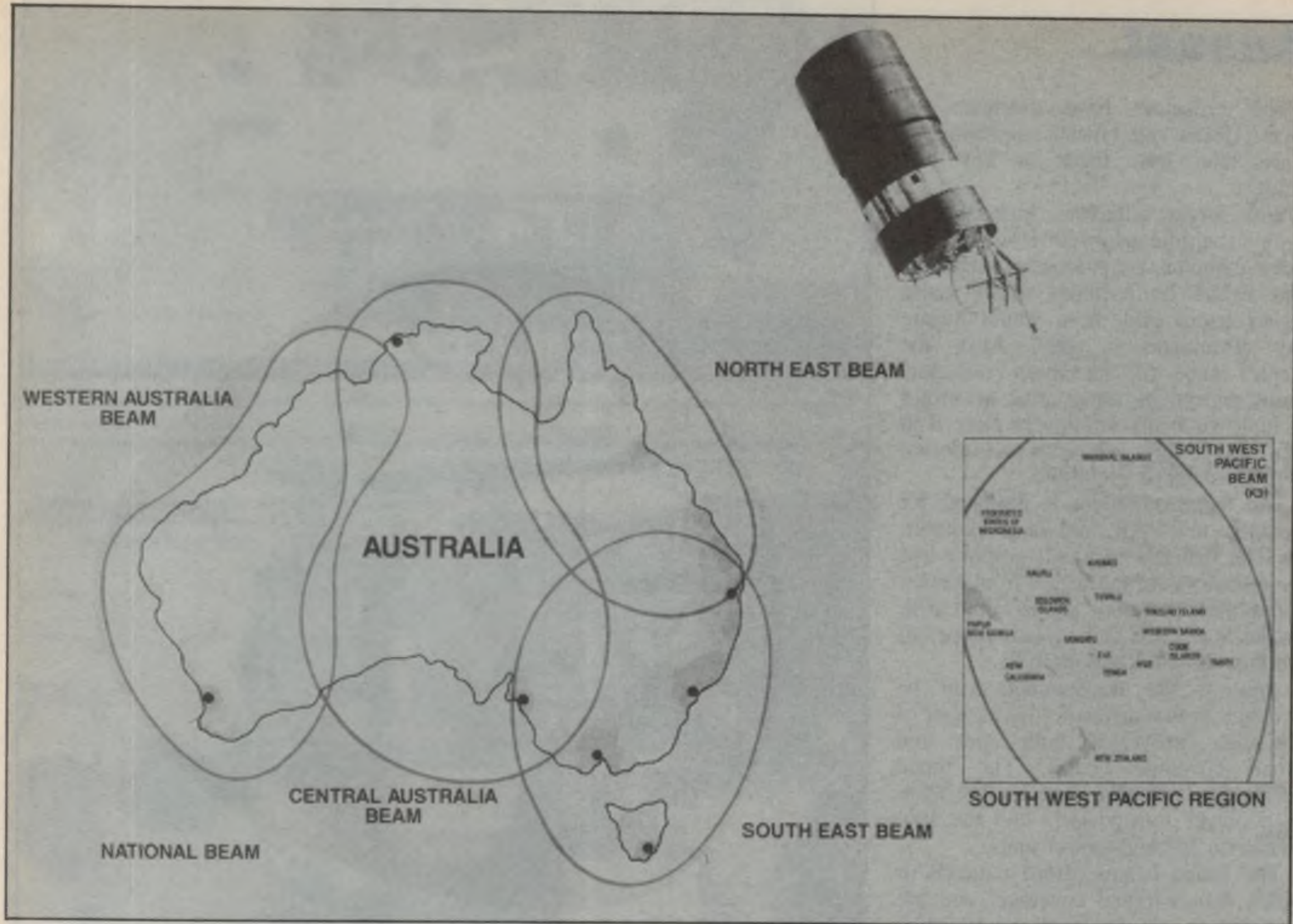
A total of 15 active communications channels are provided, each with a minimum bandwidth of 45MHz and with a channel spacing of 64MHz.

Signals in the 500MHz uplink band are amplified by two identical two-stage amplifier modules in series. Each module contains gallium-arsenide field-effect transistors with input and output microwave integrated circuit (MIC) ferrite isolators. A waveguide to MIC transition is used at the receiver input.

The uplink signals are frequency-converted from the 14GHz to 14.5GHz band to the 12.25GHz to 12.75GHz band by a single-stage downconverter, employing two Schottky barrier diodes driven by a 1748MHz local oscillator. They then go through 12GHz travelling wave tube amplifiers (TWTAs). The TWTAs are standard devices, except for those of higher power — 30W or above — which pose special design challenges due to the harsh space environment in which they have to work and the high level of reliability throughout a long life required from them.

Each TWTA consists of three sections: an electron gun, providing a high-energy electron beam; a helical slow wave structure, similar to a coaxial cable, through which the wave travels; and an electron beam collector.

The helical shape of the structure causes deceleration of the travelling wave, reducing its velocity slightly below that of the electron beam. This allows the wave to acquire energy from the beam and causes it to be amplified



The coverage of the new Aussat 3 satellite. There is a broad beam covering the whole of the continent, and spot beams covering smaller areas. Each of the 15 transponders can be switched to provide either broad or spot coverage.

exponentially.

Each of the Aussats carries two types of TWTs: the lower power tube which produces 12W of saturated RF power and uses an oxide coated nickel cathode, with a current loading of 100mA/cm2; and the higher power tube which produces 30W of saturated RF power and uses an "M"-type coated dispenser cathode, attaining a current density of about 600mA/cm2.

The higher power tube is quite different from the lower power tube. Because of the high power at high frequency, the required cathode current could not be produced by an oxide cathode without exceeding the safe limit of cathode current density. Reliability of operation and an adequate life expectancy were additional concerns in choosing a cathode. To maintain safe operating temperatures in the output circuit, fins have been attached to the tubes, to conduct the heat directly to the TWT baseplate.

Both types of TWT have temperature-compensated rare earth cobalt magnets, to eliminate efficiency degradation at high temperature.

Each satellite has six high-power TWTs (four active and two spares), and 13 standard-power TWTs (11 active and two spares).

Each set comprising a receiver, frequency converter and travelling wave tube is called a "transponder".

The transponders are powered by means of solar panels or, when the satellite is in eclipse with Earth being between the sun and the satellite, by Ni-Cad batteries. The TWTs are the main DC load on the satellite, consuming 97% of the total payload power. Since the TWTs are also the heaviest payload components, the satellite's payload mass and power requirements are largely dictated by its 19 TWTs.

From the TWTs the signals go through output multiplexers, which combine the channels for retransmission through the transmit antennas.

Designing the satellite's antenna system was critical and a careful balance had to be achieved between its performance, mass and complexity.

The system had to make it possible to transmit and receive in 15 channels of 45MHz width each, within the Ku band, without mutual interference. It also had to be able to handle seven transmit and three receive beams of adequate directivity.

To achieve this the antenna system includes three specially-designed reflector sets. Each reflector set consists of two offset paraboloidal surfaces, one behind the other, with displaced foci. Each surface is impregnated with a wire grid orientated orthogonally (at right angles) to the other. Thus a beam polarised in one direction will be either transmitted or reflected from one of the surfaces and will be transparent to the other surface.

The two surfaces can thus share the same physical aperture and focal length, while each has a physically separate focal region with enough room for independent feed arrays.

A total of 27 rectangular feedhorns, arranged into 9 independent arrays, feed these reflectors to provide the 10 communications beams. Aussat 3 has two additional horns covering the south-west Pacific.

Aussat

The reflectors have diameters of 61cm, 100cm and 110cm, employing no more than four feeds in any one array.

With larger reflectors, higher directivities could be achieved. However, the more complex beam-forming networks that would be required would cause higher losses and these would negate any advantages in gain. Also, the greater mass of the larger reflectors would necessitate using larger quantities of fuel within the satellite to place it in orbit and to adjust its orbit and orientation, reducing its useful life.

The antenna system is designed for strength, low mass, and thermal stability. The structure is mainly graphite and the reflectors are fabricated from Kevlar honeycomb material, and covered with Kevlar facesheets etched with copper to produce the polarisation grids.

Any of the transponders can be switched in various ways to a number of antennas, providing both spot and broad coverage beams. The broad beams are normally used for the standard power transponders and the spot beams for the high-power units.

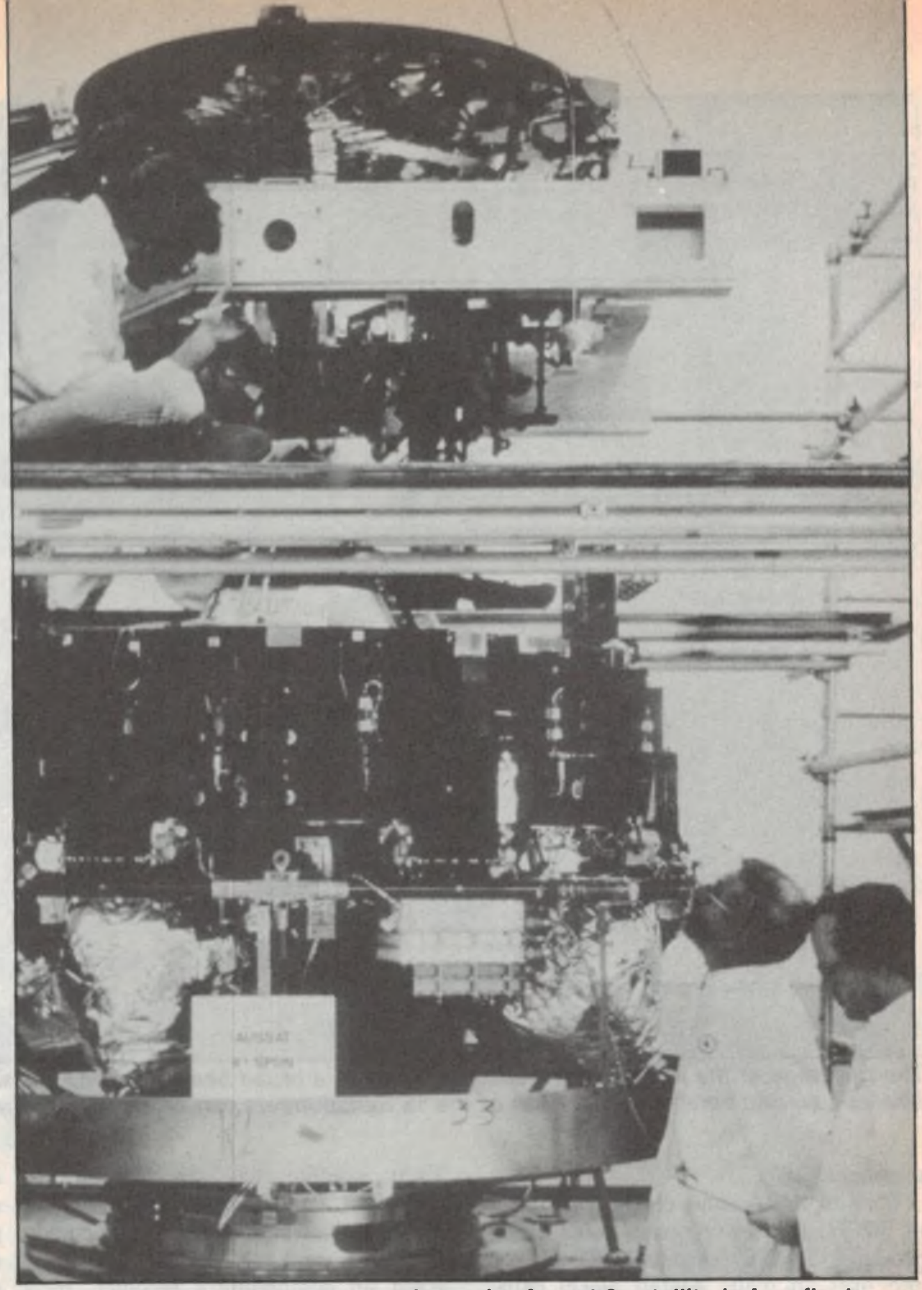
The broad beams afford national or wider than national coverage, and are intended for professional use, because to adequately receive and process the much weaker signals coming from those beams, large-diameter, high-gain ground antennas have to be employed.

The spot beams are intended for domestic reception, requiring smaller and cheaper receiving equipment.

They cover different sections of the continent and, in the case of Aussat 3, also of New Zealand and the southwest Pacific. They are used for downlinks only, except for Papua New Guinea for which a spot beam provides both up and downlink. Small spot beams will cover Lord Howe and Norfolk Islands.

The high-powered transponders are used for TV and radio transmission whereas the low-powered ones are used mostly for telecommunications, voice and data transmission by organisations such as Telecom, AAP, the Federal Department of Transport and Communications, and by state governments for various community services including education, health and police.

The single largest application at present is broadcasting radio and TV directly to private homes in remote outback locations throughout Australia. Known as the Homestead and Community Broadcasting Satellite Service



Functional adjustments being made on the Aussat 3 satellite before final assembly took place, at Hughes Communications.

(HACBSS), this service is being provided by the Australian Broadcasting Corporation (ABC). HACBSS comprises TV programming, two AM radio services and a stereo FM radio service. A teletext program and information service is also provided.

HACBSS uses the high-powered 30W satellite transponders, making it possible for TV signals from the satellites to be received on relatively small and low-cost, receive-only, earth stations. Thus it is possible to receive TV broadcasts from the Aussats with antenna dishes ranging in size from 1.2m to 1.8m in diameter. The entire receiving and signal decoding equipment required costs about $2500 retail.

The establishment of HACBSS, on 26 January 1986, brought radio and TV to an estimated 650,000 people living in remote areas of the country who, prior to the advent of Aussat, had little or no radio or TV services.

Another main user of the Aussats is the Department of Aviation, which has contracted for a total of four 12W transponders. They are being used to establish a network of voice and data links between 46 air traffic control facilities and 55 unmanned VHF air-to-ground facilities throughout the country.

These links will be fully duplicated to provide high reliability. They will include one or more pairs of antenna dishes, each dish of a pair pointing at a different satellite, at 101 locations. Each of the pairs of dishes will receive and transmit identical data and, by means of automatic diversity switching, will ensure selection of the signal of highest quality at all times.

Belrose in Sydney, NSW, is one of two control stations known as tracking, telemetry, command and monitoring (TTC&M) stations, from where the orbiting satellites are tracked and their position and orientation adjusted as necessary. The other TTC&M station is in Perth, WA, acting as a back-up for Belrose.

There are also six unmanned major city earth stations located in Canberra, Melbourne, Adelaide, Brisbane, Hobart and Darwin. These are designed to provide "gateway" access to the satellites, to customers of Aussat who cannot or don't want to instal their own earth stations. The transmission is then completed in the conventional way through a microwave or land-line connection from each earth station to customer premises.

One of the big questions in satellite communications is who is going to get what? In other words, who will be allowed to use the satellites' transponders?

This depends partly on the number of transponders, on their power, and on their bandwidth. Predictably, not everybody is equally happy with the transponder allocation as it stands. But this could change in the near future.

Commercial TV stations are not allowed to provide direct broadcasts via satellite to domestic users at this stage, but can use the satellite to relay signals to other TV stations.

So far there are only two private TV networks which are allowed direct satellite broadcasting to private, but other than domestic users, such as hotels, clubs and pubs. They are Sky Channel and Sportsplay, both of Sydney, which transmit special programs such as sports events, news and entertainment.

At present, only one privately-owned TV station, Golden West Network, of Western Australia, is allowed direct satellite broadcasting to domestic users. GWN broadcasts general commercial programs to homesteads throughout Western Australia, outside Perth.

Aussat 3 will have an estimated life of 10 years. Aussat 1 was deployed in August 1985 and Aussat 2 in November of the same year. Both Aussat 1 and 2 are expected to have each a life of about 7.5 to 8 years. Thus all three satellites will be operating during the next few years. The next generation of Australian communications satellites is to be launched in 1991 and 1992.

The Aussat company's general manager, Graham Gosewinckel, said the idea of developing a launch site at Cape York in northern Queensland is very good and quite sound and realistic. Such a facility would probably be of great benefit to Australia and the idea is not merely a politician's gimmick. He said the next generation of Australian communications satellites could be launched from a site at Cape York.

Gosewinckel said it was fitting that the launching of Aussat 3 coincided with the 31st anniversary of the introduction of television to Australia.

Aussat has completed the design of its second generation satellite system planned for launch in 1991/1992. The system will comprise two much larger satellites with increased communications carrying capacity and higher power.

Apart from ensuring the continuity of the established services, the second generation satellites will carry L-band transponders to enable the provision of a domestic mobile satellite service. This service is to be available by 1992 and could be the first of its kind in the world.

Electronic vehicle ID system

A new electronic identification system available from Westinghouse Systems allows railways, trucking and shipping companies to track automatically and manage very large numbers of freight cars, trucks, containers or other modules.

Incorporating technology developed over the last 14 years by Amtech Corporation in the USA, the new Westinghouse "Shadow" system uses electronically encoded ID "tags" which are attached to the vehicles or containers. The tags are scanned and interrogated using a low power UHF radio beam, and employing the principle of modulated backscatter.

The scanner (or interrogator) sends out a low level (> 1 watt) unmodulated RF signal. Any of several antennas may be used, with the beam shape being tailored to the application. A tag entering the RF beam modulates the signal with the message encoded in its single chip circuitry. The scanner detects the modulated reflected signal and decodes the message (128 bits, or 24 alphanumeric characters). It then either stores the message or forwards it to a computer system. Proprietary circuitry eliminates false or incorrect readings of tags in close proximity to each other.

The tags are not transmitters and do not contain components to generate radio frequency signals. Rather, they act as field disturbance devices, modifying slightly the signal transmitted by the scanner and reflecting it back. Since the tags do not radiate signals by themselves, electromagnetic radiation is reduced, overall reliability is enhanced, and tag costs are minimised.

The Shadow system not only delivers reliable performance, but also offers a number of other operational benefits. The system's RF-based design gives it an inherent advantage over optical and inductance based systems. Operation is substantially unaffected by dirt, snow, fog, rain, ice, darkness, electrical noise, other RF signals, temperature extremes, vibration, or similar environmental conditions that pose major problems to other systems.

Operating range is up to 40 metres for the battery powered tag, where tag power is supplied by a 15-year-life lithium battery. A passive tag with a range of up to 10 metres is also available. The system can detect tags at relative speeds exceeding 200kph, while other systems begin to lose reads at 80kph.

The tag or transponder is maintenance free and compactly packaged in a low profile, easily mountable, and durable Lexan case measuring only 238 x 60mm. The tag's 128 bits of information may be either fixed or reprogrammable, and may be programmed either in the factory or the field. All major functions are embedded in a single custom IC chip, resulting in very low power consumption, enhanced reliability, and a low unit cost that helps make the system affordable.

In both test and commercial applications, the Shadow system has demonstrated extremely high accuracy. Data for thousands of reads show the system's capture rate (its ability to detect or sense a tag) approaches 99.99% (fewer than one error per 10,000 trials), while its ability to accurately read the tag's information approaches 100% (errors are virtually unknown). By comparison, optical systems, depending on the application and on maintenance (cleaning), typically achieve 60% to 80% read rates.

Another of the system's advantages is its sophistication and versatility in handling and processing its data. As each tag is read by the system, the 128-bit message is decoded multiple times and compared for accuracy before being stored. The Shadow system employs capture and hold logic, to prevent unwanted multiple reads of the same tag. Once read, a tag will not be re-read until at least one other tag has been captured. When several tags in the antenna beam simultaneously, only the one with the strongest signal is read. Other tags are read as their signals take precedence. A real time clock in the scanner provides time and date information on each read.

The scanner will store tag reads indefinitely (up to 5,000 messages with available 48K memory) should communications to an external processor fail, eliminating the need for a back-up processor. Output from the scanner is via a standard RS232C serial communications interface, and in standard ASCII character format, permitting interface to virtually any computer system. Two additional ports are provided, permit-

Closeup of a "Shadow" tag attached to a freight car.

ting a variety of interface configurations.

Early in 1987, extensive tests of the Shadow system were carried out by the Atchison, Topeka and Santa Fe Railroad in its intermodal freight transfer centre in Albuquerque, New Mexico.

Amtech personnel put battery-powered tags on containers and chassis. Containers were tagged on the top right front corner and chassis on the landing gear. Using the Amtech field programmer, each tag was programmed with the identification code of the container or chassis respectively.

Railroad personnel Kenneth T. Faust and Daniel Crellin set up the field test to simulate "worst-case" conditions. They parked containers and chassis alternately in an uneven row, simulating twenty-foot containers between two forty-eight-foot containers, to put the greatest demands on the identification system.

Amtech's mobile inventory vehicle was a pickup truck with the special scanner equipment built in, designed to take inventory as it is driven up and down the rows of an intermodal yard. In the truck bed were a high antenna to read container tags and a low antenna to read chassis tags. In the cab was a keypad data entry terminal so the operator could read and type in identification codes of any containers that did not have tags. (This would be used to enter identification codes of untagged equipment if, for example, the Santa Fe Rail road equipment all bore tags for automatic identification, but equipment owned by others did not). Also in the cab was a radio transmitter that sent the retrieved identification data back to the computer system.

In the course of two days of testing, the mobile inventory vehicle was driven by the test row of containers many times. For each run, the driver kept the vehicle at one steady speed, from two to thirty mph. For each run, the driver also kept the vehicle at one measured distance from the front of the container row, from four to fifteen feet.

As the system transmitted identification codes to the computer, the codes were printed out. They were verified by comparisons to the codes written on the containers.

The mobile inventory vehicle was found to be 100% accurate and effective in identifying containers and chassis at speeds from zero to 15mph and up to 10 feet from the front of the test row. It was also found that containers (excluding chassis tags) could be read at speeds up to 30mph.

Following up on the results from the co-operative test with the A,T & SFR. Amtech demonstrated the system to members of the shipping and defense industries at the American President Lines facility in Oakland, California later in February. Containers were arranged to simulate a "worst-case" configuration, as in the Atchison, Topeka and Santa Fe Railway tests. Results were perfect: no errors or omissions in dozens of trials, over a period of two weeks.

More recently, a further test has been carried out at the AAR Transportation Test Centre in Pueblo, Colorado.

A train consisting of approximately 80 cars was arranged to pass an Amtech Shadow Identification Reader between 80 and 100 times a day, and fast speeds varying from 35 to 45 mph. On this train 52 rail and and 3 locomotives were equipped with tags. Each day, data collected by a local computer was dumped and analysed by the AAR.

So far 40,000 tags have been read with no errors, giving an accuracy of 100% which is unheard of in the industry. This test is being continued for another five and a half months. In this period of time over 1/2 million tags will be read.

Further information on the Shadow System is available from Westinghouse Systems, 80-86 Douglas Parade, Williamstown 3016. EA

IBM's Wangaratta plant now using SMT

IBM is now operating a surface mount PCB plant in Wangaratta, Victoria, with the finest equipment currently available for the job. The process is fully automatic, with only some odd-man-out components mounted manually. The plant permits low-cost and high-volume production to an extent not yet achievable elsewhere in Australia.

by PAUL GRAD

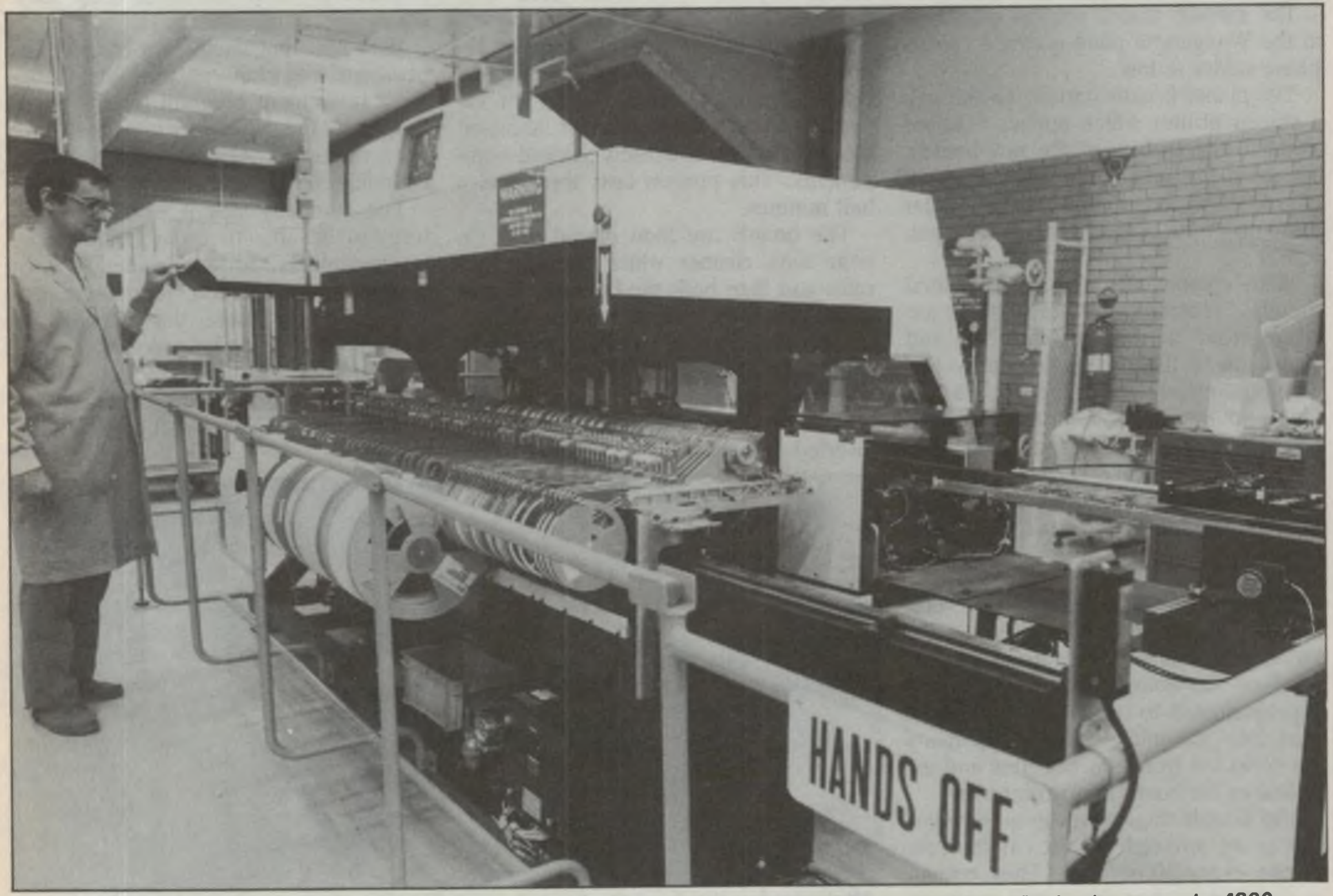
A group of media and Federal Government representatives from Canberra, Sydney and Melbourne had a pleasant day recently as guests of IBM Australia. They were invited to see the company's upgraded computer assembly plant in Wangaratta, Victoria.

The visitors converged to Wangaratta in four Cessna Citation aircraft carrying about 10 people each. They were received by the Wangaratta plant manager Bern Clarke and officials of IBM's parent company in the US. Two Japanese visitors from IBM Japan were also present.

The company wanted to show us its latest-model SMT (surface mount technology) production equipment — "the Rolls-Royce of that type of machinery", as an IBM official put it — at its Wangaratta plant, where components are surface mounted on planar boards. It has recently added a $6.3 million investment in the plant's new production systems, about 18 months after it first started producing planar boards there.

In surface mount technology the components are soldered directly to the front of the board. In the old pin-in-hole technology the components' pins are drawn through holes in the board and soldered at the back. The new technology permits fitting the components into a smaller space on the board and in future will permit using both sides of the board.

The Wangaratta plant employs about 100 people and has the capacity to produce up to about 500 planar boards a day, depending on their size and com-



One of the high-speed SMT pick and place machines at IBM's upgraded Wangaratta plant. Each places up to 4800 components per hour, with an accuracy of 0.1mm.

plexity. Each board contains about 400 components on average. Some of them have six layers, four signal and two power. The largest currently produced at the plant measures 406mm by 305mm.

The planar boards' production is now fully automatic, except for the case of a few unusual components, which are mounted manually.

Also, the production line was designed to furnish products with zero defects using the concept of continuous flow manufacturing. This entails establishing several inspection stations along the line, instead of only one at the end of the manufacturing cycle.

The boards coming out of the plant are incorporated into IBM's new System/2 personal computers, models 30, 50 and 60, which are produced in the same plant. In early 1988 the plant will also be producing the System/2 model 80.

During the past 12 months the Wangaratta plant has produced IBM PCs, including the XT, AT and System/2, of which about 40% were exported to countries in the Asia Pacific region including New Zealand, China, South Korea and Southeast Asian countries.

The surface mount process employed at the Wangaratta plant is called vapour phase solder reflow.

The planar boards initially go through a screen printer which applies a solder paste to the surface of the raw boards. There is a screen for each type of board, designed to place the solder paste on to the board in the desired pattern.

Next, components such as integrated circuits, resistors and capacitors are taken from a row of cassettes and placed on to the pasted boards by two preprogrammed, high-speed placers. These operate to an accuracy of 0.1mm and are capable of placing up to 4800 components an hour.

A third machine then places large scale integrated circuits such as memories on to the board, at the rate of 2400 per hour.

The operation of these placer machines is quite impressive. To ensure accurate positioning of the various components on the boards, the placing speed is programmed to take the components' sizes into account. Larger components are collected from the cassettes and attached to the board at a slower pace.

The boards then travel in a conveyor belt to an infrared furnace, at the rate of one every 30 seconds. They remain in the furnace for about four minutes, during which the solder paste is cured.

Here an automatic screen printing machine applies solder paste to the raw planar boards, before the components are placed.

The temperature in the furnace is then gradually raised to "prepare" the boards for the next manufacturing stage, the vapour phase solder reflow, in which the temperature reaches about 220°C.

In the vapour phase solder reflow process, a tray containing a solvent, which boils between 210°C and 220°C, is heated to provide a saturated vapour cloud. The board is placed in the cloud and the hot vapour condenses on to it. Latent heat flows into the metal contacts on both components and board, causing the solder paste to melt or reflow. Bonding occurs over the full area between contact surfaces. The hot vapour penetrates even the most inaccessible gaps between densely packed components. This process lasts three and a half minutes.

The boards are then placed in a vapour tank cleaner which sprays, saturates and then boils the boards in Freon at 43.5°C. This process loosens and removes excess flux. Before emerging from the cleaner the boards are dried in hot Freon gas at 30°C.

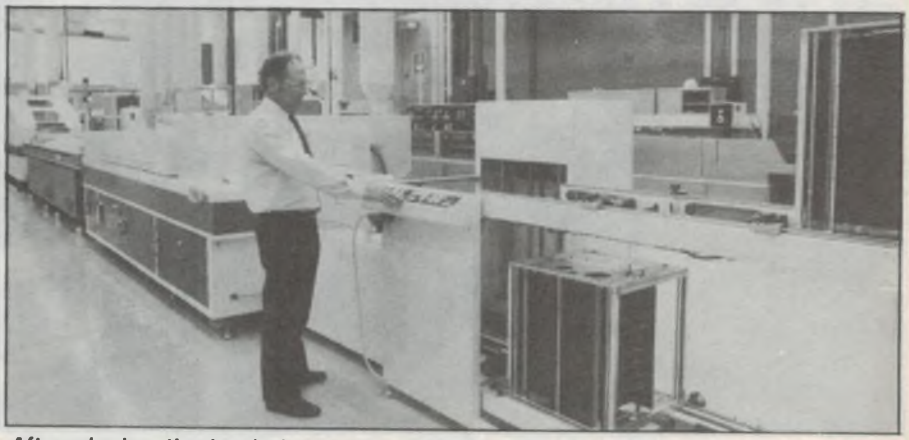
Some of the components are then still inserted into the board according to the old pin-in-hole technique, and irregularly shaped components are assembled manually.

With the entire manufacturing process being fully automatic, except for the odd component, the personnel at the plant are engaged mainly in testing and quality control.

Although suitably high-quality boards are produced in Australia by a few companies, these are not yet capable of the low-cost and large-volume production required by IBM and some other leading computer manufacturers.

IBM said that technology-transfer has been an important part of the company's investment program for the plant. Several of the company's engineers have been trained in Australia and overseas, including the US and Japan.

The company said it expects, in future, to be able to order boards from local suppliers, to supplement its own Wangaratta production. Its training program aims to make this possible by making some of its personnel fully familiar with the surface mount production and testing techniques necessary to achieve IBM's quality and cost requirements. EA



After placing the loaded planar boards pass through the vapour-phase soldering unit, then through solvent cleaning.

HIFI REVIEW:

Audiosound's 8025 mini monitor speakers

The latest product from true-blue Australian hi-fi manufacturer Audiosound Labs is the 8025 "mini monitor" compact speaker system, which replaces the previous Motet 8024 system. It offers improved performance, at a price which compares very well with imported compact systems.

There aren't that many local Aussie manufacturers still going in the hi-fi market. Walk into the average hi-fi store, and the odds are you'll have a hard time finding anything that isn't made in Japan, Taiwan or Korea. Even a lot of the up-market "European" brands are now being made in these countries, for fairly obvious economic reasons.

Speaker systems are generally no exception. There's precious few of these made in good old Aussie either — something that seems to me pretty ironic in view of the world-recognised and pioneering work on speaker system design which has come from Australia. Like the work of Neville Thiele and Dr Richard Small, which has formed the basis of many overseas designs.

Audiosound Laboratories and its founder Ron Cooper have been bucking this trend for quite a few years now, valiantly flying the "Australian Made" flag. And they're still going strongly; but it hasn't been easy, battling to be seen and heard amid the ever-growing hordes of imported products and their high-powered marketing campaigns.

I went to school with Ron, and I know he's been almost constantly striving to achieve "the ultimate" in high quality sound reproduction ever since we were both in short pants. I've also watched while he's slowly but surely carved out a slice of the market. Not with a big fanfare and fancy marketing, but quietly and in the old fashioned way: by working hard and building a solid reputation for product quality and reliability.

Mind you, Audiosound is still hardly a household word, although you'll find the company's equipment and speaker systems used all over the place by professionals in the know. The ABC installed Audiosound professional 8066 monitor systems in its Sydney Opera House control rooms, for example — choosing them in preference to top-drawer imported systems, after independent testing.

Despite this many hi-fi dealers still seem reluctant to stock Audiosound's systems, perhaps believing that customers either don't want to buy an "unknown" Aussie product, or will have more confidence in big-name imports. So there's a certain amount of *dealer* resistance, at least — although even this is slowly breaking down.

Anyhow, enough of the rambling introduction. Audiosound is very much alive and well, and living at North Curl Curl on Sydney's northern beaches peninsular. And the company's latest product is the new "mini monitor" 8025 compact speaker system, as pictured. I've been listening to a sample system for a week or so now, and putting it through its paces.

The 8025 system consists of a pair of compact "bookshelf" style enclosures, measuring 370 x 162 x 280mm and finished in oiled walnut veneer. That's real wood veneer, by the way, not vinyl. The critical parts of the enclosures themselves are made from very dense MDF material.

For those who wish to have the speakers free-standing rather than on bookshelves, there's an optional pair of stands to raise them about 37mm above the floor — just below ear level when you're sitting down in a typical lounge chair. The pedestal section of each stand is finished in the same walnut veneer, to match, and the stands also angle the speakers upwards by about 5 degrees.

Inside each enclosure is a two-way system, with a 95mm low frequency driver and a 25mm dome tweeter.

The enclosures are of the vented type, designed in accordance with Neville Thiele's now classic engineering paper. This makes the speakers rather more efficient than the typical sealed type, and more suitable for use with low to medium power amplifiers.

Audiosound's proprietary bass driver features a vented magnet system for improved low end response, and a twin cone which is apparently well damped to ensure smooth midrange performance. The voicecoil is wound on an aluminium former, to allow operation at higher power levels than would otherwise be possible.

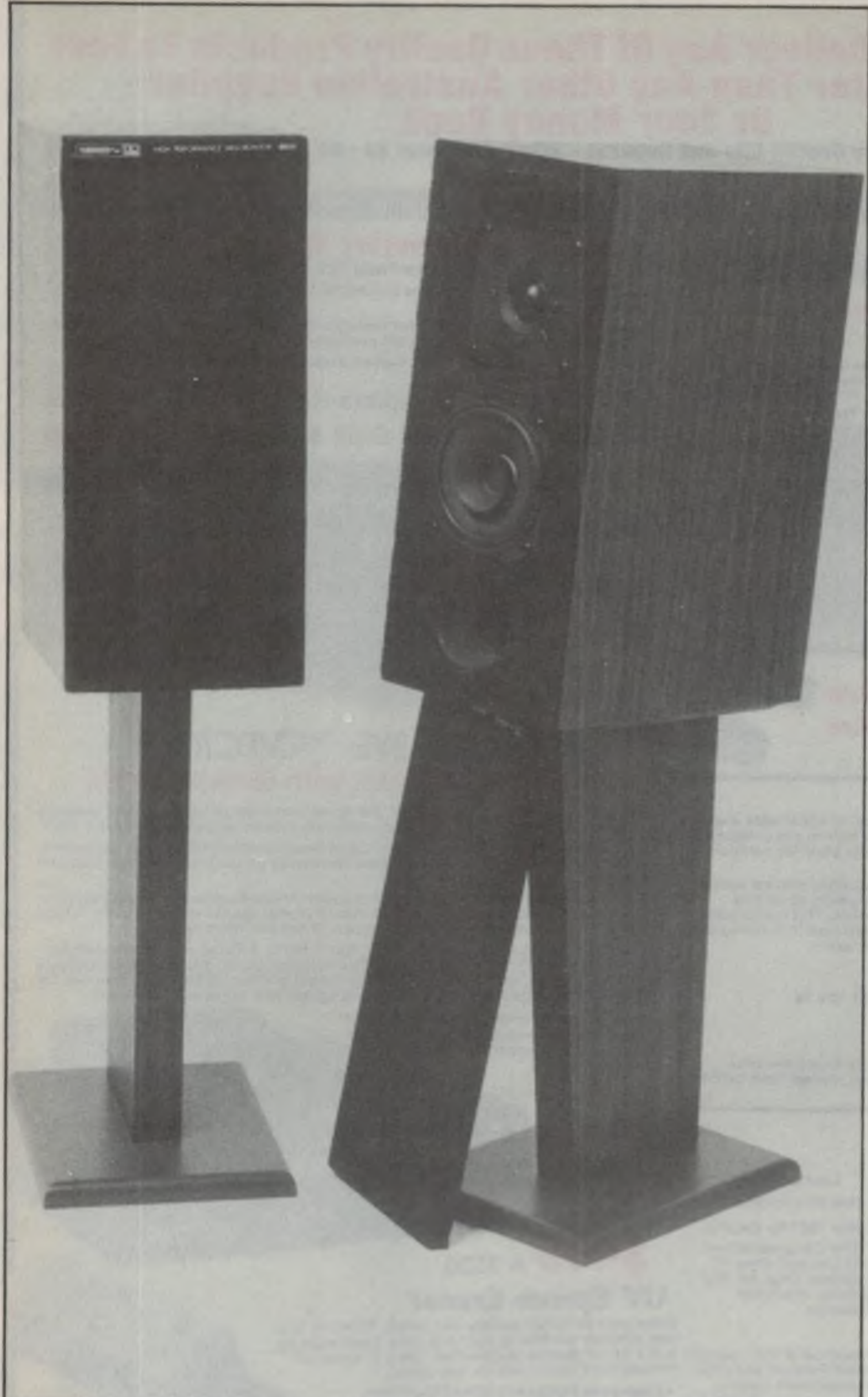
The bass tuning vent is L-shaped, and in his notes which accompany the system Ron Cooper points out that this helps brace the enclosure internally and reduce panel vibration. The front baffle of the enclosure is also stepped, with the tweeter mounted about 20mm behind the woofer to ensure that the two are accurately phased. The baffle front is covered with felt, and bevelled around the tweeter to reduce diffraction effects. The grill frame is also bevelled internally, to match.

The dome tweeter used in the 8025 is one that Audiosound has used in many of its designs, the HF8. It is a particularly smooth and efficient unit, which emerged from tests carried out at Sydney University a few years ago in conjunction with Richard Small (now with KEF in England).

The crossover network used in the 8025 is of the six element type, and uses air-cored inductors to ensure that no distortion is introduced even at the higher power levels. Crossover is at 2.5kHz.

The rated sensitivity of the enclosures is 84dB SPL (sound pressure level) at 1 metre, for 2.83 volts input. This makes them suitable for use with amplifiers having an output of 10-40W per channel — or higher powered amplifiers providing you're careful. The nominal impedance is 8 ohms, and rated frequency response is from 50Hz to 20kHz.

A quick instrument check of the sample 8025 system showed a very smooth response overall. The crossover region



An 8025 system with one grille unclipped, showing the drivers.

was especially smooth, and the mid-treble response generally free from peaks or other colouration. The only minor effect I could find was a small colouration "edge" evident at around 400Hz with both speakers, but this only appeared at higher power levels. I somehow had the impression that it was associated with the woofer's small second cone.

The bass response was again very smooth, with only a small peak evident at 50-60Hz. This amounted to less than 2dB, and is fully predicted by Audiosound's design calculations. The vent system seems to limit air velocity quite efficiently, and provides good damping.

The response naturally falls off below the peak, but still seems quite useful down to about 40Hz. This makes it respond quite well to modern amplifiers with a "bass equalisation" LF boost facility, to extend the lows. (But don't tell Ron Cooper if you do this — he believes it's cheating!)

Needless to say, I also listened to the 8025 system doing what it's designed to do: play music. In fact I tried it out playing a wide range of material, from my own favourite CDs of classic organ, instrumental and orchestral music to rather more popular and punchy stuff — even a bit of rock.

The results were very satisfying. The system seems to be very well balanced in a tonal sense, and also very crisp and clean. There was no trace of the muddiness often found in smaller speaker systems. In fact the 8025 has a much "bigger" and more open sound than you'd expect from such modest enclosures, and I don't just mean it's louder by virtue of the higher efficiency achieved by venting. It also has a less "forced" sound, more characteristic of larger systems.

By the way, when playing music I couldn't detect any evidence of the small "edginess" noted earlier at higher levels around 400Hz, with the tone testing. In fact the sample 8025 system gave very clean reproduction right up until it hit obvious overload, as shown by "cracking" on bass peaks. By then the sound volume in my loungeroom had well and truly reached the antisocial level, anyway!

The only minor worry I was left with concerns the 8025's optional stands. These have quite a small base area, and seem to me to provide barely enough stability — at least when they're standing on carpet. I think they'd be a bit of a worry if you have small kids. But I can see why Audiosound has made them the size they are, to provide the smallest possible "footprint".

On the whole, Audiosound's new 8025 "mini monitor" system seems to me to be an excellent performer, delivering clean *big speaker sound* from very compact packages. At the quoted price of $889 for the pair of enclosures and a further $130/pair for the optional stands, it appears to be very competitive with imported systems of similar size and/or performance.

Well worth a listen, in other words, even if you have to search around a little to find a hi-fi dealer who can give you a demo. Like other Audiosound products, it's only available from "selected hi-fi dealers" — which unfortunately still means all too few.

If you have difficulties, I suggest you contact Audiosound Laboratories directly, at 148 Pitt Road, Nth Curl Curl 2099 — or telephone (02) 938 2068. I'm sure Ron Cooper and his crew will be happy to help. (J.R.)

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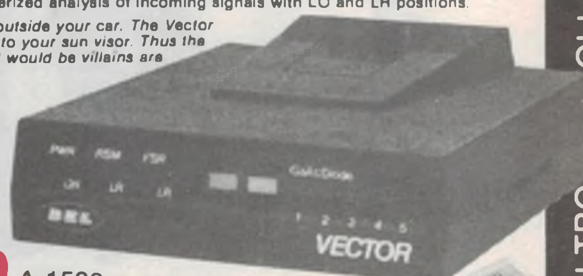

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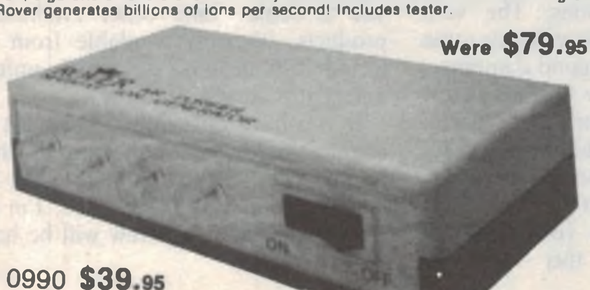

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• 60 watts per channel into 8 ohm loads • Very low noise on all inputs - better than CD performance • Very low distortion • Excellent headroom • Tape monitor loop • Tone controls with centre detent and defeat switch • Mono/stereo switch • Toroidal power transformer • Easy-to-build construction • Very little wiring.

Performance Specification

Power Output — 8 ohms 62W **Distortion** - Less than .0% at 1kHz. **Frequency Response** - Phono Inputs - RIAA/IEC equalisation within + - 0.5db from 40Hz to 20kHz Line Level Inputs — -0.5db at 20Hz and -1db at 20kHz **Input Sensitivity** - Phono 1kHz -4 3mV • Line Level - 270mV **Hum & Noise** - Phono - 89db • High Level Inputs - 103db. **Tone Control** - **Bass** - + -12db at 50Hz **Treble** - +-12db at 10kHz. **Damping factor** - At 1kHz and 30Hz - greater than 80 **Stability** — Unconditional.

K 5060 **$299**

Beginner Constructors Can Build this Amplifier Kit — It looks terrific and will last you a lifetime. **Save $200 or More on comparable performance commercial units.**

"This New Amplifier offers a standard of performance far ahead of anything we have previously published and ahead of most commercial Integrated Stereo Amplifiers".

"It is half to one third of the cost of an imported Amplifier with equivalent power output and performance". *Says Leo Simpson Managing Editor Electronics Australia Magazine.*

The reproductive purity of these speakers simply amazed us. The secret, of course is the DANISH VIFA Drivers. VIFA drivers are used in many top selling imported systems such as Bang & Olufsen, Rogers, Mission, Jamo, DCM Timewindow etc.

Build These Fantastic New Playmaster HiFi Loudspeakers

See Electronics Australia Sept '86

$449 full kit K 5090

If your budget won't run to the $600 to $800 needed for a fully imported pair of equivalent speakers, these are the ones to go for.

Exhilarating Sound Performance

Brilliant Digital Headphones

Incredibly Comfortable

• Utilizes newly developed flat disk vibrator copper clad aluminium wire voice coil and Somarium cobalt Magnet. The resultant reporduction is outstanding. • Impedance 45 Ohms. • Maximum input 400 mW
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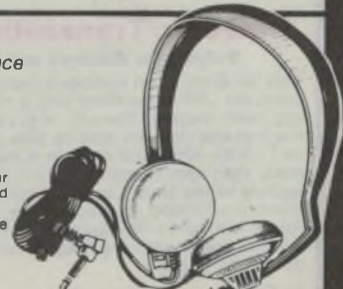

C 9010 .. .. **$39.50**

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Just Imagine a Security/Alarm System you can Install in about an Hour — Uses No Wiring or Cables and Costs Less than $1 for the Mounting Hardware

Fantastic UHF 305MHz Microprocessor Control Wireless Security Alarm System

Commercial grade, quality alarm systems are expensive — Just phone one of the "Name" security firms and get a quote for your home—our estimate is that it will be anything up to $1,000 just for the equipment-**then there is the installation**-countless holes punched through walls, miles of wiring and a day or two of installers labour and **that's around $25 per hour these days. Hardly worth the effort is it? After all what have you got to loose?—Only the Video Player, CD Player, Camera, Hi Fi, TV, Jewellery and so onll**

Well all that is now changed—with our brilliantly engineered Home Guard Wirless Security System Read On—

Take It With You If You Move

Apart from the flawless operation of the Home Guard System—One of the great features is its application with rented or leased premises—Lets face it, money spent on installing a wired system in your Home or Office, Factory etc. is irrevocably lost when you move on. With the Home Guard you simply take it with you.

This alarm system is a brand new design that features completely wireless connection to all accessories, even the reed switches. Think of how easy it is to install a "Wireless" alarm system. The benefits are endless, e.g. arming your Flat or Townhouse with an alarm you don't need to run wires through the roof or drill great holes through your walls. When moving house the alarm is simple to dismantle and re-install elsewhere.

The system divides protected areas into either perimeter zone or internal zone, programmable by dip switches in each transmitter/detector. **Pocket remote control** can simply arm or disarm your house perimeter from your bedside when retiring etc. this allows essential protection while cancelling internal zone as desired. Each transmitter/detector unit can be programmed into interior or perimeter zone. Zones can be programmed for instant or delayed trip. The system has a built-in ear piercing siren for intrusion and panic alarm signals. It also has another dry relay output with normally closed, normally open contacts for connecting to other alarm reporting devices such as telephone dialer, additional outdoor siren etc.

System Is Comprised Of :

Main Control Receiver

S 5265 .... **$349**

Features:

- Wireless reception of external or internal sensors or detectors.
- Selectable home or away modes for selecting internal and external arming or just external to allow movement inside the building
- Built in Piezo electric siren gives different signals to indicate different functions.
- Sends signal down power line to activate one or more remote sirens.
- Programmable Arm/Disarm switch buttons.

The main control receiver runs on 240V AC with a 12V 1.2AH battery for emergency backup. All other units with the exception of the line carrier, run on a 9V battery each. The average life expectancy is approximately one year. System works around the 305MHz frequency where there is less chance of false alarm. The range of the unit is normally 80 metres in open space.

Alarm and Indication Sounds

Intrusion Alarm — Panic Alarm — Arm Tone — Disarm Tone — Exit Click Tone — Monitor Tone — Tampering Alarm.

Detector/Transmitter Unit (Reed Switch)

Suitable for Windows and Doors

This consists of an enclosed reed switch and compact UHF transmitter and a removable enclosed magnet. The unit is at rest when magnet and reed are side by side (within 25mm or 1 inch). When the magnet is moved away more than approximately 1 inch the alarm signals to the Main Control Receiver and the alarm is sounded. In practise the Reed/Transmitter is mounted on the door or window frame with the magnet on the moving door or window.

S 5270 .... **$55**

Passive Infra Red Movement Detector

Ideal for the lounge room, family room or hallways e.g. anywhere where an intruder is likely to pass through. Mounts up on the wall or on top of bookshelves etc. Detects movement within an area of 9M by 9M by sensing intruder body heat movement through the protected area Should not false trigger with the family cat or curtain movement etc. — as is the case with the cheaper Ultrasonic alarms.

S 5280 .... **$129**

Remote Piezo Siren

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.

S 5290 .... **$125**

Complete System Special Package Price

Comprising:

One S 5265 Main Controller
One S 5270 Reed Switch
One S 5280 Passive I/R Detector
One S 5285 Wall control unit.
Including Batteries

System Cat.No. S 5260...... **Value $579**

Accessories

Note: For larger installations your system may well require several Reed switches, movement detectors and 2 or more sirens. Also the remote door controller and or pocket remote controls could be very worth while accessories. The fantastic thing about the Altronic system is you simply add more detectors as you discover the need — no wiring, no expensive technicians, no modifications to equipment.

Hand Held Control Transmitter Unit

A real joy to use — keep it at the bedside table — allows you to, say, alarm the house perimeters when retiring or you can take it with you when you go out, arming your system after you lock the door. Unit is a function control transmitter — to send 4 different signals.

Off — To disarm the system before entering. **Home** — To instantly arm the system with 'Perimeter' detection only. **Away** — To arm complete system after a given exit delay time of about 40 seconds. **Panic** — To start an emergency signal whenever needed, in any mode.

S 5275 .... **$59**

Front Door Keypad Control Unit

This handy accessory virtually duplicates the function of the Master Controller unit but at a more convenient location i.e. just inside your entry door etc. System can thus be armed or disarmed without the need to go to Master unit. Especially handy for larger homes or offices.

S 5285 .... **$99**

Get a System for Mum and the Kids Full Security System

Fantastic system for this price. Frankly we were amazed at the performance of this very compact system.

Very simple to connect and operate - New Technology has enabled very compact overall dimensions (master unit only 180 x 100 x 65) hence ideal for concealing amoung book shelves etc.

S 5310 ~~$99~~ $75

Look At The Features

EXIT DELAY 30-35 secs. **ENTRY DELAY** 10 secs. **DC SOURCE** AC adaptor 240/9V DC Supplied **BATTERY BACKUP** 9V Nicad rechargeable- additonal cost S5024 $14.50. **AUTO RESET** 3 minute operate cycle and auto reset **RANGE** Reliable to 30ft (9M) **LOW BATTERY INDICATOR** included.

Accesories Included for the One Low Price

4 Sets Reed Switches for Window/Doors. 1 Roll fig. "8" cable. 1 External Type Horn Speaker. 1 AC/DC plug pack adaptor. Now there is now excuse for not Protecting yourself, your family and all your hard earned possessions!

Strobe Signal Lamp

Uses Xenon Strobe tube for High energy strobe flash output at a rate approx. 1 per second Fantastic light energy output for the DC power used. DC input 12V 320mA Dimensions 97 dia.90H

S 5450 **RED**
S 5455 **BLUE**

Were **$24.50**
NOW $19.00ea

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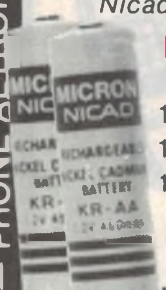


1-9	**$3.50**
10-99	**$2.95**
100up	**$2.45**

Why Pay $5?

Sealed Lead Acid Batteries

These rugged high performance batteries are ideally suited for systems where uninterrupted DC power is required i.e. Security Systems, Computers, Solar Power Systems etc.

Three Models To Choose From

S 5065	12V/1.2AH	**$22.95**
S 5067	12V/2.7AH	**$34.50**
S 5069	12V/4.5AH	**$45.00**

Fantastic for Heatsink Cooling with Amplifiers, Power Supplies, Inverters Etc.

DC Brushless Fan

Electronically commutated DC Motor ensures low vibration and ultra Long Life

120 x 120 x 38mm

Voltage	24V DC
Current	330mA
Speed	3100 RPM
Air Flow	23 C.F.M.
Noise Level	32dbA

F 1040
$29.98
4Up **$28.00ea**

Quality Long Life Hand Tools

All stainless steel construction with insulated handles. Ideal for the hobbyist and tradesman alike

Diagonal Cutter	T 2700	**$9.95**
Flat Nose Plier	T 2710	**$9.95**
Needle Nose Plier	T 2720	**$9.95**
Curved Needle Nose Plier	T 2730	**$9.95**

Buy the set of 4 for Only $30 and Save

Mylar Stereo Phones With Dynamic Mic

Simply Brilliant Mylar Stereo headset and Dynamic Mic combination. **Phones** 30-18KHz 28 Ohms, 6.5mm stereo Jack Max. input 400mm **Mic.** 84db, 600 Ohms, 6.5mm Mono Jack

$32.50 NOW **$29.50**

C 9050

Two Great Kits

Blowing Fuses Blowing Your Cool? You Need

The Electronic Fuse

K 2535 **$32.50**

All you do is clip the unit across the DC fuse holder (fuse removed), dial up the required current (max. 10A) and if the circuit draws more than this then the circuit "trips" or opens. Thus power is removed from the device.

Features: Fast blow - slow blow setting • Manual reset button • LED fuse tripped indicator • Operates off 1 single 9V battery (not supplied) • Two current ranges 0-1A & 0-10A • Any current setting available up to 10A • Current Settings easily adjustable via. a pot and calibrated scale. • Housed in a rugged Jiffy Box

A Must for prototyping and service work. No Electronic workshop should be without one.

Zener Tester

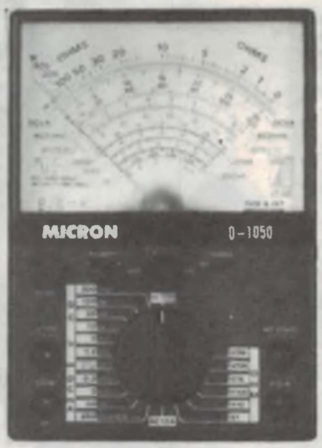
Used with your multi-meter - Reads exact zener voltage up to 60V. **K 2620**

$12.50

Precision Electronic Fet Multimeter For Laboratory Or Workshop

Going Up Next Shipment $89.95 Be Quick

• 10 Meg Ohm input • 12 Amp DC and AC Current Ranges • Centre zero Pointer Adjust for + and - readings • Single Range and Polarity Reversing switch • Power on LED indicator • Transistor Tester inbuilt • P-P calibrated scale



We're absolutely delighted with our laboratory FET VOM. The Q 1050 breaks new ground for an advanced, prescision analogue meter of this quality below $100. The Q 1050 has the advantage of digital multimeters i.e. insignificant circuit loading, high accuracy etc. without the misleading and erroneous readings that DVM's are famous for.

DC VOLTS
Ranges—0-0.3, 1.2, 12, 30, 120, 300, 1200V— 0-• 0.15, 0.6, 6, 15, 60, 150, 600V at Centre 0
Input Impedance—Approx 10M Ohm, 3M Ohm at 300mV range
Rated Accuracy—2.5% DC and 3.5% AC full scale on all ranges

AC VOLTS
Ranges—RMS 0-3, 12, 30, 120, 300, 1200V—Peak-peak 0-8.4, 33, 84, 330, 840, 3300
Input Impedance—Approx. 1M Ohm 80PF 2.5M Ohm on 3V Range

Rated Accuracy—50Hz—5MHz • 3%—**dB**—-10dB— •63dB at all AC ranges

DC CURRENT
Ranges—0-0.1 uA, 0.3, 3, 30, 300mA, 12A
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Rated Accuracy Within • 2.5% full scale all ranges

AC CURRENT
Ranges—0-12A

DC RESISTANCE
Ranges—

RX1	0-1K Ohm
Rx10	0-10K Ohm
Rx100	0-100K Ohm
Rx10K	0-10M Ohm
Rx1M	0-1000M Ohm

Centre Zero Pointer Setting Allows + and - Readings

Q 1050 **$79.95**

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Magazine Binders for Your EA's and ETI's

Holds 12 magazines, each on a spring out wire rod. Just the shot for each years set of EA's ETI's or any of your favourite magazines. **Cat. B 9999**

$8.50

Phone Double Adaptor 1/2 Price

P 0995 **$4.50**

High Definition Computer Monitor New 2 DIN Series 4

The New 2 DIN Computer Monitor has a high performance Non Glare CRTdesigned to reduce eye strain and improve concentration. Coupled with the non-glare screen is a rock solid Video display and high resolution characters.

SPECIFICATIONS:

Screen	Green Phosphor - Non glare 14
Front Controls	Power On/Off, Contrast, Brightness
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Bottom Controls	Horizontal hold, horizontal position
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Bandwidth	18MHz
Resolution	900 lines at centre screen
Input/Output Connector	RCA
Input	Composite Video 1V P-P

D 1115 **$229** This Month **$199**

Definitely Australias Best Value in a High Resolution Monitor

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$79.00

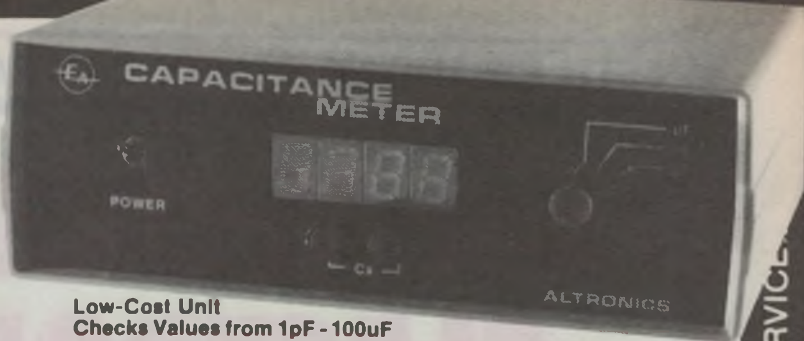
FEATURES:
* Output 3 to 30V at 1A * Short circuit protected * Load switching * Current limiting. Dual scale meter * Housed in our Deluxe "ABS" instrument case.

SPECIFICATIONS:
* Output Voltage - 3 to 30V * Output Current - 0 to 1 amp (fully variable) * Load Regulation - Better than 0.2% from 0 to full load * Output Ripple-Less than 2mV RMS. Cat. **K 3210**

Transistor Tester *For In Circuit Testing*

"NO NEED TO UNSOLDER SUSPECT TRANSISTORS"

FEATURES:
• Tests both NPN and PNP transistors in circuit at the touch of a switch • Tests Diodes and SCRS as well • No need to switch between NPN and PNP—its automatic. Two LED indicators are used to show condition of device being tested. **Altronics Kit Feature** - "ABS" jiffy box and test leads supplied. **Cat. K 2530**



Low-Cost Unit
Checks Values from 1pF - 100uF

Upgraded Digital Capacitance Meter

The readout consists of a bright 4-digit LED display and the full scale readings for each range are 9999.9nF and 99.99uF. No adjustments are necessary when taking a reading. You simply connect the capacitor to the test terminals and select the appropriate range. The circuit can accurately measure capacitance down to one picofarad (1pF). This is made possible by the internal nulling circuit which cancels any stray capacitance between the test terminals or test leads. So when you measure a 5pF capacitor, the unit will display 5pF.

K 2522 .... **$79.00**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

Dead easy to build and (even better) there are only 3 electrical connections required to the car wiring system.

K 4010 .... **$39.50**

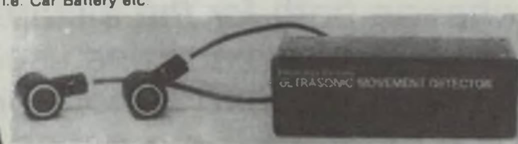
Screecher Car Burglar Alarm

This alarm drives off wouldbe thieves with an ear splitting modulated tone. Once activated it is near impossible to stay within the confines of the car.
Features: Entry Delay • Exit Delay • Alarm Timer • Lamp Flasher • Three second soft alarm reminder. Piezo siren produces modulated tone of 110db at 1 metre. Simple to build and install. **Two Sensor Inputs**

K 4360 **$39.95**

Ultrasonic Movement Detector

This Ultrasonic Movement Detector provides added protection against illegal entry via an open window etc. Connects directly to an alarm with a normally open input. Detects any movement up to 3 metres within an angle of 30 degrees. Will operate directly off 12V i.e. Car Battery etc.



K 4400
$29.50

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Sharpens up your picture when Copying Video to Video

Here's a **simple** but **effective** video enhancer that is super **easy to build** at a fraction of the cost of commercial models. Unit sharpens picture detail, and can actually improve the quality of a copy by amplyfying the top end of the video signal **K 5825**

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*65TH BIRTHDAY FEATURE — PART 2

From WIRELESS to ELECTRONICS

One sweeping change after another!

The past 30-odd years have been a period of drastic change both for the electronics industry and for the magazine itself. But no single development had a more profound and lasting effect than the emergence of solid-state technology. Engineers, technicians and hobbyists alike had either to adapt to it, or drop out!

by NEVILLE WILLIAMS

Back in the '50s and '60s, when it was all happening, there was no special exemption for the staff of *Electronics Australia*. We were very much at the technical cross-roads. Conditioned by decades of valve circuitry, and with a commitment to many thousands of like-minded readers, we had to absorb and interpret the new solid-state concept, without appearing to be over-anxious to abandon the old.

Ironically, from the earliest days of "cats-whiskers" and galena (lead sulphide) crystals, experimenters had dreamed about the possibility of somehow inducing crystals to amplify signals, rather than just detect them, thereby combining their reputed "sweetness" of tone with economy in battery drain. Occasionally, over the years, isolated experimenters claimed to have succeeded — without ever being to able to repeat their results.

At an academic level (see "The Beginnings of Solid State Physics", London, The Royal Society, 1980) the behaviour of electrons in solids had been the subject of speculation and research in Europe and elsewhere from the turn of the century. In Jan 1930, U.S. patent 1,745,175, issued to Dr J.S. Lilienfeld, documented what can now be classed as NPPN and PNNP transistors. A subsequent Lilienfeld patent (U.S. 1,900,018, March 7, 1933) showed an elemental NPN transistor operating in common emitter mode, and an P-N junction functioning as a variable capacitor.

But such had been the progress in valve-based technology over the same period, that the solid-state concept was virtually ignored by the electronics industry until after World War II. Only then, in mid 1948, with a new era of consumer electronics ahead and with the valve technology nudging physical limits, the frustrating half-century of solid state speculation and research was finally climaxed by the announcement of practical transistors. This was by three scientists attached to the Bell Laboratories: William Shockley, John Bardeen and Walter Brattain.

A further 10-odd years was to elapse, however, before their now historic announcement was translated into large-scale production and a new regime of practical, transistor based equipment. As it happened, Australian manufacturers and consumers alike were largely preoccupied with the introduction of television during that interim period, although key companies were positioning themselves for the coming solid-state revolution.

The new era arrives

Looking back to those early '50s, I can well remember the release of germanium signal diodes such as STC's ubiquitous GD3 and the Philips/Mullard "OA-" series. Unlike the earlier "Westectors" — basically miniature copper-oxide rectifiers — germanium diodes proved reliable and efficient from the outset, in a wide range of circuit applications.

They even removed much of the mystique from the traditional crystal set. One was denied the anticipation of trying this catswhisker with that crystal, in a search for an elusive super-sensitive spot. Over-the-counter germanium diodes worked first-up — and that was that!

I also remember a call from the late Graham Hall of Ducon, to say that he was sending over some sample silicon power diodes "that will supersede those bulky, inefficient valve rectifiers that you've been using in your receivers and amplifiers". This they certainly did!

The first transistors to reach our lab were odd point-contact and junction germanium types, of little immediate use for RF service but sufficient to permit a certain amount of basic "fiddling".

Our first "conversation piece" was a breadboard style receiver involving — as I recall — four of those early transistors, plus prototype audio driver and output transformers from RCS: simply a non-regenerative detector, followed by an amplifier stage driving two transistors in class AB push-pull.

Gain and selectivity were limited but, on the signals that it could receive, it produced useful output from a sensitive loudspeaker, while operating at 6V from four ordinary torch cells. The promise for battery powered equipment — portable and automotive — was obvious.

Progress in transistor design was thereafter mirrored in a number of simple constructional projects, culminating in a full-scale transistorised portable receiver, the "Transporta-7" described in February 1959. This comprised a vinyl-covered wooden cabinet and an inner metal bracket which supported the loudspeaker and two circuit boards, one carrying the tuner section, the other an audio amplifier with class-AB output stage.

It performed very well and I used it for some years as a casual portable, much as ones with present-day transistor receivers. The one-time experimenters' dream had become a reality: acceptable quality with economy of battery drain.

But old habits die hard. The issue carrying the design was ready for distribution when the company publisher suddenly realised that the poster had been overlooked — the one normally supplied for display by newsagents. Would editor John Moyle please scribbled out the few eye-catching words necessary to occupy the space?

He duly obliged and a few days later the resulting poster was on display all around Australia:

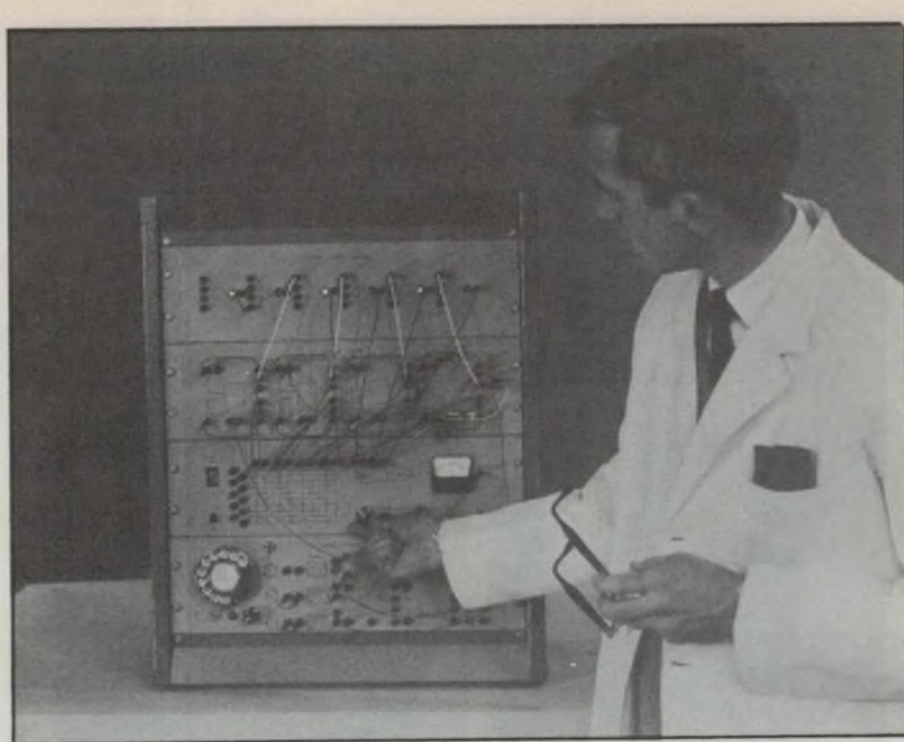
A 7-VALVE
TRANSISTOR
RECEIVER

Tragedy intervenes

Sadly, editor John Moyle was not to share in the technological explosion that characterised the solid-state era.

As an active radio amateur, a former president of the WIA (Wireless Institute of Australia) NSW Division, and a federal councillor of the same body, he had been nominated to represent the interests of Australian amateurs at the 1959/60 ITU (International Telecommunications Union) conference at Geneva.

Before leaving, he had not been a well man but, characteristically, decided to fulfil the assignment first and worry about his health later. On the way back from Geneva, he planned to follow up matters arising from an earlier fact-finding tour in 1956, and to spend some time with veteran American publisher Hugo Gernsback, with whom we had had a long and cordial relationship.



A somewhat younger Jim Rowe, proudly showing off the first EA Logic Demonstrator. This was described in the issues for April and May 1967, as the culmination of our first series of articles on digital concepts.

But as the conference drew to a close, John had to seek medical help. A Swiss doctor diagnosed cancer and advised him to fly straight home, while he was still able to do so. He died in March 1960, leaving the future of the magazine in the hands of the team which he had done so much to consolidate and inspire. His obituary was published in the April 1960 issue under the heading "Engineer, Writer and Musician". The same issue carried his final article on the conference: "ITU: How the amateurs fared".

A couple of months later, I had my own share of trauma, although minor by comparison. While working on a project in my backyard "shack", I hurried out into the damp, wintry night, slipped on a wet concrete step and ended up with a broken femur. Next morning, my wife had to ring Phil Watson with the news that I would be on a traction in Parramatta hospital for an indeterminate number of weeks, and that he'd have to be the new instant editor!

So while, for the next four months, I wrote and edited what articles I could, propped up on pillows, it fell to Phil to make the on-the-spot editorial decisions.

Transistors take over

By 1960, with both germanium and silicon transistors, plus related devices, pouring off the production lines, their ruggedness, small size, operating economy and low cost offered undeniable attractions across the whole range of electronic equipment. Equally, their compatability with printed circuit boards or "PCBs" fitted in with industry moves towards mechanised assembly and soldering.

In relatively short order, most new consumer equipment was "transistorised", along with test equipment and a variety of electronic gadgetry that would not have been practical in the valve era. The changeover took a little longer in the case of hifi power amplifiers, TV receivers and transmitting equipment, which had to await the development of reliable high power and/or high frequency devices.

As far as the magazine was concerned, we had little choice but to "move with the times", conforming to the worldwide industry switch from valves to solid state. It was a move that tended to polarise readers, for reasons that had a lot to do with the basic difficulty of visualising solid-state theory.

Valve based technology had always lent itself to comprehension by the "mental picture" process. It was relatively easy to visualise electrons being emitted from a heated cathode and attracted across a vacuum to a positively charged anode; to appreciate the modifying effect of intervening grids on the

The above pictures strictly belong with the first of these articles, but they've only become available to us since then. At left are Wireless Weekly editors and brothers Braith (left) and Ross Hull, with Ross Hull again at right with a homemade telescope. (Courtesy Ross Hull Jr.)

electron steam, and the way in which valves could function as rectifiers, detectors, amplifiers and oscillators. Physically, they could be seen to be operating and, by breaking one open, one could examine the structure in detail.

When it came to building valve equipment, the sockets provided logical anchor points beneath the chassis and, to a hobbyist, wiring was both an exercise in workmanship and a reminder of circuit functions as the connections were effected between the valve electrodes. and various peripheral components.

Not so easy to follow

By contrast, solid-state technology was and still is less "transparent". While the processes may be clear enough to those versed in molecular physics, they do not lend themsleves at all well to explanations based on diagrams and metal pictures.

Despite the valiant efforts of technical writers, transistors remained, for many, enigmatic 3-legged blobs, rendered even more so by an endless confusion of terms and type numbers.

Again, with transistors normally assembled on PC boards, wiring had more to do with getting leads through the right holes, as per a layout diagram, than taking a perceptive interest in the individual copper tracks.

Wiring became an even more "mechanical" routine with the emergence of ICs (integrated circuits) particularly the "dedicated" types, which combine multiple circuit functions in small, multi-legged chips.

During that period of basic change, some relished the new technology others had no choice but to embrace it; some coped as best they could, while not a few dropped out quietly with the last generation of valve equipment — broadly the last batch of B&W TV receivers in the mid '70s and the few remaining valve based hifi amplifiers.

As it turned out, the magazine's move into solid-state technology was spear-headed by a young engineer who joined the staff shortly before the death of John Moyle. While the rest of us were still, for necessity, technically "bilingual", with a foot in each camp (!) it fell to Jim Rowe and our then new draftsman Bob Flynn to sort out the early confusion of terms and symbols and to come up with adequately illustrated articles and handbooks.

A new title

My chief role, in those days, was to "steer the ship" and a change in course seemed to be indicated.

Back in 1939, the "& Hobbies" was judged to be a necessary and appropriate part of the title but, with electronics playing an ever-increasing role in science and technology, space devoted to non-electronic topics was clearly not serving the best interests of either readers or advertisers. So the decision was taken that, henceforth, the magazine would concentrate on technology, popular science, hobbies, activities and interest that had some tangible connection with electronics.

In fact, the editorial content had been moving in that direction for some time and even Calvin Walters, our popular and free-ranging science writer through the formative years, began so to bias his choice of subjects.

To match the change in course, a new name *Electronics Australia* — abbreviated to *EA* — seemed to be desirable and a memo to that effect was duly despatched to the management of our parent company.

I shall never forget the incredulity with which it was greeted by the company's then editorial manager, Lou Leck, who knew a great deal about producing newspapers and popular magazines but to whom "electronics" was an obscure buzz-word used mainly by space-age weirdos.

It was only with the greatest misgivings that he finally accepted my assurance that it was also commonly used and understood by all our existing readers and advertisers; it might even attract others who were being put off by the down-market connotation of "& Hobbies". He, in turn, convinced the Board and, in April 1965, "R,TV & H" disappeared and "EA" took its place.

The name change certainly proved timely, because the availability of solid-state devices encouraged the construction of a whole array of new electronic gadgetry, as well as a new range of updated test equipment, receivers and amplifiers.

No longer was the cost and complexity dictated by the number of valve functions that the constructor could afford, accommodate or provide power for. With transistors, and more especially ICs, circuit functions could be expanded or added for the price of a few small components and a minor increase in the area of a PC board.

Glancing back through the indexes that immediately follow the name change, I noted an electronic anemometer, a pipe and wiring tracer, motor speed controllers of various kinds, model train controllers and power supplies, an electronic metronome, a "decision maker", fluorescent lamp inverters, an electronic thermometer, a projector timer, a crystal clock, gas laser, burglar alarm, light dimmers, a metal locator — plus an assortment of circuits and ideas under the old "Reader Built It" heading.

Instruments listed included R/C bridges, audio signal generators, a tone burst generator, an audio millivoltmeter, a "dip" oscillator, "Q" meter, crystal calibrator, and more.

In the audio music field, there were phono, tape and guitar preamplifiers, an add-on 16ft voice for organs, a vibrator generator, volume compressor, solid-state "Theremin" and the popular EA "Musicolour" — not to mention a variety of amplifier and receiver projects.

Featured in the period 1965-70, most of these would by now have been updated or superseded. Who, these days would bother to build their own crystal clock?

Since 1970, virtually all our projects have been based on constantly evolving solid-state technology, ranging from relatively simple gadgets to the ambitious Series 200 Playmaster amplifier and the state-of-the-art Playmaster stereo AM/FM tuner.

The revolution is complete. Valves and valve type components exist mainly for a few specialised functions, for replacement purposes, for nostalgia and for those hifi fans who insist on reversing the 60-year old adage. Valves sound sweeter than "crystals"!

Reader enquiry service

While the variety and novelty of such projects served to generate and maintain reader interest in do-it-yourself electronics, they also created a major problem for our technical staff.

Virtually from the outset, our policy had been to assist individual readers, who had run into problems with their projects, either by direct mail or through the columns of the magazine. In this respect, we were probably being more ambitious than any other comparable magazine in the world.

Actually, it wasn't too difficult in the early days, because fault symptoms in the limited range of valve projects could usually be recognised without having to search back through circuits and articles. But, as the range and complexity of projects increased, especially in the context of solid-state technology, it became necessary to establish an extensive filing and record system so that current technical staff could more easily cope with past projects.

Our first digital frequency counter project, which appeared in the issues for February-June 1970. It used gas discharge tubes for readout, with a mixture of RTL, DTL and ECL ICs.

With hindsight, the service probably became too accessible at its peak involving three full-time secretarial staff and imposing an impossible load on the technical staff and the assistant editor.

It was a matter of morale, as well as time and money. The technical staff would be keen to get on with a project or article with which each was involved — only to be reminded that they had not yet answered their fair share of the week's mail! In the end, we had no option but to limit correspondence to more manageable proportions.

Import duties cut

In 1972, Federal Government initiative totally changed the complexion of the electronics industry. Faced with the need to accept more imports to balance export earnings, the Whitlam labor government drastically reduced tariffs, including those on electronic components and equipment.

The decision signalled a flood of imported components which were at least as good and generally cheaper, than those produced locally. The same was true of built-up equipment, notably domestic, portable and car radio receivers, small to medium-size TV sets, audio-hifi components test equipment, communications equipment, etc. The impact on the local industry was devastating, with many factories forced to close.

For hobbyists, the effects were quite complex. Through enterprising parts dealers, they gained ready access to new high-tech components, often keenly priced. But against that, the supply of such components has often been selective and erratic. Again, the cost incentive to build one's own has been eroded by the availability of affordable built-up equipment at all levels. (How many amateurs, these days, use home constructed "rigs"?)

Even where the urge to acquire experience has prevailed, familiarity with built-up equipment has heightened expectation that the home-built unit should "look the part" — hence high-tech designs, with professional looking panels, cabinets and PC boards.

Like it or not, over the last decade or so, home constructors have tended to become assemblers of pre-digested kits, rather than students of the "Teach Yourself Radio" and "Learn While You Build" articles).

There is obviously a place for ambitious, professional looking projects — and there have been any number of them over the last few years — but I can never quite forget the pleasurable experiences I, and others, have re-lived, while generating simple articles for the magazine re-creating a more selective crystal set, or a humble little regenerative short-waver!

It might even be that the resurgence of interest in old valve radios is more than mere nostalgia; that it's as much a rejection of "pre-digested" routines; that part of the motivation is to grapple with circuits at a basic level, be they valve or transistor based.

But forgive me. I've inadvertently put on my "Forum" hat!

The digital & computing era

The '70s also saw yet another revolution in the emergence, at a consumer level, of digital technology. It came first in the context of computers and later in roles which had traditionally been filled by analog equipment.

While the digital concept is at least as old as the abacus, the first fully electronic calculating machine (computer) is generally reckoned to have been ENIAC, commissioned in 1945 at the University of Pennsylvania.

My own first encounter with electronic computers, analog and digital, was at the Commonwealth Aircraft Laboratories in Melbourne, my most vivid recollection being a room full of racks crammed with thousands of twin-triode valves, all glowing warmly and presumably awaiting their turn to lose emission.

Solid-state technology subsequently reduced those early monsters from room size to furniture size but, while they rated a mention in feature articles, they still seemed far removed from the technical activities of EA readers.

The first step towards closing the gap came when our then parent company, John Fairfax, invested in a couple of Digital Equipment PDP8 minicomputers which amongst other things, became the focus of a staff familiarisation program.

As technical editor of EA at the time, Jim Rowe sacrificed quite a few lunch hours for the chance to gain "hands on" experience — and was duly bitten by the computer "bug". But, having in mind the current cost of even those "mini" computers, and the specialised roles for which they seemed best suited, we quite seriously debated whether the magazine itself would ever need or be actually able to own one. As for individual readers, it seemed an even more remote possibility.

So, initially, we were resigned to publishing articles to explain the rudiments of logic theory and its representation in electronic circuitry. The highlight of this phase was a Logic Demonstrator (April/May '67), a project which filled a teaching role very well, but had no other function. After sitting around in

Jim Rowe shown trying out his historic EDUC-8 computer project in mid 1974, with the Digital Equipment PDP-8 minicomputer that had inspired it visible in the background.

our lab for some time, admired but never used,it was finally donated to a youth training group.

Then came our first actual build-it-yourself computer, introduced in August 1974, a project that actually tied as a world first with one published in the American magazine "Radio Electronics". With due parental pride, Jim Rowe insisted on calling it the "EDUC-8", signifying an educational, 8-bit computer.

Unfortunately, not everyone noticed — or conceded — the play on words and Jim has had to live, ever since, with sly references to his 'E-DUCK-ATE"!

I might add that designing the EDUC-8 project took Jim almost twelve months of work (all in his own time), and probably placed his marriage under some strain.

Even in 1974, however, the everyday role of computers was still a matter for speculation. "An emerging group of computer "nuts" was insisting that, one day, we would be using them for routine lab and office jobs, but the fact remains that the issue in which "EDUC-8" first appeared did not carry a single advert for computer equipment aimed at John Citizen.

I doubt that many foresaw the enormous impact which the then new and costly LSI (large scale integration) chips would have, when coupled with Asian and/or automated production methods. Until it actually happened, I know of no-one who would have credited the release of the technically advanced VZ-200 and VZ-300 computers through the Dick Smith organisation, for an Australian retail price of $99.00.

Yet, if one can venture to "compare

apples with oranges", those mechanically basic $99 colour computers, operating from a humble 12V plug pack, may well have had more computing potential than the one-time rooms full of valve equipment referred to earlier.

The still current VZ-300 and the considerable assortment of more pretentious models which continue to be offered at highly competitive prices, not only provide an enticement to get involved, but also a strong disincentive for individuals or parts suppliers to do so at the build-one-yourself level. Not surprisingly, therefore, technical interest in the subject centres on the choice of equipment and the options by which it can be used to best advantage.

As for the magazine itself, every work in it has, for years, been readied for printing by computerised typesetting equipment. Most of the articles have been written and/or sub-edited on computer-based word processors, some in the EA office, others owned privately by staff members and contributors.

Taken at Neville Williams' retirement dinner in 1983, this shot shows him receiving a VZ-200 computer from current managing editor Jim Rowe.

So much for the early reservations which Jim Rowe and I shared, about the availability and affordability of basic computers.

"The best laid plans . . ."

Facing the '80s and my own pending retirement, everything looked shipshape for the future. We had a functional, though not pretentious, office/laboratory complex within a few hundred metres of Sydney Central railway station.

Assistant editor Phil Watson was due to retire but, while his position could be taken over by Greg Swain, Phil would still be on call on a casual basis. Jim Rowe was firmly entrenched as editor with Leo Simpson looking after product reviews, plus a laboratory team by now as much at home with solid-state and digital technology as their predecessors had been with valves and analog.

It was then that entrepreneur Dick Smith rocked the boat, by making Jim Rowe one of those offers that, as per the cliche, "he could not refuse". In consequence, the editorial team had to be restructured, with Leo Simpson moving to technical editor (ultimately editor) and my own period of service extended by a couple of years.

It proved a challenging and busy period, with the personal computer market virtually exploding and with push-button digital methodology invading the video, audio and receiver equipment market. Levers, mechanical switches, meters, dials and tuning condensers gave place to "logic" controls, not only in commercial equipment but in projects as well.

Home videos also "exploded" to the extent that, for good measure, we were able to found a new companion publication called "VideoMag", which was later hived off under a separate staff.

And now, yet another era

And that's about the way it looked when I officially retired in July 1983, leaving *Electronics Australia* in the able hands of Leo Simpson and Greg Swain.

What none of us foresaw were the complications that would subsequently arise and with which that team would have to cope.

Faced with a critical space problem at the Regent Street address, company management decided that EA could logically be transferred from the existing Fairfax subsidiary (Magazine Promotions) to a jointly owned publishing company (The Federal Publishing Co Pty Ltd), which already had a number of technically orientated magazines in its stable.

The trouble was that Federal was itself undergoing reorganisation, and the changeover turned out to be a double move to addresses first in Waterloo and then Alexandria, which were accessable for some members of staff but not to others. It added up to double trouble for a magazine which depends so heavily on staff continuity, plus laboratory and reference facilities.

That's why, over the last few issues, you've noted staff changes; a new face in the wheelhouse, with Jim Rowe back at the helm and a new crew to keep the ship moving.

As I said at the outset, the past 30-odd years has certainly been a period of drastic change and this, the most recent, is part of the pattern. On the law of averages, Jim Rowe & Co will be able to handle it! EA

METEX M-3650 MULTIMETER

20A, 3½ digit frequency counter multimeter with capacitance meter and transistor tester.

This spectacular, rugged and compact DMM has a bright yellow high impact plastic case. It features a frequency counter (to 200kHz), diode and transistor test, continuity (with buzzer), capacitance meter, up to 20 amp current measurement and comprehensive AC/DC voltage current and resistance ranges.

CHECK THESE FEATURES...
- Push-button ON/OFF switch.
- Audible continuity test
- Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection
- Transistor test
- Diode test
- Quality probes
- ½" High contrast LCD
- Full overload protection
- 20 Amp
- Built in tilting bail
- Capacitance meter
- Instruction manual

Q91550 ...... Normally $165
Special, only $149

METEX 4500H MULTIMETER

10A, 4½ digit multimeter with digital hold, transistor tester and audible continuity tester.

The Metex 4500H is perfect for the technician, engineer or enthusiast who requires the higher accuracy of a 4½ digit multimeter. This meter is exceptionally accurate, (just look at the specifications) and yet still retains an exceptionally low price!

The Metex 4500H features digital hold which is normally only found on very expensive multimeters. This enables you take a reading and hold that reading on display even after you have removed the probes simply by pressing the hold button.

CHECK THESE FEATURES...
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- 4½ digit x ½"(H) LCD
- Audible continuity tester
- Push-button ON/OFF switch
- Quality set of probes
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- Built in tilting bail
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- Full overload protection
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- Diode Tester
- Vinyl case

Q91560 ...... Normally $175
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This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- ½" high contrast LCD
- Automatic over-range indication with the "1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5 KV-3 KV
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS
Maximum Display: 1999 counts 3½ digit type with automatic polarity indication.
Indication Method: LCD display
Measuring Method: Dual-slope in A-D converter system
Over-range Indication: "1" Figure only in the display
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91530 ...... Normally $109
SPECIAL $79

METEX 3530 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- ½" high contrast LCD
- Automatic over-range indication with the "1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5 KV-3 KV
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS
Maximum Display: 1999 counts 3½ digit type with automatic polarity indication.
Indication Method: LCD display
Measuring Method: Dual-slope in A-D converter system
Over-range Indication: "1" Figure only in the display
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

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ADCOLA E024 SOLDER SYSTEM

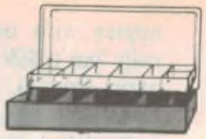
The E024 is a top quality, Australian made soldering station suitable for use with either the Adcola CT-6, CT-7 irons or desoldering pencil. The E024 features a continously adjustable temperature range from 200°C to 400°C. The E024's electronic temperature control circuit monitors the temperature element in each of the irons, allowing it to maintain a constant temperature to within an incredible +/- 5°C of the temperature dial setting on the front panel.

Power to the irons is via a "zero crossing" controller. The power to the irons is switched on/off at a point on the AC power supply where the voltage passes through zero. Hazardous spikes caused by commutated AC are avoided using this technique.

Mains spikes are virtually eliminated by an electrostatic shield wound between the primary and secondry of the power transformer, an important safeguard for easily damaged MOS devices. To further safegaurd sensitive components, an auxiliary ground lead earths the equipment to be soldered to the same level as the solder station, limiting the effective tip EMF to approximately 10mV. (Well below the damage level for MOS devices). If static control is important, the E024 unit is an excellent choice.

E024 Base Station with: CT7 Iron.
Cat.T12570 .... $165

Base Station with: CT7 Iron & Desoldering Tool
Cat T12580 .... $220



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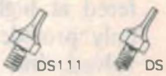
Cat. H10087 .... $9.95



DS111 DS112

WELLER WTCPN SOLDERING TIPS

Weller's "temperature sensing" tips have a small ferromagnetic sensing element attached to the tip shank. The sensing element is coded with a number to indicate idle temperature in hundreds of degrees F. Thus a simple change of tips is all that is necessary to adapt the tool to an entirely different temperature range.

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1-9 ~~$5.95~~ $5.50 10+ ~~$5.75~~ $4.95

2.4mm SOLDER TIPS

T12508	PTB7	370°C	Screwdriver
T12509	PTB8	430°C	Screwdriver
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T12512	PTBB8	430°C	Spade

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3.2mm SOLDER TIPS

T12514	PTC7	370°C	Screwdriver
T12515	PTC8	430°C	Screwdriver
T12517	PTCC7	370°C	Spade
T12518	PTCC8	430°C	Spade

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T12520	PTD7	370°C	Screwdriver
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SPECIAL, $69.95

RS232 FAST CABLER

Makes RS232 interface configuring fast and simple. 3 slide switches enable line swapping functions positive and negative voltages are displayed on 6 tricolour LED's.

SPECIFICATIONS:
Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable.
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR).
Switches: 3 Slide switches to swap leads.
Power: Interface power
Enclosure: Black, high impact plastic
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An economically priced "hands free" magnifier, lets you take care of all those tricky fine detailed jobs so often encountered in electronics, or any of many other practical uses such as home work, hobbies etc.
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WELLER WTCPN SOLDERING STATION

The WTCPN Features:
- Power Unit 240 V AC
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- Flexible silicon lead for ease of use
- Can be left on without fear of damaged tips!

The best is always worth having.
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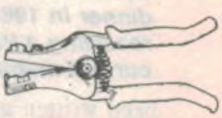

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- Fully automatic action. Squeeze grip will simultaneously strip and eject insulation.
- Length 180mm (7")

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A versatile 12V electric tool for:
- Sanding
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Features:
Operates on safe, low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor, 10,000 R.P.M. Can drill 2mm holes in steel. 2 year guarantee.

Contents:
- 12V Super Tool
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- 1 spherical milling cutter
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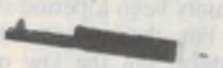
Cat. T12300 .... $59.95

RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching. 10 signal powered LED's and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions.

SPECIFICATIONS:
Connectors: DB25 plug on 80mm ribbon cable and DB25 socket.
Indicators: Tricolour LED's for TD, RD, RTS, CTS, DSR, CD, TC, RC, DTR, (E)TC.
Jumper Wires: 20 tinned end pieces
Power: Interface power
Enclosure: Black, high impact plastic.
Dimensions: 85 x 95 x 30mm
X15700 .... $94.95



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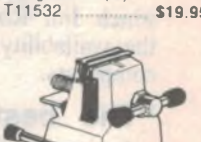

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Minor Scale Division: 1/100 turn
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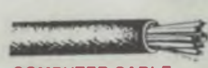

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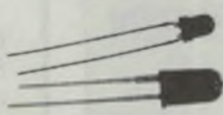

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QUALITY 5mm LEDS

Cat. No.	Col.	1-9	10+	100+
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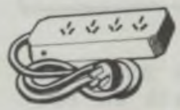
Z10151	Grn	$0.15	$0.12	$0.10
Z10152	Ylw	$0.15	$0.12	$0.10



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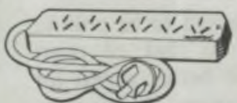

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X10086
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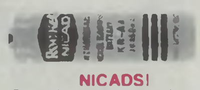

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Save money on expensive batteries with this universal battery charger. Features include meter tester, and provisions for D, C, AA, AAA, N button and cell batteries, 9V and 6V (square types). Comes complete with detailed instructions.
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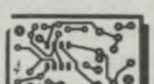

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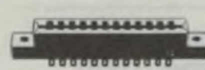

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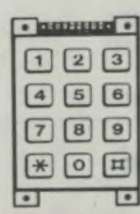

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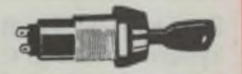
4	Row 4
5	Column 3
6	Row 1
7	Column 1
8	Row 2
9	Row 3
10	N.A.

Cat C19030

1-9	10+	100+
$2.95	$2.50	$1.95



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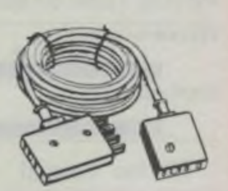
Cat. S12500 Normally $7.95

1-9	10+	25+
$4.95ea	$4.25ea	$3.95ea



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Compact Disc Reviews

by RON COOPER

BEETHOVEN

Symphony No.4 in B flat. Op.60
Symphony No.5 in C minor. Op.67
London Symphony Orchestra
Conducted by Wyn Morris
IMP PCD 869 DDD
Playing Time: 67 min 23 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Written around 1805-6, the fourth symphony of Beethoven is sometimes regarded as the most misunderstood of his symphonies — yet it is to me just another "mere masterpiece", like the rest. Who cares, the music here is superb so all you need is to enjoy it.

Beethoven symphonies are forever, and having nine (ten with the battle one!) to choose from, they never become boring. The fourth has quite swift and sudden changes of mood, which helps to create its own uniqueness.

Coupled with this here is the famous fifth which no doubt will generate sales for this disc — or will it? Surely everyone already owns one; but few will have a version as lively as this one. Tempos are certainly quite brisk, yet with the fifth this is no problem.

I never enjoyed Karajan's early version on DGG with its labouring tempos. On this new all-digital recording here though, I did sense a few brief moments of anxiety in the playing, otherwise it is very good.

The sound is well balanced and clean but not quite up to say, the standard of the Decca recordings. But for those who wish to add this version to their collection, they will not be disappointed. It is also excellent value for money.

MOZART

Violin Concertos No.1, 2 and 4
Arthur Grumiaux, violin
London Symphony Orchestra
Conducted by Sir Colin Davis
Philips 416 632-2 ADD
Playing Time: 60 min 36 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Although Mozart must have been a very accomplished violinist, he never felt happy playing the instrument during his years as leader of the Salzburg court orchestra. He was pleased to be able to change his position to that of court organist which he felt better suited for his own musical expression. However he wrote all five of his violin concertos between April and December 1775.

The concerto No.1, K207 shows a variety in thematic writing with some influences of the old Italian masters such as Vivaldi and Corelli. The violin concerto No.2 K.211 is different in that the 1st movement is similar in manner to his serenade — marches and is likely to be more familiar than the 1st concerto.

The 4th violin concerto K218 shows an advance in the linking of solo instrument and orchestra, as well as in the expressiveness of the music and intensity of emotion.

This recording is quite dated and even more so after listening to more modern recordings. There is a certain thickness to the sound which took a little adjusting to, but considering its age – 1962/1964, it is nevertheless quite remarkable. After a while you really do adjust quite nicely.

I'm sure many people will like this recording because it does possess a warm quality, and being re-issued on CD the noise level is almost non-existant. Perhaps it was filtered out, and this may be the cause of the softer top-end.

The playing is very good, but not in the stunning class of some other artists.

MOZART

Divertimento No.15 in B-flat major, KV287
Philharmonia Quartet Berlin
Denon 33CO-1057 DDD
Playing Time: 49 min 39 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Divertimenti are suites of music usually of four or more instruments, written for social or informal gatherings. They were most popular around the later half of the eighteenth century.

Mozart wrote around 30 such works and most were composed in cheerful

CLASSICAL SAMPLER Vol.2

IMP PCDS 2 DDD
Playing Time: 67 min 46 sec

PERFORMANCE 1 2 3 4 5 6 7 8 9 10 (bar to 8)

SOUND QUALITY 1 2 3 4 5 6 7 8 9 10 (bar to 8)

Here is a disc to obviously demonstrate the budget price ($19.99) IMP label. It gives a sample of excellent selections from some 14 different discs.

This in itself is very good from a potential customer's point of view, as it lets you try all these discs by buying just one. However, from a different point of view I am not one for bits and pieces. I prefer my music complete and straight, within the bounds of the original composition. I am certainly not hooked on *Hooked on Classics* for example (yuk!).

Yet, here we have a disc which will have much appeal in its own right, because of its very interesting selection. This is the disc to play when you "don't feel like listening to anything in particular"...

Opening with bright Spring movement from Vivaldi's *Four Seasons,* it sets the mood with this very familiar and recognisable sound. The second track is a pleasant contrast with *Gymnopedie No.1* by Erik Satie, followed by some snappy Johann Strauss, with plenty of champagne corks!

The other tracks are: Chopin: *Preludes 7 and 15*, the first movement of Grieg's *Holberg Suite*, Daquin's *Le Coucou* played on harpsichord, the second movement of Mozart's *Horn Concerto No.1,* Bach's *Harpsichord Concerto in F* (first movement), Handel's "Hornpipe" from the *Water Music Suite,* the third movement from Mozart's *Flute and Harp concerto* (albeit with a minor touch of LF aberration in the first few bars), the second movement from his *Clarinet Quintet,* the finale from Schubert's *Symphony No.3*, the third movement from Brahms'. *Second Symphony* and finally Wagner's *Ride of the Valkyries*.

Overall, very good recordings, well balanced. Not quite up to the Decca versions for the larger works, but still representing excellent value.

major keys to avoid sounding dull or sullen. Divertimenti come in a variety of instrumentation, ranging from four or five solo parts with string orchestra to a clavier trio. The movements also vary from about three to seven.

The KV287 here is a six movement work with a five part string section and two horns. The second and fourth movements are slow, with the third and fifth movements being minuets.

The KV137 is a string quintet, with cello and contrabass sharing the bass part. The movements follow a slow-fast-fast pattern, gradually building the tempo. It was written around the spring of 1772, after Mozart returned from his second trip to Italy. This one is probably better known than the KV287; it is typically Mozart and most relaxing. I somewhat preferred this work over the KV287, possibly because I was more familiar with it.

The players here are all members of the Berlin Philharmonic, and their playing here is impeccable with tempos "just right".

The recording is very close and clean, with the odd atmospheric chair creak which gives you a sensation of "being there". Tonal balance is very good, but with a slight hole in the middle, stereo wise. There is a very slight tendency towards harshness on a few passages but overall, little to complain about.

If you enjoy chamber music, you will find this disc most relaxing. EA

A first-hand user's report on

FUNWAY INTO ELECTRONICS — 2

Following on from December's article, EA's secretary tackles soldering in her quest to understand electronics . . .

by NAOMI LENTHEN

After last month's successful learning experience, I was ready and eager to learn more — so I moved onto Funway 2 & 3. The Giftbox 1, 2 & 3 which I had contained both books 2 and 3, as well as two projects from each series.

Book 2 again launches into a description of various components and their purpose, but also includes other components not previously covered in Book 1. Integrated circuits are explained, and there is talk of analogue and digital but where it said "See technical terms" at the back of the book, they weren't actually there.

A component marking chart is also included, as well as in the actual kit packs of the projects. This is followed by a lesson in reading circuit diagrams and circuit laws. I glanced over the "Learning to solder" pages as I already had vast experience in soldering(!). I did notice that clear photos were provided on common faults and remedies.

Then it was onto my first project, a Multi-Purpose Flashing LED. The circuit was small and after reading the instructions carefully, I put it together. Success first go! I now had a little LED that flashed nonstop every half-second. The book then explains in what way such a circuit can be used. For example, a darkroom warning indicator, or in a car alarm, or even as a flashing brooch! I have decided to use it as a fake burglar alarm. Don't tell anyone.

At my desk, making sure my fingers are well away from the "hot" part of the soldering iron.

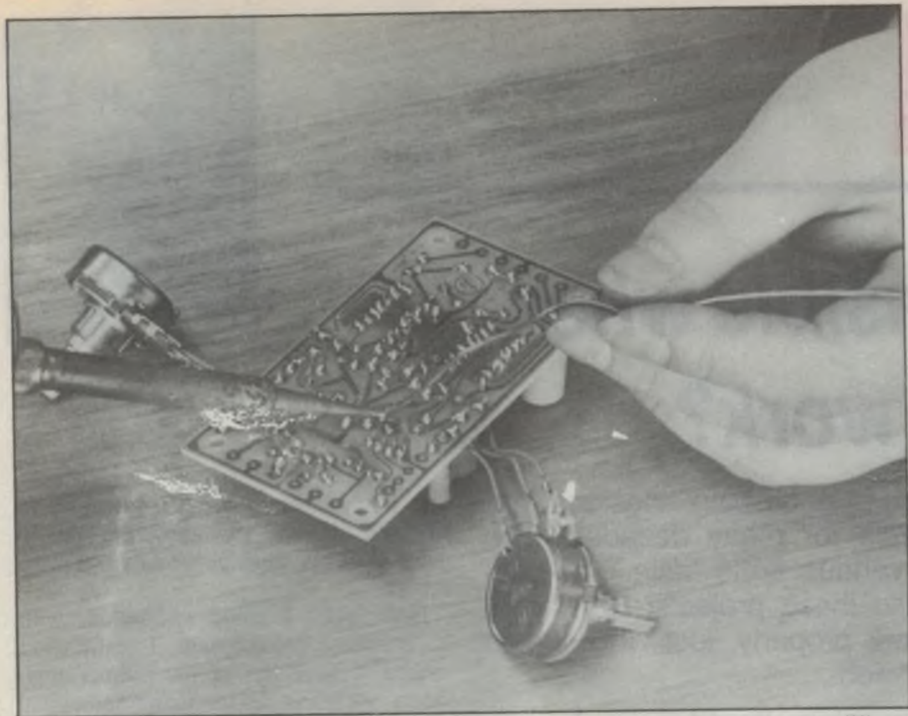
The other project supplied for Funway 2 was a Wireless FM Microphone. This too worked first go, although I did burn my finger slightly on the soldering iron in the midst of construction. Watch out for that soldering iron! I tuned the microphone into the radio in our office and my voice came clear through.

Excitement ruled the office that day as we tried to think of several ways of using it. We did play a really great trick though. Since Carmel (our production editor) was out when I made the microphone, we placed the microphone in the laboratory in front of the radio speaker in there, so in our office, the sounds of 2DAY.FM came through our radio. When Carmel returned, one of the engineers announced into the microphone that the next song was a "special request for Carmel With-An-Italian-Surname-I-Cannot-Pronounce". Due to the engineer's obvious accent, the game was given away. We next bugged a few offices, but nothing much exciting goes on here by the sounds of it!

The book also shows you how to make your own circuit boards, but I haven't tried this yet!

Now onto Funway 3. The beginning of the book is the same as in Funway 2, except there is a chapter on how to use a multimeter. The two projects supplied with this book were an Electronic Cricket, and a Mini Stereo Amplifier.

The Electronic Cricket looked fairly simple, so I built it without reading the instructions first. Using only the the PCB overlay diagram as a guide, I soldered my components in, confident that



The tricky application of solder to the PC board for the Mini Stereo Amplifier.

I wouldn't make a mistake. I did!

Only a slight one, though. I put one of the components on the wrong end of the circuit board. This was easily rectified and I finished this project okay. Jim came to watch me test out the "cricket" and soon it chirped away merrily. You can set this one to work in the dark, which is the whole purpose of this project. I took this one home and placed it in my mother's room and annoyed her to bits as she couldn't find any cricket. Ha Ha.

And my last project for this series was the Mini Stereo Amplifier. Again I did this without looking at the instructions, and I was told to stop getting too cocky. But I soldered this with no problem although I have as yet to find some small speakers and a walkman to hook it up to and test out.

Other projects from these two series include a Mini Synth, a Home and Car Burglar Alarm, a Pocket Transistor Radio and a Home Intercom. The books also contain several interesting tidbits like Pioneers In Electronics, Milestones In Electronics, and Understanding Electronics. The third book also has pre-printed front labels to make your projects look professional, and instructions on how to put them into a container.

Well I definitely found this experiment to be very worthwhile. I now can read complex circuit diagrams, solder professionally, and understand electronics. Well, almost!

So Funway into Electronics 2 and 3 get my vote of approval, at least. You'll find them at any Dick Smith Electronics store or dealer. EA

FORUM

Conducted by Jim Rowe

Who's responsible when a kit doesn't work?

Magazines like EA have been publishing designs for build-it-yourself electronics projects for many decades now, and for almost all of that time various firms have marketed kits of parts to help readers build these projects. But if you buy such a kit and it doesn't work properly, just who should be responsible? It's a thorny question . . .

The other day, a bloke who sounded a little like a solicitor (although he didn't claim to be) rang me up to complain at some length about a problem experienced by his brother. According to my caller, his brother was a reasonably experienced electronics technician, and a regular reader of the magazine. He apparently decided some time ago to build the Playmaster Stereo AM/FM Tuner of January-March 1986, and had accordingly bought a kit from one of our advertisers.

But when it was ultimately completed and turned on, quite recently, there were all sorts of problems which he couldn't solve. So he rang the kit supplier seeking help.

"Oh — sorry about that," said the kit supplier, "but we just sell the kit of parts. If you have any problems making it all go, ring EA. It's their design!"

So consequently he rang our office, and apparently spoke in the first instance to our secretary Naomi Lenthen. She in turn duly explained that the project development engineers weren't really able to talk at length on the 'phone to individual readers concerning problems with projects. Nor were they able to repair individual projects, because they're almost always flat out designing next month's projects.

In any case, she explained, the designer of the project concerned had departed from the magazine about six months ago, and was currently working for one of our competitors. So we had no-one who was particularly knowledgeable about the project concerned, and therefore not in a position to offer much help. We didn't even have the prototype of the project concerned to use as reference, as this had apparently also disappeared.

But what about the reader's problem? Well, said Naomi, we do provide a Reader Information Service to assist readers with problems, providing they write in with clear and concise details. The project engineers then tackle each letter at a convenient time, perhaps when they're held up for some reason with the current project.

They then offer suggestions and advice, which are either sent directly back to the reader concerned, or published in the next available issue of the magazine itself in the Information Centre section. This depends on whether the reader chooses to enclose the appropriate small fee, to cover a direct mail reply.

What if the problem was due to a clear design fault, or some other error in publishing the design? Well, said Naomi, as soon as we discover any problems of this nature, we publish full details of the solutions in the next available issue, in the Notes and Errata column.

Naomi said we'd be happy to send out a photocopy of all of the published Notes and Errata for the project concerned, if that would help. And this was duly done, but the reader concerned apparently still had problems with his AM/FM Tuner.

Surely someone ought to be responsible, he decided, because he had spent hundreds of hard-earned dollars on this #@!@★% kit and it still didn't work properly. I gather it was at this stage that he apparently asked his brother to ring me up, and try persuading me to get one of our engineers to fix the project.

Now while I could sympathise with his brother's predicament, I really can't afford to have any of the project engineers spending hours fixing individual reader's projects. I explained this to him, and suggested that his brother could either try writing us a letter in the usual way, or seeking help from a service technician with experience in sorting out tuner kit problems.

His reaction was to state that neither of these alternatives seemed to him satisfactory. Accordingly he intended to contact the Consumer Affairs people, to seek their help in getting either the kit supplier or ourselves to accept more responsibility.

That's his right, of course, but it remains to be seen whether he'll achieve the kind of result he wants. The fact is that he'll be opening something of a Pandora's box, because the whole situation is rather more complex than it seems.

First of all, let's forget the thorny question of responsibility itself for a moment, and look at the practical question of economics. Who can *afford* to accept responsibility for fixing reader projects?

Consider the magazine first. If we were to try fixing reader projects with our current complement of engineers, the odds are we'd have to have blank pages in future issues, where the project articles would have been. I can guess what would happen to EA's circulation sales (and the jobs of all of us who work here) if that were to happen!

On the other hand, if we were to try fixing reader's projects *as well as* producing the necessary number of new projects for the magazine each month, I estimate that I'd need to put on at least two extra service engineer/technicians.

And they'd need to be rather more experienced and knowledgeable than your average TV service technician, so they wouldn't come cheaply.

To be honest, we simply couldn't afford them. I don't know whether many of our readers realise it, but electronics magazines like EA really don't make all that much money nowadays. Compared with many other magazines, we have to carry quite heavy overheads. I suspect our competitors both here and overseas are in a very similar position.

With many other kinds of magazine, on the editorial side you often need little more than an enthusiastic and hardworking editor, plus a journo or two. Sit them down at desks with a typewriter/word processor each, a telephone and a supply of paper, and away they go.

But with an electronics magazine like EA, this just isn't enough. To produce an attractive, credible and viable magazine, you really need to set up and maintain an electronics lab with a suitable complement of well-trained engineer/writers, to develop and describe projects. You also need to provide them with the right equipment and tools, to work efficiently. And you need to provide both them and the editors with the necessary reference books and journals, so they can keep up to date.

It all costs money, of course. So much money that the company accountants seem to be forever "shocked and horrified" at what seems to them to be our abnormally high level of overheads. I can just imagine how they'd react, if I wanted to put on a couple of extra highly-paid service people.

Don't get me wrong. I'm not crying poormouth, or suggesting that EA is in danger of sliding down the gurgler. Far from it; in fact we're doing fairly well, and probably in a somewhat better position than our competitors.

No, the point I'm making is that electronics magazines in general simply *can't afford* to offer much more than written advice to readers with problems. I imagine our competitors would find it even more difficult to do so than we would.

If we were all forced to do so, I'd say it was very likely that we'd all either have to close down altogether, or at least stop describing construction projects. I can't believe that either my unhappy caller, or any of our other readers for that matter, would want either of these rather draconian scenarios to eventuate. It really would be a case of throwing the baby out with the bathwater.

How about the kit suppliers? Now as some readers will be aware, I spent a few years working at one of our largest advertisers, and one of the major kit suppliers. OK, let's not be coy — it was Dick Smith Electronics. Anyway, during those years I was able to see things from the "other side of the publishing coin", as you might say. And I saw just how much money could be made (at least at that time), by at least one of the firms selling project kits. It was a good deal more than magazines like EA were making out of describing the projects concerned, I can tell you.

Yet it was the magazines who had to maintain the electronics labs, and pay the engineers to design and develop the projects. So at that time, I know from my own experience that while the magazines did much of the work and carried a lot of the overheads, it was the kit suppliers who made most of the money.

Having said this, I can almost hear my old boss and sparring partner Dick Smith picking up the blower to remind me (probably with some emphasis!) of the kit suppliers' contribution.

It's true, of course, that there's often quite a lot of work involved in sourcing all of the parts needed for a project — particularly here in Australia. Most of the components are imported, and they're often hard to get. Overseas sources dry up, orders get lost or delayed, manufacturers change their models or specs, and all sorts of other problems can occur. I do remember it all, Dick, so please don't ring me!

The fact remains that a few years ago at least, kit suppliers were making an awful lot of hay — and rather more than magazines like EA. Whether or not they're still doing so I don't know, although many of the guys at the helm of these firms still seem to have some pretty fancy toys, like $80,000 sports cars, cruisers and private planes. I can assure you I don't have any of these toys, and I've never met any other electronics magazine editors who did, either.

Even DSE reserves the right to refuse servicing a kit if it's too much of a mess . . .

Mind you, I suspect things aren't quite so rosy for kit suppliers nowadays, as there seems to be a lot more competition in the kit market. Some of the larger kit suppliers have also set up their own R&D/kit development departments too, so at least these firms now have rather higher overheads as well. One way or another, I suspect that the kit suppliers would claim inability to help readers with problems — at least if it had to be done for nothing.

Not the least reason for believing this is the fact that so many of them seem to refer readers with problems straight back to ourselves. It's called passing the buck . . .

Of course one notable exception to this is DSE, with its well-known "Sorry Dick, it doesn't work!" service. But this is only available for the more complex and costly project kits, and even so it's neither free nor without qualification. There's basically a fixed service fee (appropriate to each kit), to cover labour and any replacement parts required.

In addition, DSE reserves the right to refuse to service an assembled kit, if it's too much of a mess. And this is quite understandable; I've seen what some assembled kits look like — including some from supposedly "experienced technicians".

OK, so much for the economic side of things. Let's now turn back to consider the question of responsibility. Just who should be held responsible for a project/kit that doesn't work properly?

Perhaps I shouldn't be admitting this, but it seems to me we probably *do* have to rule out the kit supplier. After all, as they're quick to point out, they only provide a service by collecting together the parts for a published project design and making them available in a convenient parcel. At an appropriate price, of course.

There's probably a parallel here with the pharmacist, making up a prescription from your doctor. If the resulting medication doesn't fix the trouble, you can hardly hold the pharmacist responsible — providing he made it up with the ingredients as specified.

FORUM

On the other hand, you may not be able to hold the doctor responsible, either. It could be that there was something else wrong with you, something very unusual, that the doctor could not reasonably be expected even to consider. After all, the doctor is only human, and not infallible. Providing he/she acted in good faith and took all reasonable care in making the diagnosis and writing the prescription, most people would think it unreasonable to hold them responsible, even if the patient should die.

The same kind of thing applies, I would argue, in the case of published designs for electronics projects. Here at EA (I can't speak for the other mags) we spend a lot of time and effort designing the projects, and trying to make them as easy to build and get going as we possibly can. In other words, we take all reasonable care, and present the designs in good faith.

But we don't claim to be infallible, or that the designs are guaranteed to work. This would be quite unrealistic. What we're providing is not a normal product like a TV set or a CD player, but information for the benefit of those interested in it and able to put it to good use.

Sorry mate, we just sell the bits. Try ringing EA!

For a start, sheer economics and time constraints prevent us from building up and testing more than a couple of prototypes at most, for any of our designs; often we can do only one. We don't have the luxury of building a "pre-production" run, as commercial designers do, to iron out the almost inevitable bugs due to component parameter spreads, etc. All we can do is check things out as thoroughly as we can, and try substituting a number of parts in the most critical areas.

Sometimes I think it's nothing short of a miracle, in the circumstances, that most of our designs turn out as trouble-free as they do.

Even more importantly, the designs we publish are only part of what's needed to produce the final product. The other ingredients are the necessary components, and the labour/skill necessary to put them together according to the design. We don't supply these other ingredients, nor do we have any control over them. Yet in reality they're just as important as the original design, when it comes to the final result.

When magazines like EA first started to publish designs for electronics projects, over 60 years ago, they were quite often little more than a circuit diagram and a few suggestions regarding overall layout. It was assumed that the reader would be able to provide the rest for themselves, from their own experience and knowledge. And by and large, this seemed to work out quite well. No one expected the designs published to carry any kind of guarantee of success, but accepted them for what they were: worthwhile and useful information.

But over the years, things have changed. Magazines like ourselves, trying to be of even greater value, have gradually published more and more information for each project. Parts lists, wiring diagrams, PCB and front panel artwork, you name it — all aimed at helping the constructor to achieve a more professional result, and with minimum hassle.

One result of this is that our projects can now be tackled by readers with somewhat less experience than before, with a greater chance of success. That's great, of course. The more people able to experience the satisfaction and enjoyment of putting electronics to work, the better.

But at the same time, the original idea of publishing these designs seems to have been forgotten — at least in some people's minds. To say it again, all we do is publish *worthwhile and useful information*, for the benefit of those interested in it, and *able to make use of it*.

So if it's not the kit supplier who's responsible for the success of a project built from a kit, and not the magazine either, who is? There's only one party left, of course: the constructor themselves.

I know this sounds like passing the buck *par excellence*, but I'm afraid it's true. When we publish a design for a project, we simply can't take responsibility for what you do with that design. You really have to accept that responsibility yourself, because it's you that buys the kit, and you that supplies the labour and necessary construction skills. You're really the project manager, for your particular implementation of our design, and therefore you're ultimately responsible.

Don't forget that all we charge for the information we provide you is a few measly bucks each month. For that kind of money, no one should be expected to provide a full Rolls-and-chauffeur service, surely.

We can certainly sympathise if you've paid hundreds of dollars for a kit, and can't get it to work properly. But our role in the enterprise has only been to publish the basic information, and for this you've paid *us* only $3.50.

Does this mean we don't care if you get into strife? No, not a bit of it. We spend a lot of effort trying to make sure you won't get into strife, in the first place. And if we discover we've made a mistake that might cause you strife, we drop everything to advise you as soon as possible. We also offer advice and suggestions via the Information Service, if you still get into trouble.

But when you boil it all down, it really has to be a case of *caveat constructor*. Any other way, and you mightn't have any electronics magazines around, to provide you with a steady diet of interesting designs.

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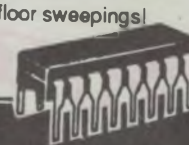

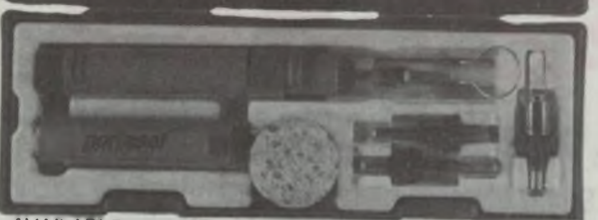

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Until now! Dick Smith Electronics is proud to introduce you to the "Datak" range of US-made pcb materials. Top quality, easy to use, make a professional product . . . yet extremely good value. What more could you want?

NEW LOW PRICE!

Complete Photo Tech PCB Kit

It's so simple! This kit contains everything the hobbyist or workshop could want to make pro-quality PCB's: 125 x 150mm stell printing frame, pos-neg film, film processing pack, yellow filter, 100g negative acting etch resist, resist developer, blank pcb's, dry concentrated etchant, 1:1 resist patterns and tapes and, best of all, COMPLETE INSTRUCTIONS.

Cat N-5700

WAS $104.95 NOW ONLY $99.95

Individual Components to Build Up or Replenish your Packs.

Photofilm Sheet

Makes film positives from magazine art, 1:1 patterns on film, etc. Two sizes available: 125 x 150mm (6 sheets) Cat N-5705 $18.85

200 x 275mm (2 sheets) Cat N-5709 $18.85

Film Processing Chemical Pack

Processes either of above photofilm sheets. Cat N-5909 $11

Tin your PCB pattern

Avoid oxidation & contamination of patterns: tin them without mess or elecricity. Soluble powder puts bright tin plate over copper of pcb, ready for soldering. Cat N-5730 $12.55

Circuit Fix-It

Damaged PCB? Fix it easily and simply with this one. Pure copper pads, sheets on self-adhesive carrier to allow virtually any repair. Cat N-5900

$62.95

Dry Transfers for Panels, projects

Choice of three types for that real "factory made" appearance. (1) Switches and Marks 2 sheets each of black and white. Cat N-5750

$11.95

(2) PCB pads, fingers, etc. DIL, surface mount and component donuts all in one handy pack. Cat N-5766 $19.95

(3) Targets. A must for accuracy in pcb making — especially on double sided boards! Cat N-5820 $7.95

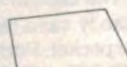
Contact Printing Frame $35.65

Pro quality frame makes negs or pos up to 225 x 300mm, from film pattern or even direct from printed magazine pages. Contains spring loaded steel exposing frame with glass, backboard, yellow filter & instructions. Cat N-5710

Yellow Filter

215 x 295mm yellow filter for exposing Datak light-sensitive products to pcb patterns. Full instructions included with master kit. Cat N-5711

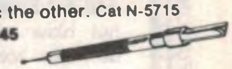
$10.45



Burnishing Tool

Sure beats using the old ball-point pen! Professional quality results demand a professional approach. Aluminium ball one end, flat pastic the other. Cat N-5715

$10.45



Photoresist Made Easy

Spray pump of negative photo resist (118ml) ready for coating blank pcb's. Easy to use, no tight tolerances required for heating, etc. Cat N-5907

$18.95

Resist Developer

Suitable for above resist. 473ml tin. Cat N-5905 $11.95

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AUSTRALIAN MADE

The Weller 15 Watt Soldering Iron

Just one of the range of Weller products, made right here in Australia to exacting standards. Performance tested Weller soldering irons are built for long life and durability even under the toughest conditions.

Look at the features: • Robust design • Lightweight easy to handle • Ceramic encased element for durability • Pre-tinned nickel plated tip • Guaranteed to perform

Official Supplier of Handtools to the Australian Olympic Team, Seoul, 1988.

CooperTools

LET'S TEAM UP WITH AUSTRALIA

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$22.95

Cat T-1310

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AIRONIC

Negative Ion Generators

AUSTRALIAN MADE

The complete air re-conditioner: Aironic 2000

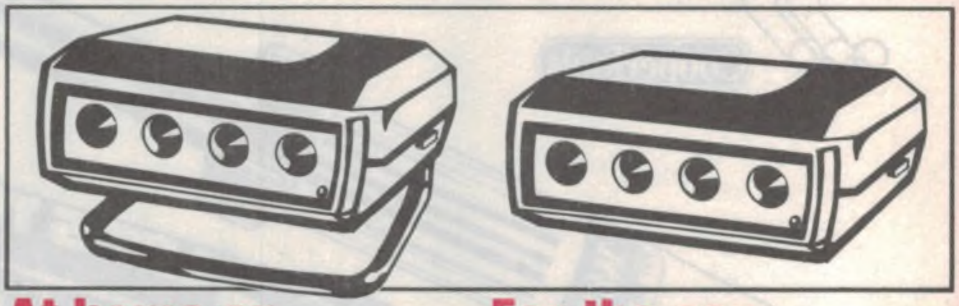
Take a step towards better living with the Aironic 2000 air freshener/ionizer. Cigarette smoke, pollen and airborne bacteria can accumulate in rooms and be detrimental to your health. And many air conditioners rob rooms of negative ions so vital to a properly balanced environment. Simple opening a window can't solve the problem — it may even aggravate the situation. But the Aironic 2000 cleans, freshens and recharges the air you breathe with an effective three step process:

- **A powerful fan draws in air trapping minute dirt particles in an advanced filtering system.**
- **A built-in ionizer charges the drawn-in air with negative ions.**
- **The quiet 4-speed fan disperses invigorating air into every part of the room. You'll feel the difference.**
- **Use the Aironic 2000 in homes, offices and even large public areas, such as restaurants or convention rooms. It's the 'fresh' approach to better living!**

Cat Y-9004

$449

Your personal Negative Ion Generator Either Type $69.95



At home or the office

Want to feel a tingling freshness? A better environment for concentration? For many, negative ion generators are the solution to rooms or offices chocked with cigarette smoke and pollutants or robbed of vital negaitve ions by air conditioners. The personal negative ion generator sits next to you on a desk or nearby shelf — anywhere it can be plugged into a standard 240V power point: it uses so little power it won't even turn the meter. Try a negative ion generator today — enjoy the difference! Cat Y-9000

For the car

Alertness is essential for safe driving, especially on long trips. Drowsiness could be the result of your car's air conditioner, lingering cigarette smoke or just the drain of peak hour traffic. Why take a chance? Use a negative ion generator. It simply plugs into your car's cigarette lighter, charging the cabin with invigorating negative ions. Arrive at work fresh... and it's perfect for sales representatives, taxi drivers and truckies. Cat Y-9002

AIRONICS PRODUCTS PROUDLY STOCKED BY:

DICK SMITH ELECTRONICS PTY LTD

A Sound Team

SANYO

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Budget Portable System With Detachable Speakers

ONLY **$199**

Fantastic value Mini Portable from Sanyo! It's got 4-band radio, cassette deck, 5-band graphic equaliser and detachable speakers for true stereo separation. With a HUGE 50 WATTS peak output power, AC/DC operation, tape counter... everything! Cat A-5600

It's Hot!! Walkie Stereo

Walkie-style Stereo Cassette from Sanyo! Comes with great headphones and has belt clip for rockin' on down to the milk bar, or joggin' round the park, or... It's not cool to get caught without one! Cat A-4111

NOW ONLY **$39.95**

With AM/FM Stereo...

Budget priced and it's got the lot! Portable Stereo Cassette with AM/FM radio as well. Comes with headphones and belt clip of course. Don't let the price fool you... the quality's great! Cat A-4109

JUST **$59.95**

Top Number

Want the best in portables? This has to be it! Amazing features include, auto reverse, AM/FM radio, 4-band graphic, quality design and construction through and through, Dolby NR, normal/metal tape selection, monitor speaker and twin duct stereo earplugs! Sounds incredible. Cat A-4107

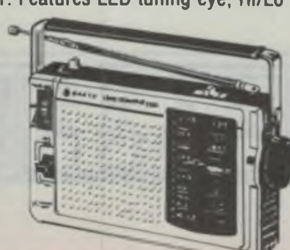
With protective case!

$199

The Picnic Portable

When the entire family wants to listen — here's what you'll want! AM/FM portable radio with carry handle, telescopic antenna and large speaker so everyone can hear. Features LED tuning eye, Hi/Lo control and AC/DC operation. Cat A-4115

VALUE **$49.95**



A Mini System

It's even got detachable speakers! Portable sound system with AM/FM radio, stereo cassette, 3-band graphic equalizer, four speakers, inbuilt mic and 22 watts peak output power. It's got the right features and a tiny price! Cat A-4104

$149

HATADI & DICK SMITH ELECTRONICS PTY LTD

Present

The Pearce Simpson Cub $30 Off!!

The amazing CUB Deluxe AM CB is now at a sensational low price! If you need the features this one has them. Full scanning facilities so you can keep your eyes on the road, instant access to the emergency channel 9 — no matter what channel you're on, switchable ANL and more! All this and it's only 130(W) X 35(H) X 180(D)mm.

- Maximum legal power
- Full 40 channels
- LED Readout
- Push-button channel selection
- Fits tiny space

Cat D-1460
DOTC Approval No. 249A0129

Normally ~~$149~~

This Month ONLY

$119

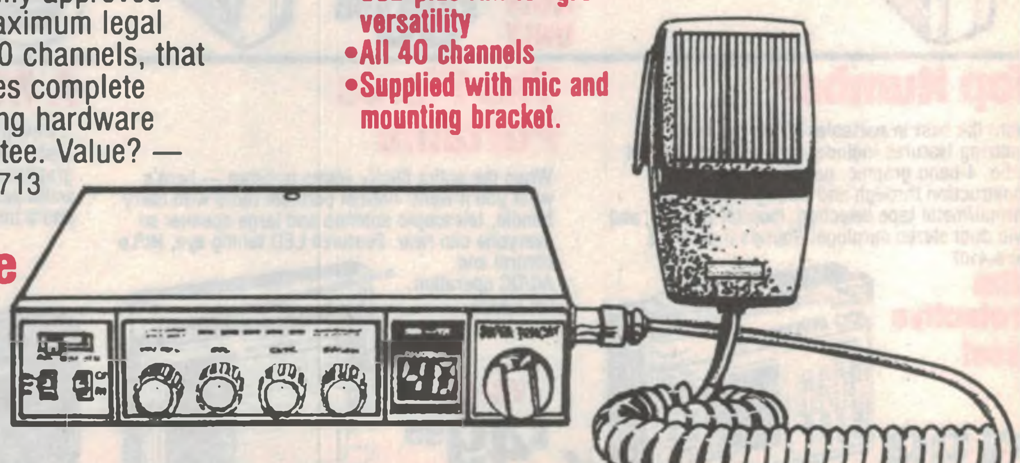
SSB SUPER TOMCAT ... by PEARCE SIMPSON

For that extra range — the Super Tomcat SSB/AM CB! This has to be the best value SSB CB in the country. It's fully approved and packed with features. Maximum legal power on AM and SSB, full 40 channels, that extra SSB performance, comes complete with microphone and mounting hardware and carries 12 month guarantee. Value? — that speaks for itself! Cat D-1713
DOTC Approval No. 2440040

- Fully approved
- Maximum legal power
- SSB plus AM for great versatility
- All 40 channels
- Supplied with mic and mounting bracket.

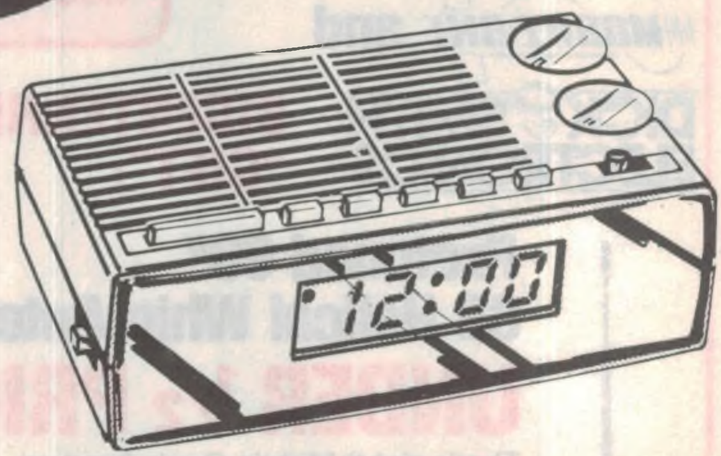
Sensational Value at ONLY

$249



Wake Up!

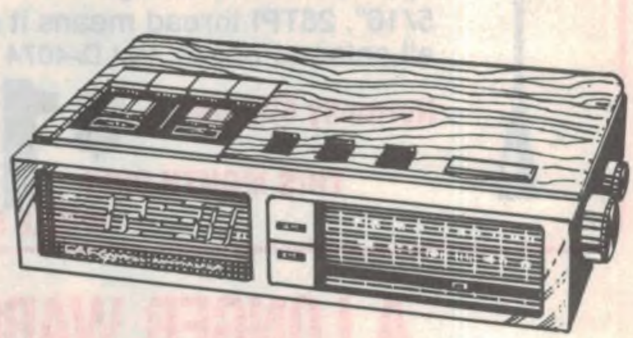
Nearly 25% Off! Compact AM/FM Clock Radio



It doesn't take up much room on the bedside table and doesn't make a hole in your pocket either. AM/FM Clock radio with all the features including battery back-up so the alarm doesn't go out with the lights. Cat A-4110

SAVE $7

ONLY $22.95



Don't wake with a fright! Ease yourself into the morning with one of these G.A.F. Alarm Clock Radios.

GAF CONTROL

Budget AM Radio

Great for listening to the sport or for the kids! Pocket size portable AM Radio with carry strap at this all-time low price. Get in now while the saving's on! Cat A-4305

NOW $7.95

His and Hers Dual Alarm

The best thing since they bagged the rooster! Dual Alarm Clock with AM/FM Radio. Amazing features include two independent alarms, forward and backward time setting (saves time adjusting the time), fast slow time setting, battery back-up, snooze... etc, etc, etc. Fantastic! Cat A-4461

$39.95

DICK SMITH ELECTRONICS
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There is one easy way to tell the difference between "cannon-type" and "Cannon"

THIS

You've seen those so-called "Cannon-type" plugs and sockets. Some even look pretty much the same. But if you look really closely, you'll find they're cheap, nasty imitations made down to a cheap, nasty price.

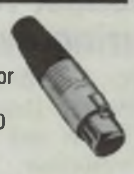
Don't wait until you use them to find out the difference. Only Cannon connectors — the real ones — are labelled just that: Cannon.

Genuine, guaranteed, prime quality. Quality that you can depend on — whether it's for audio work or mains power. **ESPECIALLY** for mains power: are you game to trust cheap imitations where live wiring is concerned?

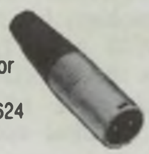
"Cannon-type" connectors? You simply can't take the chance!

You **KNOW** you can trust Cannon connectors

CANNON STANDARD AUDIO



AXR-3-11
In-line audio socket for microphones, line inputs, etc. Cat P-1620
$5.25



AXR-3-12
In-line audio plug for microphones, line inputs, etc. Cat P-1624
$4.95

AXR-3-31
Panel mounting low level audio socket (mates with AXR-3-12 plug). Cat P-1626
$5.75

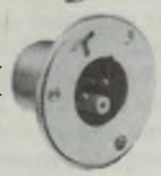
AXR-3-32
Panel mounting low level audio plug (mates with AXR-3-11 socket). Cat P-1622
$4

CANNON HIGH LEVEL AUDIO

AXR-PDN-12W
High level audio (speakers, etc) line plug, colour white. Cat P-1632
$10.50

AXR-PDN-11B
High level audio line socket, colour blue. Cat P-1634
$9.95

AXR-PDN-31W
High level audio socket, panel mounting, colour white. (mates with AXR-PDN-12W). Cat P-1636
$7.50



AXR-PDN-14B
High level audio plug, panel mounting, colour blue. (mates with AXR-PDN-11B) Cat P-1638
$8.50

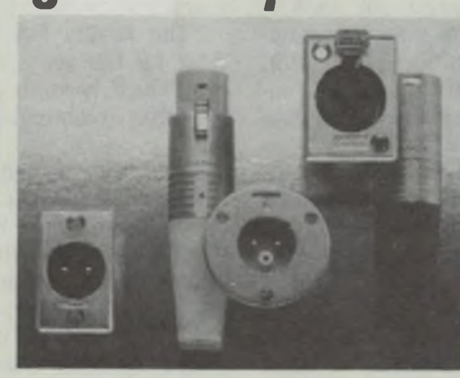
CANNON 240V MAINS RATED

AXR-LNE-12
240V mains rated and approved line plug, 3 pin. Cat P-1627
$9.95

AXR-LNE-31
240V mains rated and approved socket, chassis mounting. 3 pin. Cat P-1630
$7.95

AXR-LNE-11
240V mains rated and approved line socket, 3 pin. Cat P-1631
$9.50

AXR-LNE-32
240V mains rated and approved plug, chassis mounting. 3 pin. Cat P-1629
$7.50



CANNON "BOOTS"

Use boots to "colour code" your lines making identification much simpler — particularly when you have a big board with lots of plugs & sockets coming in!

Boots fit over all Cannon connectors.

Orange boot: Cat P-1615 **50c**
Yellow boot: Cat P-1616 **50c**
Green boot: Cat P-1617 **50c**
Blue boot: Cat P-1618 **50c**

PROUDLY MADE IN AUSTRALIA

Genuine Cannon connectors: Now available at

DICK SMITH ELECTRONICS
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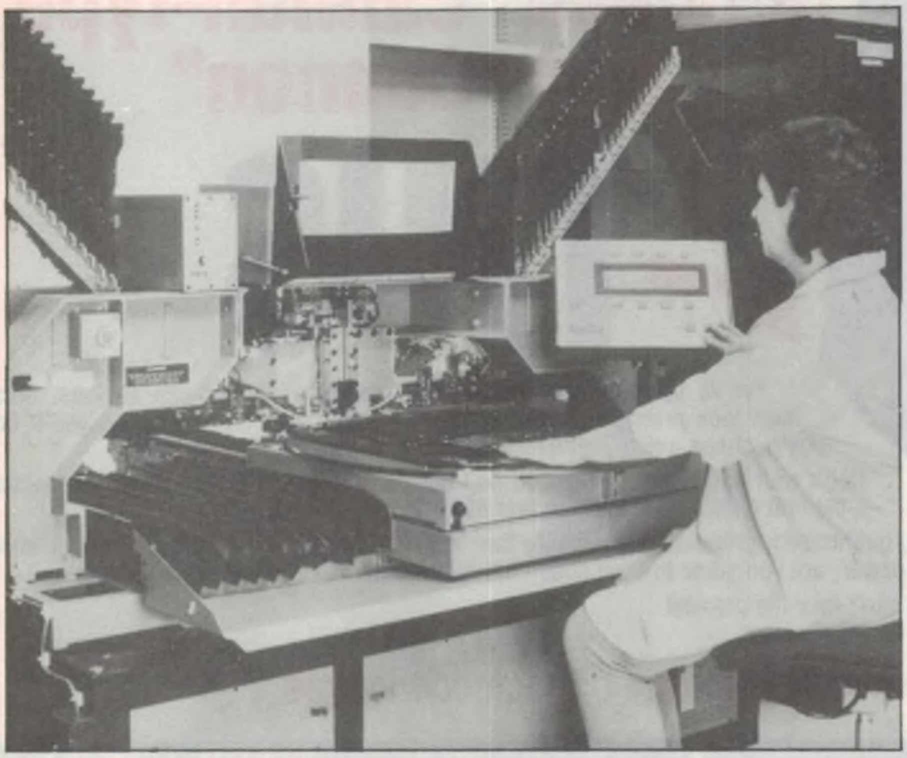
News Highlights



Nepean Electronics wins AWA-Nortel contract

Nepean Electronics has won a contract to assemble selected printed circuit boards for AWA-Nortel's Meridian SL-1 PABX products. The project is expected to be worth in excess of $2 million over the next three years.

The PCBs for Meridian SL-1 PABX systems were originally assembled in Canada by Northern Telecom. Mr John Sager, general manager of AWA-Nortel, said "they will now be assembled by Nepean Electronics, in Penrith, as part of AWA-Nortel's plan to increase its commitment to Australian content."

"We enthusiastically support the efforts of Nepean, which has demonstrated willingness to understand and implement international manufacturing standards," Mr Sager said.

AWA-Nortel is a joint venture company formed by Northern Telecom of Canada and Amalgamated Wireless Australasia. It has 60% Northern Telecom ownership and 40% AWA.

Nepean has also commissioned the first phase of a major expansion, enabling it to achieve world class standards in the assembly of printed circuit boards. The expansion involves the installation of $1.3 million worth of automated manufacturing and assembly equipment.

Nepean Electronics' founder and managing director, Roy Bowyer, said the first phase of the expansion would see the company achieve an expected turnover of $10 million within two years.

"The facility has been expanded to cater for the needs of overseas companies which need to meet local content or offset requirements," Mr Bowyer said.

The new assembly equipment is housed in a 1440 sq metre climatically-controlled building. It includes an Amistar CI 3000 automatic integrated circuit inserter and an Amistar CA6448 automatic axial inserter, both fully configured; a Seho 8040 wave/cut/wave integrated soldering system; and an Omega 3-stage aqueous cleaning and cleanliness test centre.

Together with a new Fairchild 333S in-circuit tester, this equipment will allow Nepean Electronics to readily double its capacity.

Laser surgery centre opened in Brisbane

Australia's first comprehensive centre dedicated to the teaching and practice of advanced laser surgery has been opened at Brisbane's Mater Private Hospital.

The centre is a joint venture between a number of leading surgeons and Gold Coast laser systems manufacturer Laser Dynamics Ltd (LDL). Initial resources include two Australian-made laser systems and at least 12 practising surgeons. The lasers comprise of an LDL CO_2 laser and a metal vapour laser from Sydney manufacturer Metalaser.

Mater Hospitals' chief executive officer Mr Pat Maguire says the centre will be a vital addition to medical teaching in Australia. It will incorporate the best features of the world's leading laser centres in North America.

Mr Milton Waner, senior lecturer at Sydney University's Department of Surgery and at the Royal Prince Alfred Hospital, says it will do much to advance the use of lasers to the levels current in North America. Similar laser centres have become an essential feature of the US medical scene.

Mr Waner has studied lasers in the US and is recognised as one of the

IBM scientist receives 1987 Turing award

John Cocke, an IBM Fellow at the Thomas J. Watson Research Centre in Yorktown Heights and the inventor of Reduced Instruction Set Computer (RISC) technology, has been awarded the 1987 ACM A.M. Turing Award. The award is the Association for Computing Machinery's (ACM) highest honour for technical contributions to computing.

Cocke was cited by the Turing Award Selection Committee for his significant contributions to three areas of computer science: the development of RISC computers, the design and theory of compilers, and the architecture of large systems.

RISC, invented by Cocke and a small group of collaborators in the mid-1970s at the Watson Centre, is a "back-to-basics" computer architecture that simplifies computer instructions and reduces operation cycles.

Cocke is credited with discovering and systematising many of the fundamental formulas now used in compilers, the software that transforms user programs into machine-readable programs.

leading laser researchers and practitioners in Australia.

Mr Waner describes the role of lasers in surgery today as analogous to that of computers in business and industry ten years ago.

It is expected that the new centre will be the forerunner of other such centres in Australia.

The first two lasers and ancillary equipment have cost about $150,000. There will be substantial additional investment within months of opening, according to Peter Schultz, managing director of LDL.

He was instrumental in the development of the IBM Stretch computer, a prototype for the IBM System/360; and the IBM Engineering Verification Engine, a special purpose parallel processor used to simulate IBM computer logic circuits before they are built.

Cocke also played a leading technical role in innovations involving pipelining — a type of parallel processing — which have become an integral part of mainframe computers.

The Turing Award is given annually in commemoration of Dr. A.M. Turing, the English mathematician who was a major influence in the early development of computing.

Melbourne Cup run in Pitt Street

A crowd of more than six hundred shoppers and tourists took up positions in front of just one television screen in Sydney's Pitt Street mall, to watch their horses in the 1987 Melbourne Cup.

Most of them had a good view of the finish. The television screen, a Philips Vidiwall showed the race on a picture almost eight square metres in area.

The Vidiwall, now a permanent feature of the Pitt Street mall, consists of sixteen "frameless" Philips 37" Superscreen televisions, which can be programmed to display multiple images or one single giant picture, as for the coverage of the big race. It can also freeze frame on certain screens to emphasise the main action.

Housed in a huge kiosk at the Market Street end of the mall, the Vidiwall is operated by Videodisc, a division of David Hooker Investments. It displays video entertainment, news broadcasts and television commercials around the clock.

Philips has supplied Vidiwalls for installation in many cities around the world, but the Sydney system is the first to operate non-stop — 24 hours a day, seven days a week.

NEWS BRIEFS

- Len Altman, formerly managing director and co-founder of Elmeasco Instruments, has formed a new Sydney company ***Obiat Pty Ltd*** to distribute electronic and mechanical products from both Australian and overseas manufacturer. Address of the new firm is 129 Queen Street, Beaconsfield 2015; phone (02) 698 4776, fax 699 9170.
- University-Paton subsidiary ***Advanced Component Distributors*** has been appointed sole Australian agent for the modems, EEPROMS, codec filters and DTMF diallers of US-based firm Sierra Electronics. Data cable and connector distributor *Pegasus* has also joined the University-Paton group, and will now trade as ACD Pegasus. Former STC-Cannon staffers John Dunlop and Alan Peterson have been appointed as founding staff of ACD Pegasus's new NSW office.
- Software specialist ***Computer Sciences of Australia*** has signed a second contract for the Royal Australian Navy's new submarine program, raising the level of its involvement to $67 million. The second contract was with French company Thomson Sintra, and is for developing software for the subs' sophisticated sonar systems.
- G.B.S. Falkiner's ***George Brown Group*** has now fully acquired its subsidiary ***Protronics***, by buying the remaining minority interest of Bob Crabbe. Mr Crabbe will become director of marketing for the Group, and also remain as managing director of Protronics.
- Warwick Christie, formerly of Sanyo and Toshiba, has been appointed national sales manager for consumer products at JVC distributor ***Hagemeyer (Australia)***. The firm has also promoted Peter Hotson to NSW sales manager, consumer products, and Ken Rogers JVC consumer product sales manager for Victoria and Tasmania.
- National (Matsushita) relay distributor ***RVB Products*** has appointed as national marketing manager Stuart Wright, formerly with Daneva for many years. RVB has also set up a branch office in Sydney, headed by David Johnstone. The office is at 220 Pacific Highway, Crows Nest, in the Spectrum/2DAY building. Phone (02) 957 6385, fax 929 5334.
- Sole Australian distribution rights for the Burndy range of insulation displacement connectors has been won by ***Computer Switching Systems and Cables*** (CSSC), of Unit 3, 1 River Road West, Parramatta 2150.

News Highlights

Webster releases Aussie supermini

Australian computer manufacturer Webster Computer Corporation has released what it claims is the most significant product in its corporate history. Australian designed and manufactured, the Webster VENUS supermini is an AT&T 3B-series compatible VMEbus based computer which runs the Unix System V operating system. Featuring high performance discs to 1.5Gb, CPU performance to 2 MIPS, and memory to 96Mb, VENUE comfortably supports simultaneous timesharing access by up to 66 users.

For the past ten years, Webster Computer Corporation has produced compatible enhancements to the offering of Digital Equipment Corporation. Executive chairman, Mr David Webster stated "VENUS is a radical new arm to our product strategy. It is a move away from an overdependence on Digital's proprietary busses, protocols and operating systems. It is a move towards open standards. It will position Webster for dramatic development and growth as a truly independent Australian computer company." He added "the development of VENUS has provided Webster with a leading edge 32 bit machine, launching us into mainstream supermini computer applications."

The VENUS CPU is a full uncompromised 32-bit, linear address, virtual memory machine; able to run program images as large as 4 gigabytes. Physical memory limit is an astounding 97 megabytes.

Currently, two speed ranges of CPU are available. Model VS18, clocked at 18MHz, has an average instruction throughput of 2 MIPS and floating point performance of 1.3 million Whetstones. Mr Webster said "work is already underway on a successor CPU — a 6 MIPS processor clocked at 30MHz. Release is planned before June 1988."

To provide the user with a wide choice of plug in enhancements and relative freedom from obsolescence, Webster adopted the VMEbus as the internal modular interconnection system for VENUS. Supported by over 200 manufacturers offering over 1000 VME interface products worldwide, this is an extremely high performance open standard.

The open standard Small Computer System Interface bus (SCSI) was adopted by VENUS to utilise a wide range of discs and tapes incorporating the SCSI interface. These devices are of high level functionality and provide VENUS with an exceptionally high performance mass storage subsystem.

New AWA Microelectronics semiconductor plant "on schedule"

According to Dr Bob McCluskey, general manager of AWA Microelectronics, everything is on schedule with the new $65 million semiconductor design and fabrication facility being built by his firm at Homebush, in western Sydney. The plant is a joint venture by AWA, British Aerospace Australia and the NSW Investment Corporation.

Construction of the building is currently well in hand, and the process equipment on order. Installation of the equipment will begin in March, with first commercial silicon available by the third quarter of 1988.

The fabrication facility will provide Class 10 operating condition, and the initial equipment selected will be capable of handling 6" wafers with processes to submicron dimensions.

The process technology will be provided by GE/RCA, via a technology licence already negotiated. The first processing will be either a 1.5um minimum feature size CMOS double metal process with 1.2um effective channel length, or a 1.25um process with 1.0um channel length. This should enable the facility to produce state of the art chips within excess of 250,000 transistors.

The facility will also have adequate security to allow the design and manufacture of classified products.

Philips wins ESA approval for electros

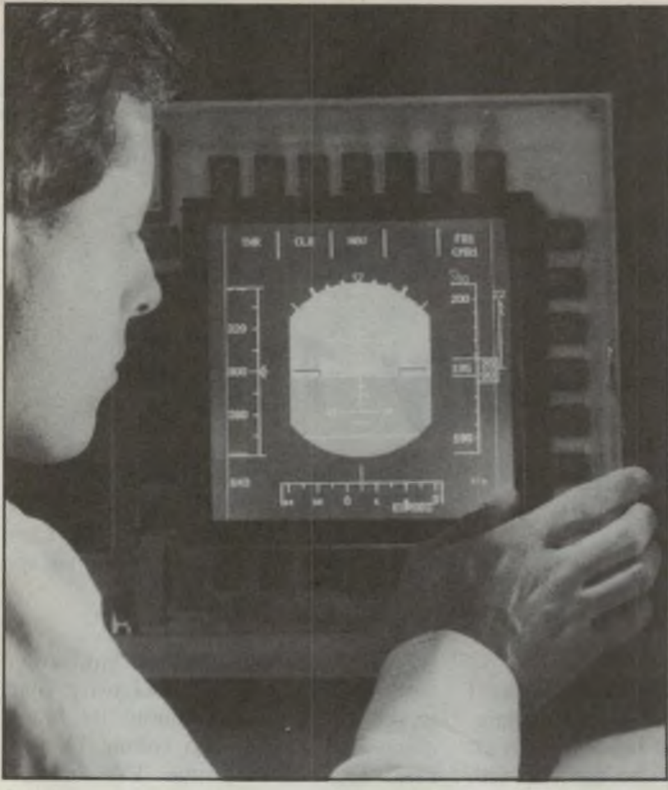
The Philips 123-Series of solid aluminium electrolytic capacitors is now officially approved by the European Space Agency (ESA). The Certificate of Qualification places the 123-Series on the ESA qualified product list; only products from this list are allowed to be used in space applications. The approval underlines the high level of quality and reliablity achieved in the 123-Series.

The axially-wired solid aluminium electrolytic capacitors have already been used for several years in the European space program. Thanks to their high reliability, they were chosen for the Ariane space rocket.

27°C superconductor discovered

Japanese firm Sumitomo Electric claims to have developed a material which becomes superconducting at 27°C (300K) — dramatically higher than all previously developed superconductor materials.

The material is said to be a compound of yttrium, copper and oxygen. At least five specimens 7mm in diameter and 3mm thick were found to exhibit zero resistance at 27°C, and also exhibited the Meissner effect, repelling a magnetic field. This is generally regarded as the critical test of true superconductivity.



GE produces largest hi-res LCD display

A team of GE scientists and engineers in New York has designed and fabricated the world's largest high-resolution liquid crystal display (LCD) panel for aircraft cockpits.

The lightweight flat panel, which measures 6.25 x 6.25 inches, is a high-resolution, full-colour liquid crystal display designed to meet military specifications. GE's flat panel LCD instruments can be programmed to display engine performance, logistic and ballistic data, and attitude reference, as well as radar images and video.

This advanced LCD is less than three inches thick. By contrast, the glass cathode ray tube (CRT) it is designed to replace is 14" deep. The LCD also requires a turn-on voltage of only 15 volts vs. 17,000 volts for a CRT. It can function at temperatures ranging from –120°F to 200°F, in the arctic as well as in the desert.

The display has more than 28,000 pixels per square inch (or more than 1 million in total), giving it twice the sharpness of a home TV screen.

GE's developmental LCDs look similar to the familiar screens seen on digital watches, pocket calculators, and laptop computers. However, the new displays produce a much higher-resolution image because of GE's ability to position thin-film transistors at the corner of each pixel. This provides a switch that runs the liquid crystal material on or off at that point, enhancing contrast between light and dark areas and improving the viewing angle.

Each of the 1 million thin-film transistors consists of a metal gate, a thin film of hydrogenated amorphous silicon nitride and amorphous silicon, and a metal source and drain. The silicon nitride and amorphous silicon layers are laid down via plasma deposition at temperatures less than 650°F. This relatively low temperature makes is possible to fabricate large arrays of transistors directly on the glass plates, without causing them to soften or melt.

The Serviceman

Index of servicing stories January 1975 — July 1987

Bearing in mind that this is a special "digest" issue, I've decided to spare you my fascinating prose for a month, and provide instead a very handy reference index of Serviceman stories which have been published here over the last 12 years.

By the way, I can't claim the credit for preparing the index myself. It comes from my good friend Jim Lawler, that tireless service tech from the Apple Isle, who prepared it originally for his own use, in helping to track down stories that dealt with particular set models and faults.

When he told me how useful it was, I persuaded him to let us reprint it here, so others could get the benefit of his efforts. Very gratiously he agreed, with the comment that I should emphasise how much time and trouble it took him to assemble. Apparently it took so long that there was a distinct whiff of divorce detectable in the Lawler household for a while — so Jim asks that we all appreciate the sacrifice he made!

So with grateful thanks to Jim Lawler and the long-suffering Mrs Lawler, here is the result. It's organised by brand name and model, with colour TV sets first, then monochrome TVs, miscellaneous products and antennas. I hope you find it as useful as I have.

COLOUR TV RECEIVERS

(Page numbers marked (*) are TETIA "Fault of the Month".)

AWA — general faults

AWA 3504	CTV	SYMPTOM	Set dead.	Jul82 P71
		CURE	Regulator transistor shorted.	
		SYMPTOM	No sound.	Jul82 P73
		CURE	Open circuit voice coil.	
AWA "G" chassis	CTV	SYMPTON	Bright screen, vert dist, no 150V.	Jun87 P73*
		CURE	R581 (4.7ohm ½ W) o/c.	
AWA C6334	CTV	SYMPTOM	Red smear.	Nov86 P44
		CURE	LC601 (M51393P) multifunction IC faulty.	
AWA "Q" chassis	CTV	SYMPTOM	No sound.	Dec85 P46*
		CURE	Solder dag in detector coil can.	
AWA "K" chassis	CTV	SYMPTOM	110V rail high. Pix hiccups	Aug85 P58*
		CURE	D907 (11V zener) gone high.	
		SYMPTOM	I'mittent partial frame collapse.	Feb83 P76
		CURE	Q204 (2SC711) leaky.	
		SYMPTOM	Pulling, jitter, sync problems.	Jan82 P76
		CURE	Q401 (2SA628) faulty.	
AWA	CTV	SYMPTOM	No sound.	Mar78 P62
		SYMPTOM	Pix blooming	Sep75 P83
		CURE	R352 gone high.	
AWA AV21	VCR	SYMPTOM	No go.	Aug86 P42
		CURE	Remove foreign objects.	
AWA N/S	Radio	SYMPTOM	Loudspeaker poling.	Nov83 P73
		CURE	Cone pigtail stiffened	

TOSHIBA — general faults

Toshiba C810	CTV	SYMPTOM	Highlights flare with brightness.	Jan86 P47*
		CURE	R262 (120ohm 1/2w) not grounded.	
Toshiba C812	CTV	SYMPTOM	No vertical scan.	May85 P58
		CURE	R437 (22ohm) safety resistor open circuit.	
		SYMPTOM	No vertical scan.	May85 P59
		CURE	Q307, D310 shorted. W306 open circuit.	
		SYMPTOM	Vertical linearity problems.	Nov83 P70
		CURE	Q306 and Q353 low gain.	
		SYMPTOM	Complete frame collapse.	Sep83 P69
		CURE	High resistance track on V. board.	
		SYMPTOM	Complete frame collapse	Aug83 P73
		CURE	C333 (2.2µF) faulty.	
		SYMPTOM	Intermittent pulling and bending.	Sep83 P70
		CURE	High res. track TP31 to R301.	
Toshiba C2021	CTV	SYMPTOM	No colour.	Dec82 P86
		CURE	IC501 faulty.	
Toshiba N/S	CTV	SYMPTOM	Tuning drifts on one prog button	Oct 76 P79
		CURE	Diode in series with tuning pot slider.	

BLAUPUNKT — general faults

Blaupunkt Cardona	CTV	SYMPTOM	Vertical collapse.	Jan87 P45
		CURE	R643 (1.5ohm 4W) open circuit.	
		SYMPTOM	Any unexplained stoppage.	Jun85 P66*
		CURE	Bad socket contacts under modules.	
		SYMPTOM	Mains fuse o/c, D1242, D12453 s/c.	Sep85 P66*
		CURE	EHT flashover to degaussing coil.	
		SYMPTOM	Unstable tuning.	Feb85 P57*
		CURE	C1153 leaky7.	
Blaupunkt N/S	CTV	SYMPTOM	Sound but no pix.	Mar81 P67
		CURE	C690 (.01µF) short circuited.	
Blaupunkt N/S	CTV	SYMPTOM	Green screen.	Jun79 P79
		CURE	Colour amplifier tstr open circuit.	

HITACHI — general faults

Hitachi CEP288	CTV	SYMPTOM	No go, line drive normal.	Sep86 P73*
		CURE	Open circuit emitter return to TR59.	
Hitachi CEP388	CTV	SYMPTOM	Shuts down after 2 seconds.	Jul86 P65*
		CURE	TR710 faulty.	
Hitachi CPT2065	CTV	SYMPTOM	No vertical scan.	Jun86 P69*
		CURE	Replace HM6251 module.	
Hitachi CWP139	CTV	SYMPTOM	No go.	Oct 85 P56
		CURE	Q908, Q909, one or both leaky.	
Hitachi Pal3A chassis	CTV	SYMPTOM	Thin band of horizontal tearing.	Mar85 P61*
		CURE	C750 & C751 open circuit.	

SANYO — general faults

Sanyo CTP8604	CTV	SYMPTOM	Power supply hiccupping.	Jan83 P68
		CURE	Line output transformer u/s.	
		SYMPTOM	No pix	Jan83 P69
		CURE	C603 (4.7µF) open circuit.	
Sanyo CTP6603	CTV	SYMPTOM	Reduced vertical scan.	Oct82 P87
		CURE	C451 (330µF N.P.) low value.	
Sanyo CTP7601	CTV	SYMPTOM	Smeared pix with retrace lines.	Sep82 P86
		CURE	C473 (10µF 250v) open circuit.	
Sanyo VCT-M10	VCR	SYMPTOM	No go.	Feb87 P60
		CURE	C5151 (.0047µF 250V) leaky.	
Sanyo VTC-500	VCR	SYMPTOM	Noisy pix, greenish band at top.	Jun86 P65
		CURE	Tape guide adjustments.	
Sanyo	CTV		Notes on burnt television	Feb82 P81

HMV — general faults

HMV	CTV	SYMPTOM	Vertical problems.	May87 P68
C211, C212		CURE	Discussion of common faults.	
		SYMPTOM	Intermittent vertical hold.	May87 P69
		CURE	C320 broken pigtail	
		SYMPTOM	Flagwaving after VCR mods done.	Oct85 P58*
		CURE	Reduce value of C214.	
		SYMPTOM	No go. Warbling sound from P/S.	Feb85 P51*
		CURE	R101 (2.2k ½W) open circuit.	
		SYMPTOM	Distorted sound.	Nov82 P74
		CURE	Loudspeaker poling.	
		SYMPTOM	No sound.	Mar78 P62
		CURE	Audio IC (MC1310P) faulty.	
		SYMPTOM	Intermittent sound.	Jul 79 P98
		CURE	Faulty connection to P/S unit.	
		SYMPTOM	Low brightness, out of focus pix.	Jul79 P98
		CURE	1ohm resistor in heater circuit gone high.	
HMV	CTV	SYMPTOM	Weak pix, like poor tube.	Jul85 P54
C221		CURE	C118 (100µF 10V) dry jointed.	
		SYMPTOM	No go, smell of burning	Mar 84 P71
		CURE	Line output transformer faulty.	
Decca	CTV	SYMPTOM	Vertical rolling.	Aug82 P72
33series		CURE	C415 (100pF) faulty.	
		SYMPTOM	Set dead.	Jul82 P71
		CURE	PY500A diode shorted.	
		SYMPTOM	Flagwaving, rolling.	Jun80 P62
		CURE	C200 (33µF) faulty.	
		SYMPTOM	No pix, no sound.	Feb80 P65
		CURE	D2 (BZX61C12) 12 volt zener s/c.	
		SYMPTOM	White screen, sound OK.	Aug76 P90
		CURE	First IF amplifier transistor faulty.	
		SYMPTOM	Cutout trips.	Aug76 P90
		CURE	Replace cutout.	
		SYMPTOM	No pix. No hor. hold.	Mar78 P62
		CURE	R465 sprung. 9JW8 faulty.	
		SYMPTOM	Cutout trips, PY500 glows.	Mar78 P62
		CURE	B+ boost cap shorted.	
		SYMPTOM	No colour.	Jun77 P75
		CURE	33pF on base of 1st IF transistor.	
		SYMPTOM	No go.	Mar78 P61
		CURE	PCL82, 9JW8 both faulty.	
HMV	CTV	SYMPTOM	Snowy pix, no colour.	Mar78 P62
N/S		CURE	Antenna connected to UHF terminal in error.	
HMV	Radio	SYMPTOM	Local oscillator not running.	Dec82 P89
N/S		CURE	Broken RF return on antenna coil.	

NATIONAL — general faults

National	CTV	SYMPTOM	Black shape at bottom of pix.	Aug86 P47*
TC2002		CURE	C857 open circuit.	Sep86 P68
				Dec86 P71
				Jul87 P63
National	CTV	SYMPTOM	Flutter in pix. Not V-hold.	Jul87 P63*
TC86		CURE	C808 low value.	
		SYMPTOM	Brightness varies as set warms up.	Apr82 P58
		CURE	C905 (3.3µF) heat sensitive.	
		SYMPTOM	Brightness changes.	Jan82 P78
		CURE	Contacts at edge of video boards.	
		SYMPTOM	No raster, sound OK.	Aug79 P60
		CURE	Heater o/c. No obvious explanation.	
			Explanation for o/c heater.	Nov79 P70
			More notes on o/c heater.	Apr80 P63
National	CTV	SYMPTOM	Tuning shifts downwards.	May87 P72*
TC2054		CURE	Q7 (2SC1685) leaky.	
National	CTV	SYMPTOM	Small pix, top left of screen.	Apr87 P36
TC2035		CURE	D/J at Pin 1 LOP transformer.	
National	CTV	SYMPTOM	Power supply radiation.	Dec86 P69
TC2697		CURE	Recommended modifications.	
National	CTV	SYMPTOM	No vertical scan.	Mar86 P34*
TC1801A		CURE	Output transistors open circuited.	
National	CTV	SYMPTOM	No colour.	Nov85 P70*
TV1802		CURE	C615 (1µF 50V) open circuit.	
National	CTV	SYMPTOM	N/S barrel distortion.	Jun85 P56*
TC2631		CURE	R456 value drifts	
National	CTV	SYMPTOM	Mains fuse blows	Aug83 P71
22/23		CURE	Underrated.	Apr85 P58
National	CTV	SYMPTOM	Hor. ringing, brightness varies	Jan84 P65
TC1404		CURE	C555 (10µF 250V) intermittent o/c.	
National	CTV	SYMPTOM	Blue screen.	Jun79 P78
N/S		CURE	Intermittent heater cathode short in tube.	
National	CTV	SYMPTOM	Intermittent no colour.	Apr87 P38
N/S		CURE	D/J at M 1 on control panel.	
National	VCR	SYMPTOM	No record or playback	Jul87 P58
NV-450		CURE	RF converter U/S.	
National	VCR	SYMPTOM	No record or playback.	Jul87 P59
NV-370		CURE	C1102 gone low value.	
National	VCR	SYMPTOM	Bad pix (2 cases).	Feb87 P56
NV-370		CURE	Worn and dirty heads.	
National	Radio	SYMPTOM	Low sensitivity.	Mar82 P66
R225J		CURE	Antenna lead loose.	
National	Radio	SYMPTOM	Intermittent.	Apr81 P77
R238W		CURE	Pressure contacts faulty.	

Philips — general faults

Philips	CTV	SYMPTOM	Weak pix.	Jul87 P60
K9		CURE	Bad tube.	
		SYMPTOM	Blue pix.	Jul87 P62
		CURE	Leaky tube base board.	
		SYMPTOM	Retrace lines, not adjustable.	Nov86 P49*
		CURE	C572 (100µF 40V) open circuit.	
		SYMPTOM	Barrel distortion.	Oct86 P38
		CURE	C451, C452 low value.	
		SYMPTOM	155V rail high, no adjustment.	Mar86 P34
		CURE	R187 wrong value.	
		SYMPTOM	No colour.	Mar 84 P71
		CURE	TBA 540 in U270 faulty.	
		SYMPTOM	Frame collapse.	Dec83 P72
		CURE	TS540 heat sensitive.	
		SYMPTOM	Intermittent vertical collapse.	Sep80 P84
		CURE	D/J at joint in copper pattern.	
		SYMPTOM	Picture tube neck punctured.	Jul83 P73
		CURE	Third harmonic tuning caps o/c.	
		SYMPTOM	Hiccuping.	Feb.82 P81
		CURE	(1) D175 s/c. (2) Tripler µ/s.	
		SYMPTOM	No sound or pix.	Aug76 P90
		CURE	One line output transistor shorted.	
		SYMPTOM	Pale colours, no red.	Aug76 P90
		CURE	Sticky contacts under chroma module.	
		SYMPTOM	Misconvergence.	Aug76 P90
		CURE	22ohm 2W res on blue amplitude control o/c.	
		SYMPTOM	Intermittent colour.	Jul75 P74
		CURE	Faulty transistor in tuner.	
		SYMPTOM	Yellow pix.	May77 P72
		CURE	D320 (CY206) leaky.	
		SYMPTOM	Height varying rapidly	Aug76 P91
		CURE	Sticky contacts under frame module.	
		SYMPTOM	Snowy pix after thunderstorm.	Aug76 P91
		CURE	300/75 balun cooked.	
		SYMPTOM	No contrast, no control.	Mar77 P63
		CURE	D/J at lead on convergence board.	
		SYMPTOM	Intermittent colour, no red.	Jan77 P63
		CURE	VF337 colour difference amp faulty.	
		SYMPTOM	Hiccuping.	Mar78 P62
		CURE	Tripler.	
		SYMPTOM	No go, HT about 30v.	Mar78P62
		CURE	One line transistor shorted.	
Philips	CTV	SYMPTOM	Hiccuping.	Mar78 P61
K11		CURE	D/J at main filter cap.	
		SYMPTOM	No luminance.	Mar78 P61
		CURE	TS291 (BC548C) faulty.	
		SYMPTOM	No green.	Mar78 P61
		CURE	VF337 (G-Y amp) faulty.	
Philips	CTV	SYMPTOM	Intermittent shut down.	Apr86 P50*
KT2A		CURE	Broken track under 5.6k5W resistor.	
Philips	CTV	SYMPTOM	Intermittent loss of Hor. hold.	Jan87 P43
KL9A-2		CURE	Corroded track on main cct board.	
Philips	Radio	SYMPTOM	Spurious oscillations.	Aug82 P73
596		CURE	Corrosion on valve grid pin.	

SONY — general faults

Sony	CTV	SYMPTOM	Shut down.	Jun87 P68
KV18030/2000		CURE	Q901 (SG613) µ/s.	
		SYMPTOM	Vertical lines across screen.	Jun87 P68
		CURE	R812 (18ohm 2W) o/c.	
		SYMPTOM	Bad E-W pincushion distortion.	Jun87 P69
		CURE	VR508 (Pin Bias) not faulty.	
		SYMPTOM	Erratic startup.	Jun87 P71
		CURE	C620 (332µF 160V) leaky.	
		SYMPTOM	Erratic width, Streaky pix.	Jun86 P45
		CURE	C612 (3.3µF) faulty	
Sony	CTV	SYMPTOM	Pix slowly blacks out.	Jun84 P80
N/S		CURE	Q454 (2SC633A) leaky.	
Sony	Recorder	SYMPTOM	Won't record.	Apr80 P61
TC500A		CURE	Shorted grid capacitor.	

Sharp — general faults

Sharp	CTV	SYMPTOM	White screen, R1127 fails often.	Jul87 P63*
8C220/8C223		CURE	C716 open circuit.	
Sharp	CTV	SYMPTOM	Brief pix then shutdown.	Jun83 P80
9C183		CURE	330Kohm in G2 chain open circuit.	
Sharp	CTV	SYMPTOM	Black lines down screen.	May85 P61
C1831X		CURE	R915 intermittent open circuit.	
		SYMPTOM	No sound, no pix.	Sep82 P89
		CURE	Line osc. coil open circuit.	
		SYMPTOM	White screen.	Sep82 P90
		CURE	Dry joint at IC1203 (TA7069)	
		SYMPTOM	Very weak pix.	Sep82 P90
		CURE	47ohm feeding video outputs gone high.	
sharp	CTV	SYMPTOM	Pix breakup, like AGC fault.	Sep84 P58
CX2220		CURE	CF201 (SAW filter) faulty.	
Sharp	VCR	SYMPTOM	Intermittent stoppages.	Jul86 P62
VC-9200X		CURE	Dew sensor faulty.	
Sharp	VCR	SYMPTOM	Unreliable rewind function.	Dec84 P70
VC9300		CURE	Faulty reel motor.	

The Serviceman

RANK ARENA — general faults

Rank Arena C2206	CTV	SYMPTOM	Shut down.	May87 P70
		CURE	TR2001 leaky.	
Rank Arena C2606	CTV	SYMPTOM	Shut down.	Mar87 P42
		CURE	TR2001, TR2002 faulty	
		SYMPTOM	No vertical scan.	Mar87 P44
		CURE	TR409 base lead nipped by screw.	
Rank Arena C2003	CTV	SYMPTOM	Black lines down screen.	Oct86 P41*
		CURE	TR416 faulty.	
Rank Arena C2201, 2601	CTV	SYMPTOM	Faulty tripler	Nov84 P62
		CURE	Notes on substitute triplers.	
		SYMPTOM	Faulty focus resistor.	Apr86 P51
		CURE	Notes on substitutes.	
		SYMPTOM	Faulty focus resistor.	Mar86 P32
		CURE	Notes on replacements.	
		SYMPTOM	Red/green reversed.	Jul84 P69
		CURE	T1003 primary open circuit.	
		SYMPTOM	Vert. collapse after EHT flashover.	Jan81 P67
		CURE	TR410 faulty.	
		SYMPTOM	No go.	Feb80 P65
		CURE	TR410, TR411 μ/s. D560 shorted.	
Rank Arena C1681	CTV	SYMPTOM	No horizontal sync.	Feb86 P52
		CURE	TR505 (AFC amp) faulty.	
Rank Arena C2203	CTV	SYMPTOM	Slight top foldover	Feb85 P57*
		CURE	C358 (10μF 150V) open circuit.	
Rank Arena RV-340	VCR	SYMPTOM	No go, fuse F4 blown.	Jul86 P64
		CURE	Foreign body behind control panel.	
Rank Arena C1210	CTV	SYMPTOM	Won't start.	Oct84 P58
		CURE	R2, R34 both gone high.	
Rank Arena 2603	CTV	SYMPTOM	Protection board	Jun84 P80
		CURE	Explanation of operation.	
		SYMPTOM	Set dead.	Oct83 P68
		CURE	TR2001 s/c. Tripler μ/s.	
		SYMPTOM	Dark pix.	Jun81 P81
		CURE	D555, D559 or D560 open circuit.	
Rank Arena C2204	CTV	SYMPTOM	Sudden small changes in brightness.	Feb84 P60
		CURE	Bad contacts in VIF IC sockets.	
Rank Arena 2230	CTV	SYMPTOM	Side pincushion distortion.	Oct82 P88
		CURE	D555, D559 or D560 open circuit.	
Rank Arena C2652	CTV	SYMPTOM	Shuts down after 15 minutes.	Feb82 P81
		CURE	D555 short circuited.	
Rank Arena C2251	CTV	SYMPTOM	No pix.	Nov81 P81
		CURE	D562 x/c. (Not shown on schematic).	
Rank Arena N/S	CTV	SYMPTOM	No sound.	Aug76 P90
		CURE	Speaker open circuit voice coil.	
		SYMPTOM	No go, fuse holder problem.	Mar78 P61
		CURE	Relocate holder.	

VARIOUS BRANDS — general faults

JVC 7350AU	CTV	SYMPTOM	White screen. No sound.	Jul87 P63*
		CURE	Series regulator shorted.	
JVC 7765	CTV	SYMPTOM	No green in pix, faulty tube	Mar83 P99
		CURE	Change value of R01 to 1Kohm	
Korting 5507	CTV	SYMPTOM	Green pix.	Oct86 P39
		CURE	Broken track under chroma delay line.	
		SYMPTOM	Overbright pix, 315V rail high	Oct86 P39
		CURE	Commutation transformer faulty.	
General GC145	CTV	SYMPTOM	Low voltage trip too sensitive.	Oct86 P40
		CURE	Reader's modification.	
		SYMPTOM	Premature tripping on 12V supply.	Jun86 P69
		CURE	Recommended modification.	
		SYMPTOM	Small pix on 12V supply.	Dec85 P44
		CURE	Q608 (2SC2236Y) leaky.	
General GC181	CTV	SYMPTOM	Bright pix with retrace lines.	Mar83 P76
		CURE	R604 (330Kohm) faulty.	
General N/S	CTV	SYMPTOM	Mains fuse blown.	Oct81 P89
		CURE	Replace .1μF 1000v cap on transformer sec.	
G.E. TC63L1	CTV	SYMPTOM	Intermittent shut down.	May86 P58
		CURE	Dry joint at R924 (4.7K5W)	
G.E. TC20T1	CTV	SYMPTOM	Intermittent vertical rolling.	Mar85 P58
		CURE	TR52 (Hor. AFC amplifier) faulty.	
TYNE 6200	CTV	SYMPTOM	No vertical scan.	Feb82 P81
		CURE	D306 short circuited.	
Luxor N/S	CTV	SYMPTOM	Repeated chopper failure.	Nov81 P81
		CURE	Faulty power supply circuit board.	
Princess 14CT1	CTV	SYMPTOM	Occasional pix failure. Sound OK.	Jun80 P60
		CURE	Dry joint at through board connection.	

KRIESLER — general faults

Kriesler 59-01	CTV	SYMPTOM	Stopped with a loud bang	Jan85 P57
		CURE	Component breakdown on convergence board.	
		SYMPTOM	Set dead.	Jul82 P70
		CURE	C112 leaky.	
		SYMPTOM	No colour.	Nov81 P81
		CURE	D/J at pin 1 on line output transformer.	
		SYMPTOM	No go and burning.	Oct81 P89
		CURE	D777 shorting under load.	
		SYMPTOM	Weak sync.	Jul81 P76
		CURE	Broken track from Pin 8 LOPT	
		SYMPTOM	Bad convergence.	Jul81 P77
		CURE	Broken tracks to SKT701 & SKT705	
		SYMPTOM	Faulty convergence.	Jul81 P77
		CURE	R849 (22K trimpot) broken.	
		SYMPTOM	No go. Tube neck punctured.	Aug80 P88
		CURE	Spike from D/J in power supply.	
		SYMPTOM	No raster, lines at top of screen.	Aug79 P61
		CURE	D791 shorted.	
Kriesler 59-03	CTV	SYMPTOM	No ultrasonic remote control.	Nov82 P76
		CURE	Adjust transmitter frequencies.	
		SYMPTOM	Hiccuping.	Nov78 P65
		CURE	Breakdown in chopper insulating mica.	
Kriesler 59-04	CTV	SYMPTOM	Erratic horizontal shift.	Apr85 P58
		CURE	C707 (.0022μF 250V) intermittent o/c.	
		SYMPTOM	Occsnal then total frame collapse.	Feb83 P24
		CURE	TR707 intermittent short circuit.	
Kriesler Multisonic	Radio	SYMPTOM	One channel badly distorted.	Sep81 P84
		CURE	Replace faulty output transformer.	

COLOUR TV — general notes

Electronic Organs	2 failures — was it really the vacuum cleaner?	Nov78 P66
	Notes re heater cathode shorts.	Oct79 P62
	Beetles cause tuning problems.	Aug78 P63
	Car causes impurity problems	Jan78 P61
	Notes on electronic ghost suppression.	Jan77 P63
	More on ghost reduction.	Jan78 P61
	Comments on colour servicing.	Mar78 P61
	Early comments and criticisms.	Jul75 P75
	EMI Colour TV service course.	Aug75 P72
	Converting foreign colour sets.	Sep75 P82
	Purity and degaussing.	Nov75 P67
	More on converting foreign sets.	Jan76 P64
	Rank Arena service bulletins.	Jan76 P65
	Notes on servicing.	Aug76 P90
	Notes on panel lamps.	Mar76 P79
	More Rank Arena service notes.	Mar76 P79
	Antenna Lurks — the early days.	Apr76 P71
	Interference from the downstairs flat.	Mar76 P79
	More interference from the neighbours.	Dec76 P79
	Whistling picture tubes.	Mar77 P62
	Self converging picture tubes.	Feb77 P68
	Faults built in at the factory.	Oct77 P77

MONOCHROME TV

General faults

STC N/S	TV	SYMPTOM	Bad pix and sound on holiday.	Dec79 P74
		SURE	First aid with no tools.	
HMV 1184	TV	SYMPTOM	Vertical collapse.	Feb79 P72
		CURE	C503 (0.01μF) heat sensitive.	
HMV N/S	TV	SYMPTOM	Weak sync, no fine tune Ch2.	Apr76 P70
		CURE	Shorted caps, stuck osc coil core.	
HMV N/S	TV	SYMPTOM	Something burning.	Jul81 P79
		CURE	.039 400V paper cap shorted.	
Healing 800	TV	SYMPTOM	Vertical non-linearity.	Jan78 P60
		CURE	100μF cap, 0.1μF paper cap, heat sensitive.	
Strmbg-Carlson 4A002		SYMPTOM	Intermittent frame buzz.	Mar81 P96
		CURE	Broken negative lead in dual electro.	
		SYMPTOM	Bang!	Jun76 P82
		CURE	Mains cap, without an end.	
National TR505DU	TV	SYMPTOM	Snowy pix.	Jun82 P64
		CURE	Power lead fault.	
AWA P15	TV	SYMPTOM	No pix, no sound.	Feb78 P61
		CURE	BD436 series regulator faulty.	
			Further notes.	May78 P62
AWA P17	TV	SYMPTOM	No video on left side of screen.	Aug78 P63
		CURE	C516 (200μF) faulty.	
AWA P4	TV	SYMPTOM	Small pix — new 6CM5 won't fix.	Nov78 P65
		CURE	Set only works with AWA valves.	
AWA K86	TV	SYMPTOM	Left to right shading.	Jan76 P64
		CURE	Final p/s filter cap low value	
AWA 50-00	TV	SYMPTOM	EHT transformer shorted turns.	Feb76 P78
		CURE	R418 (680K) open circuit.	
AWA N/S	TV	SYMPTOM	No pix.	Dec80 P75
		CURE	O/c resistance in brightness circuit.	
Russian N/S	RV	SYMPTOM	Works but no sound or pix	May80 P58
		CURE	Conversion to Australian standards.	
PYE T26	TV	SYMPTOM	No sound.	May78 -P62
		CURE	Q31 leaky.	
Kriesler PT1	TV	SYMPTOM	Hum bars and rolling.	Feb78 P60
		CURE	BC108 error amp faulty.	
Kriesler 49-6	TV	SYMPTOM	Side by side images.	Jul77 P62
		CURE	C116A (1μF 50V) electro open.	
Philips TR530	TV	SYMPTOM	No go.	Jun82 P63
		CURE	3.9ohm 6 watt resistor missing.	
Philips 12F	TV	SYMPTOM	No pix and only 2JJ for sound	Nov75 P65
		CURE	No HT; crack in pattern.	

PYE — general faults

PYE 20A17	CTV	SYMPTOM	Bangs and sparks, then dead.	Apr85	P54
		CURE	D416, Q612 etc breaking down.		
PYE T29	CTV	SYMPTOM	Weak colour.	Jun82	P62
		CURE	Chroma IC faulty.		
		SYMPTOM	Very loud hum.	May82	P71
		CURE	Audio preamp transistor faulty.		
		SYMPTOM	Loud bangs.	Aug82	P60
		CURE	EHT leakage to earthnear tripler.		
		SYMPTOM	Weak or no colour.	Mar78	P61
		CURE	Recommended modification.		
		SYMPTOM	No go.	Mar78	P61
		CURE	D401, D402 short circuit.		
		SYMPTOM	Intermittent or no colour.	Aug76	P90
		CURE	Antenna problem and AGC misadjusted.		
		SYMPTOM	No colour.	Mar78	P62
		CURE	Both BC548 tstrs in ident circuit faulty.		
PYE T30	CTV	SYMPTOM	Line output transistor shorted.	Mar82	P65
		CURE	R624 (2.2ohm 1-2w) open circuit.		
PYE N/S	TV	SYMPTOM	No go after burnup.	Apr81	P77
		CURE	HT short in IF can.		
PYE N/S	CTV	SYMPTOM	Out of focus pix.	Jul76	P91
		CURE	Broken focus pot.		
PYE 22A-3A	CTV	SYMPTOM	Intermittent sound.	Oct79	P63
		CURE	Bad contact in front panel plug/socket.		

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First prize is a magnificent complete home system valued at over $7700. This includes one of Pioneer's A-717 "Reference Series" integrated amplifiers, capable of delivering a solid 95 watts per channel of continuous average power into 8-ohm speakers, or a whopping 250W per channel of peak power into 2 ohm loads. The A-717 also features a frequency response from 20Hz to 20,000Hz, twin power transformers and special class-AB output stages that give only .003% total harmonic distortion.

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Crikey — what more could you want? (J.R.)

Construction project:

Regenerative Radio with Varicap Tuning

Step back in time and build this simple regenerative radio receiver. Using only three transistors, it is not only fun to build, but educational as well.

by MARK CHEESEMAN

Back in the early days of radio, when men were real men, transistors were still in nappies, and *Electronics Australia* was called *Radio & Hobbies*, a favourite project for experimenters was to build a regenerative radio receiver. The design presented here is based on this old concept, however some concessions have been made to modern technology.

A regenerative receiver, in common with most receivers of the time, had a tuned front end consisting of a capacitor and inductor in parallel. Tuning could theoretically be accomplished by altering the value of either the inductor or the capacitor, to vary the frequency of resonance. It was usually easier to adjust the value of the capacitor, by physically moving the plates closer together (for increased capacitance) or further apart (to reduce it), and this became the usual method for tuning a radio.

Of course, a signal had to be coupled into this resonant circuit in order to get anything out of it, and this was achieved by either a tap on the inductor winding, or a smaller and completely separate winding wound on the same former. In the latter case, the coupling to the tuned circuit was magnetic rather than electrical.

In order to increase the level of the signal presented to the detector, an RF (radio frequency) amplifier stage was inserted after the tank circuit, both to buffer the signal (in order to avoid loading the circuit too much), and also to amplify it.

Two important specifications of any receiver are sensitivity and selectivity. *Sensitivity* describes the ability of the radio to detect weak signals and present them to the audio stage with as little noise as possible. *Selectivity* is the ability to separate the desired signal from others which are close in frequency, particularly if the desired signal is from a distant station, and a strong local signal exists on a nearby frequency.

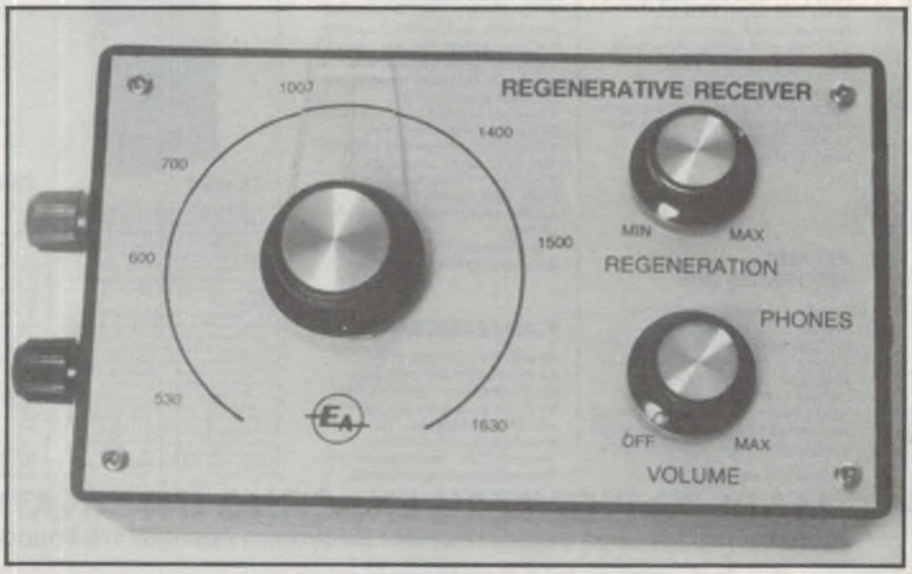
One day some bright spark figured that if he carefully coupled some of the signal from the RF amplifier back to its input with the right polarity (which turned out to be *positive* feedback), he could increase the level of the signal coming out of the amplifier — and also reduce the level of the unwanted signals nearby. That is the basic idea behind regeneration, and although one can't amplify the signal by an unlimited amount, it effectively increases the quality factor (Q) of the circuit, improving both the selectivity and sensitivity of the tuned circuit simultaneously.

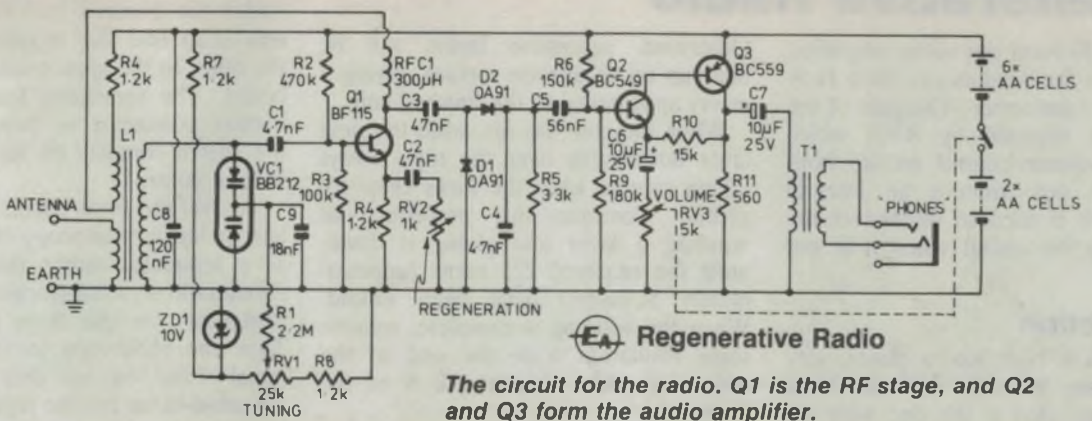
All that was necessary then was to convert this RF signal back to the original audio program which was fed to the transmitter. The most direct way of doing this was to half-wave rectify the output from the RF stage, and filter out the RF component. This left behind the 'envelope' of the received signal, which was in fact the original audio from the program source.

The audio signal was then ready for amplification, after which it was fed to a speaker or pair of headphones.

Modern approach

At first glance, our new circuit may look a little different from the description above; however in reality it is exactly the same. The coil consists of three windings, the largest of which is the main tuned winding. The two smaller windings serve to couple the antenna signal into the tuned circuit, and to couple some signal back from the output of the RF amplifier into the tuned circuit in order to perform the





The circuit for the radio. Q1 is the RF stage, and Q2 and Q3 form the audio amplifier.

regeneration function.

Mechanical tuning capacitors with a suitable range of capacitance are becoming harder to obtain, and are also quite pricey. For these reasons we have chosen to use a varicap diode instead of the more conventional mechanical type. This is basically a reverse-biased diode, which has a capacitance that varies according to a DC control voltage applied to it. For more details, see our explanatory box. The BB212 in fact contains two varicaps back-to-back, in the same package.

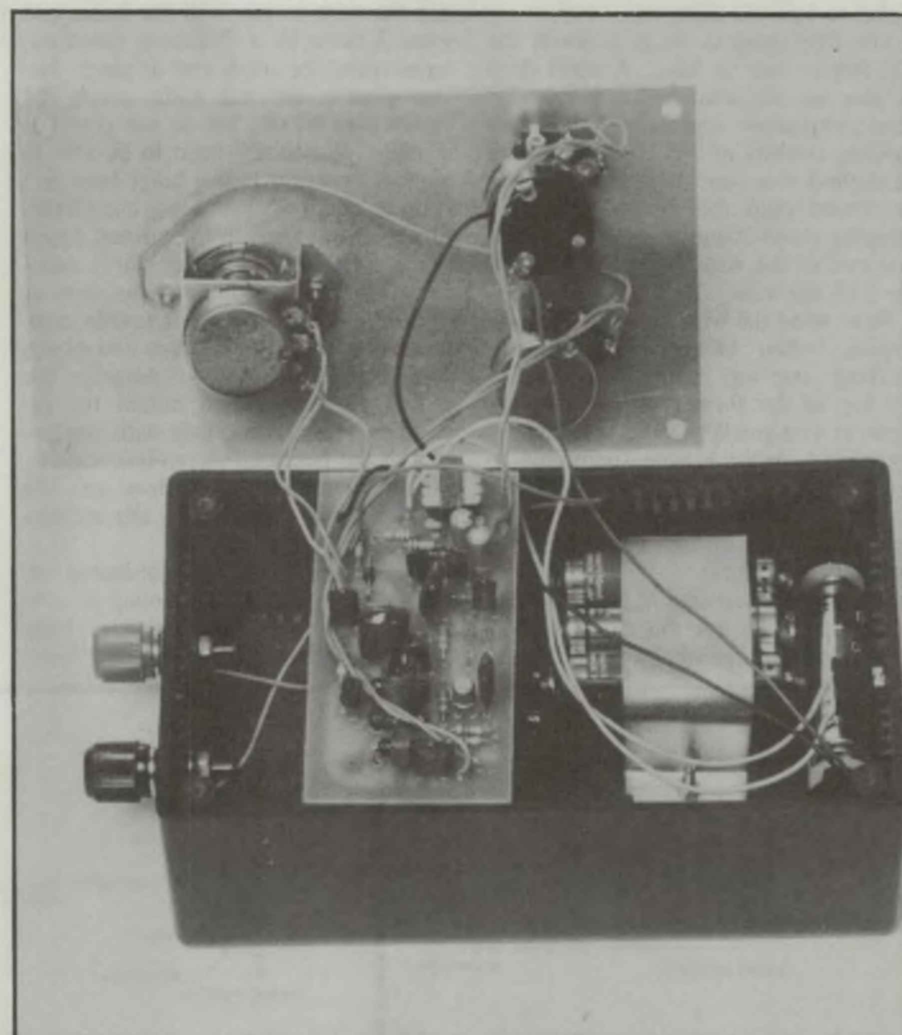
Since the capacitance of the varicap increases as the reverse bias voltage is reduced, and the resonant frequency of the circuit reduces as the capacitance of the varicap is increased, the net effect is that the frequency to which the radio is tuned increases with increasing voltage. This effect is not linear, however, as the characteristic of the varicap is approximately logarithmic, and also because of the inverse square relationship between capacitance and frequency.

A 10V reference voltage is developed by R7 and ZD1, which prevents the tuning from drifting as the battery discharges. RV1 delivers a variable voltage from this, which is used to bias the varicap via R1. The value of R1 is high enough not to significantly load the AC resonant circuit, yet the reverse current of the varicap is almost zero, so the DC voltage drop across this resistor is insignificant.

In order to make the tuning control more precise, without the need for a fine tuning control, we have incorporated a planetary reduction drive. This is mechanically connected to RV1 and gives a reduction of approximately four to one.

The RF amplifier stage is based around a BF115 transistor, which is specifically designed for this sort of application. The gain of this stage is varied by RV2, which varies the emitter degeneration (negative feedback). The load for the transistor consists of the series combination of the feedback winding of the coil, R4 and L5 (a 300uH RF choke). As the gain of the stage is increased, so is the amount of positive feedback, or regeneration, applied to the tuned circuit.

D1 and D2 form a voltage-doubler detector, with C5 and R6 filtering the output to remove RF and provide some attenuation of higher frequency audio signals. This improves the signal to noise ratio somewhat, and also helps to separate signals in a crowded band.



The inside story. The PCB slides into the pair of slots closest to the left of the box, with the component side facing to the right.

Regenerative Radio

Q2 and Q3 form the audio amplifier, which drives the headphones via a 1k:8-ohm audio transformer. The gain of the amplifier is adjusted by RV3, which forms the volume control on the front panel. This pot contains an integral switch which is used to disconnect the power from the circuit when it is not being used.

Construction

The radio is built into a plastic jiffy box measuring 95 x 158 x 50mm. Note that the type used is the one with the metal front panel, as this provides shielding of the circuit against the effects of hand capacitance when tuning.

The best place to start the assembly of the radio is to wind the coil. While this may seem to be a tedious procedure at first, you should resist any temptation to rush it. A small investment in time at this point will save much tearing of hair and gnashing of teeth when the time comes to turn the thing on.

The first thing to do is to insert the coil former into its base. A small drop of glue on the joint will help prevent their subsequent separation. The main winding consists of 225 turns of 34B&S enamelled wire, and is the first coil to be wound onto the former. Begin by scraping about 10mm of insulation from one end of the wire, and solder this to pin 1 on the base.

Now, wind the wire in a clockwise direction (when looking from above), working your way from the bottom to the top of the former — counting the turns as you go. When the first layer is completed, apply a little super-glue to the coil while holding it in place. Be careful not to glue your fingers to it, as you will need these for the rest of the assembly procedure!

Ideally, the glue should be as fluid as possible, so that not too much remains on the surface of the layer of wire. Otherwise, successive layers will be built up on an uneven surface, giving a messy appearance to the finished coil.

When the glue has set, wind the next layer downwards over the top, always taking care to keep the turns close together. Continue this procedure of winding a layer and gluing it down, until the required 225 turns (approximately 5 layers) have been wound. When the winding is complete, remove some insulation from the end of the wire and solder this to pin 6 of the base.

Next, wind the antenna winding over the last layer of the main winding. Starting at the base again, solder the wire to pin 3 of the base, and wind 10 turns in a clockwise direction, soldering the other end to pin 4. Again glue this into position, and allow it to set in place.

Finally, wind the regeneration winding just above the antenna winding. Solder the wire to pin 2 of the base, and wind 5 turns in a clockwise direction, terminating the other end at pin 5. Before placing the coil aside, screw the ferrite slug into it, but do not glue this in place, as you will need to be able to move it to set the tuning range later on.

Once the coil has been completed, turn your attention to the printed circuit board. The PCB (coded 88trl) measures 42 x 88mm, to fit in the slots in the case. Mount the lower profile components such as the resistors and diodes first, making sure you polarise the diodes correctly. Then mount the capacitors, again taking care with orientation of the polarised electrolytic variety. Finally mount the transistors and the varicap diode according to the orientation shown on the overlay.

Taking note of the internal layout, attach suitable lengths of hookup wire to the PCB to connect to the three front panel controls, and also for the headphone socket and input terminals. Also solder the positive lead from one battery snap and the negative lead from the other to the appropriate pads on the board. The remaining lead from each battery connector is then soldered to the switch contacts on the back of the volume control.

To drill the front panel, it is probably best to use a photocopy of the artwork as a template, rather than the actual Dynamark material (formerly known as Scotchcal), as this tears rather easily. Tape the photocopy to the aluminium panel of the box, and drill the appropriate sized holes for the regeneration and volume pots.

Cutting the hole for the reduction drive may be accomplished in one of many ways, depending upon the facilities available to you. If you have access to chassis punches, drill a hole that will clear the thread of the punch, and then use a 20mm diameter punch to make the hole. Alternatively, drill as large a hole as you can, and then file or ream it to the correct size.

Now, using a scrap of aluminium, fashion a bracket according to Fig.1. This will support the tuning pot below the reduction drive when the two are connected together. Using the reduction drive as a template, drill two small holes in the front panel with which to mount the tuning pot assembly. Now, *carefully* countersink the holes by hand, using a large drill bit. Do not use a machine to do this, as any slip-up here will render the panel virtually useless. Only countersink the holes just far enough to ensure that the heads of the screws sit flat with the aluminium panel.

Place two 12mm long countersunk 6BA screws in these holes, and secure these with shakeproof washers and nuts. These nuts should be tightened securely, as their heads will ultimately be covered by the Dynamark panel, making access to them impossible. The label should now be carefully affixed to the

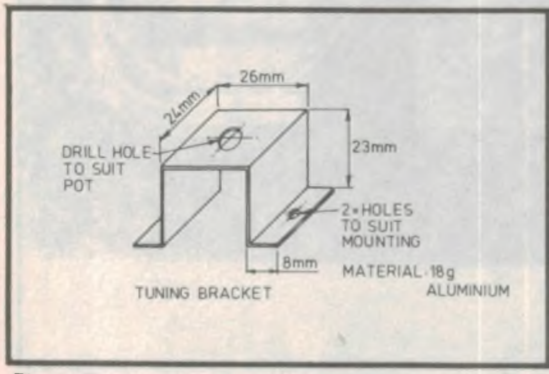


Fig.1: The pattern for the bracket which supports the tuning pot.

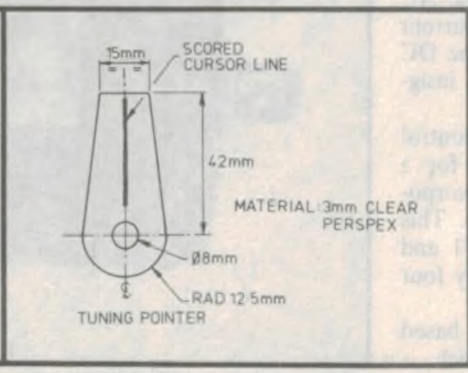


Fig.2: The dimensions for the Perspex tuning cursor.

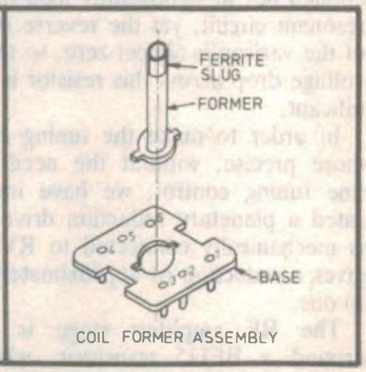


Fig.3: Note that the pin spacing is not uniform.

panel, and the holes cut with a sharp knife.

Using a piece of clear Perspex, fashion a pointer according to the dimensions given in Fig.2. Do not remove the protective paper from the surface of the Perspex, as these will prevent accidental scratching. When cutting this material, use a hack-saw with a fine-toothed blade to avoid chipping the surface, and take your time. Also, when drilling, use a high drill speed and proceed slowly, drilling a pilot hole first, followed by the correct sized drill.

Now, mark the center-line on the protective paper, and without removing the paper, score along this line with a sharp knife. This forms the mark on the pointer to indicate the position of the tuning control. When you have completed this, remove its protective paper, using some acetone if the glue proves to be a little tenacious.

The tuning pot should now be attached to its mounting bracket, and tightened as much as possible. Using washers as spacers, mount the reduction drive on the two screws previously attached to the panel. The bracket is then mounted directly behind the drive, and the nuts tightened onto the screws.

The last step in the assembly of the tuning control is to screw or glue the Perspex pointer to the reduction drive. Its orientation is not important at this point, as the pot has not yet been locked to the reduction drive. Now mount the headphone socket and the two binding posts as shown in the photos.

The two battery holders may also be secured as illustrated, using a bracket fashioned from a scrap of aluminium to hold the larger of the two in place. The smaller holder is held between the larger one and the side of the case. The two separate battery holders are necessary to fit the battery in the small space available in the box.

Now the final assembly may be completed, by soldering all the trailing wires to their relevant controls or connectors. A wire is also connected from the earthy side of the regeneration control to the front panel, to allow the panel to shield the circuitry from the effects of hand capacitance. This is most easily attached to one of the mounting screws of the tuning assembly.

Before screwing the front panel in place, it is necessary to adjust the position of the slug in the coil in order to set the tuning calibration. The most accurate way to do this is with an RF signal generator. However, if you do not have access to one of these, simply tune into a known station at the high end of the dial, and adjust the slug (and retune the tuning control) until it appears at the correct place. Now, tune in a station at the low end of the dial and check whether of not it appears in the correct place.

If the indicated frequency is lower than the known frequency of the station, reduce the value of R8 slightly (perhaps by shunting it with a higher value resistor) until the station lies in

The VARICAP or VARACTOR DIODE

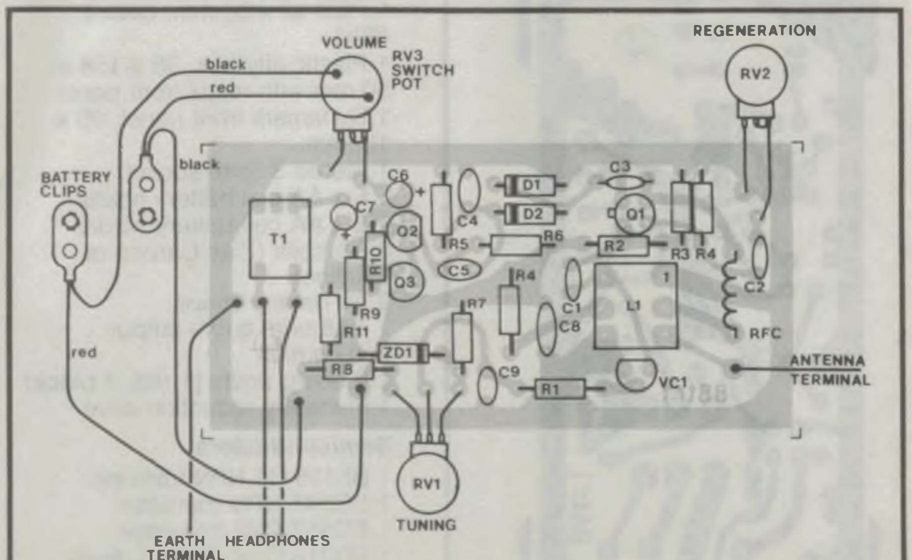
A capacitor usually consists of two electrodes or plates, separated by some form of dielectric material. The actual capacitance of the component is a function of the surface area of the plates, their mutual separation and the properties of the dielectric material separating them. Examination of a typical P-N junction reveals that it is essentially the same thing.

A varicap diode is constructed in a similar way to most diodes, with a piece of silicon which is doped so as to make it N-type at one terminal and P-type at the other. However, special care is taken during construction to minimise any series resistance and inductance in order to keep the Q of the varicap as high as possible.

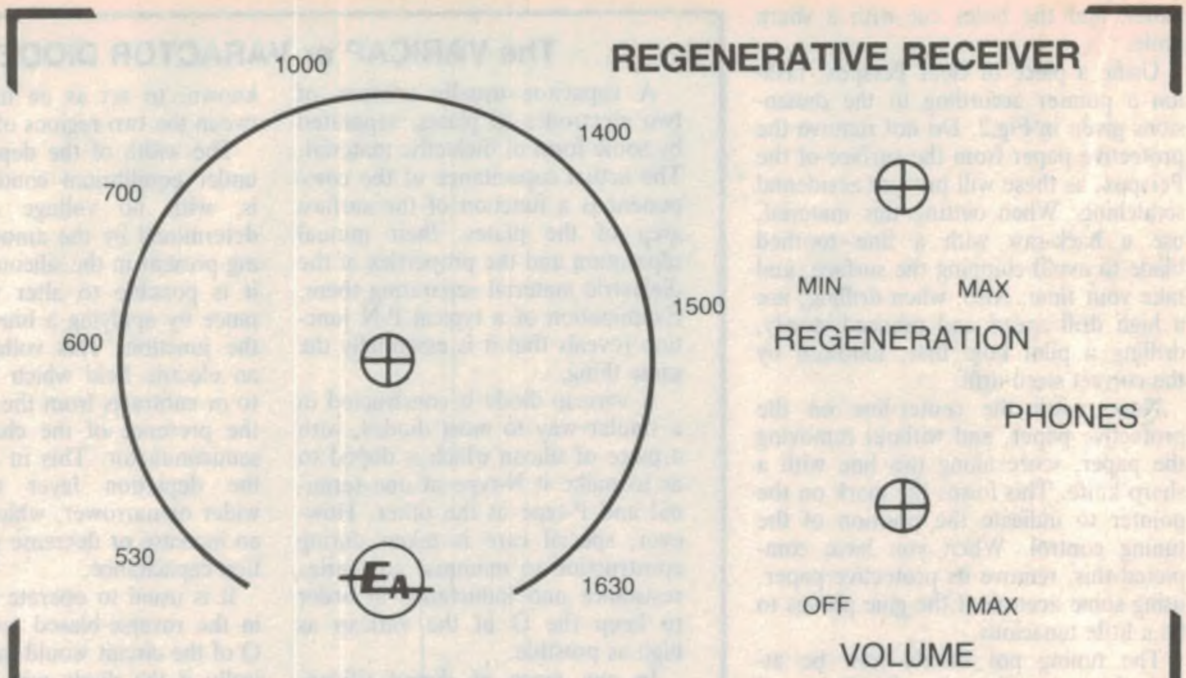
In any piece of doped silicon, there exist free charge carriers, which are either electrons (in an N-type material) or holes (in a P-type). At the junction of P-type and N-type material, some of these charge carriers diffuse into the other piece of material, causing charge cancellation to occur in the region of the junction. This causes the resulting depletion layer, as it is known, to act as an insulator between the two regions of charge.

The width of the depletion layer under equilibrium conditions (that is, with no voltage applied) is determined by the amount of doping present in the silicon. However, it is possible to alter this capacitance by applying a bias voltage to the junction. This voltage sets up an electric field which either adds to or subtracts from the one due to the presence of the charge in the semiconductor. This in turn causes the depletion layer to become wider or narrower, which results in an increase or decrease in the junction capacitance.

It is usual to operate the varicap in the reverse-biased mode, as the Q of the circuit would drop dramatically if the diode was biased into conduction — it would appear to have a low value of resistance in parallel with it. The signal in the tuned circuit is also much smaller than the voltage necessary to make a significant change to the capacitance of the device, so it may be assumed that the capacitance does not oscillate in time with the signal in the tuned circuit.



The printed-circuit overlay. Note that the antenna and earth leads are soldered to the back of the board.



Right: the front panel artwork, actual size. Below: the PCB artwork, again actual size.

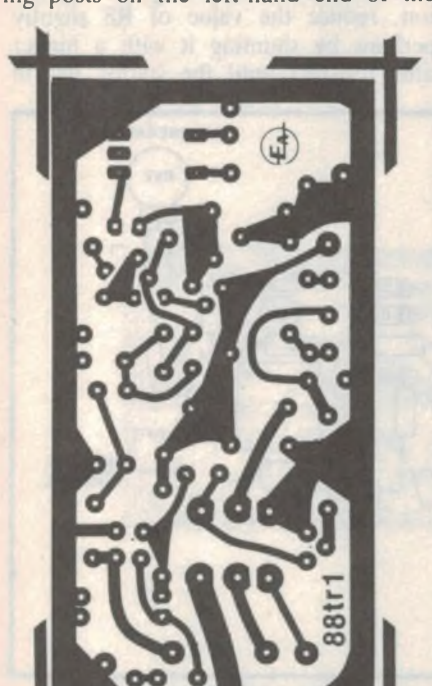
the correct place. Conversely, if the dial reads high, R8 needs to be increased. Some slight interaction between the slug position and the value of R8 may be expected, so it would be wise to re-adjust the slug at the high end of the band whenever you alter R8. Once the tuning is correct, a little wax on the coil slug will ensure that it stays in place, yet allow further adjustment if this is ever desired.

This radio requires an external aerial and earth to be connected to the binding posts on the left-hand end of the box. The easiest type of aerial to arrange is probably a long-wire type, as long as you can manage, up to about 6 or 7 metres in length, and mounted as high up as possible. If you make the aerial too long, it may start to load the tuned circuit too much, making it impossible to obtain sufficient selectivity.

In this case, you will need to reduce the coupling of the antenna to the tuned circuit. There are two ways in which this may be achieved. The first is to remove turns from the antenna winding of the coil until selectivity is recovered. Alternatively, if you don't want to play with the coil (or you have already glued the winding in place), you can try connecting a discarded tuning capacitor in series with the aerial terminal. If the capacitor is of the multiple-ganged type, connect the various gangs in parallel, and then connect this parallel combination in series with the antenna. Adjust this capacitor for the best compromise between sensitivity and selectivity.

The earth should ideally be attached to a metal stake driven into the ground,

Continued on page 173



Parts List

1 PCB 42 x 88 mm, coded 88tr1
1 Plastic jiffy box, 95 x 158 x 50 mm with metal front panel
1 Dynamark front panel, 90 x 153mm
1 Stereo 3.5mm socket
1 6 x AA cell battery holder
1 2 x AA cell battery holder
8 AA cells (Zinc-Carbon or Alkaline)
2 9V battery snaps
1 1k:8 ohm audio output transformer
2 Binding posts (1 red, 1 black)
1 Planetary reduction drive

Semiconductors

1 BF115 HF NPN transistor
1 BC547 NPN transistor
1 BC557 PNP transistor
1 BB212 Dual varicap diode
2 OA91 germanium diodes
1 10V zener diode

Resistors (all 1/4w, 5%)

4 x 1.2k, 1 x 470k, 1 x 150k, 1 x 100k, 1 x 15k 1 x 180k, 1 x 560Ω, 1 x 2.2M, 1 x 33k.
1 25k lin pot
1 5k log switch-pot
1 1k lin pot

Capacitors

2 10uF/25VW electros
2 47nF metallised polyester
2 4.7nF metallised polyester
1 220nF metallised polyester
1 56nF metallised polyester
1 18nF metallised polyester

Inductors

1 Neosid F16 coil former
1 base for above
1 slug for former
34B&S enamelled wire
1 330uH RF choke

Miscellaneous

Nuts, screws and washers.
Aluminium for brackets.

Construction project:

Low cost temperature probe

Here's an easy to build probe design which adapts a multimeter or electronic voltmeter into a general purpose thermometer. It's just the shot for measuring heatsink temperatures, how hot it gets inside your car, or whether little Johnny has a fever!

by HENK MULDER

Through the years, *EA* has presented quite a few different temperature probes and thermometers. This isn't too surprising when you realise that electronic components with their inevitable dissipation are closely related to temperature. Most engineers probably curse this relation, but still it's there and we live with it. In fact, for this project it's a blessing.

As years passed by, and technology developed, those thermometer projects became more and more elaborate. The last generation had a dual sensor and a digital readout. But for a lot of general-purpose temperature measurements, this kind of design can be "over-kill".

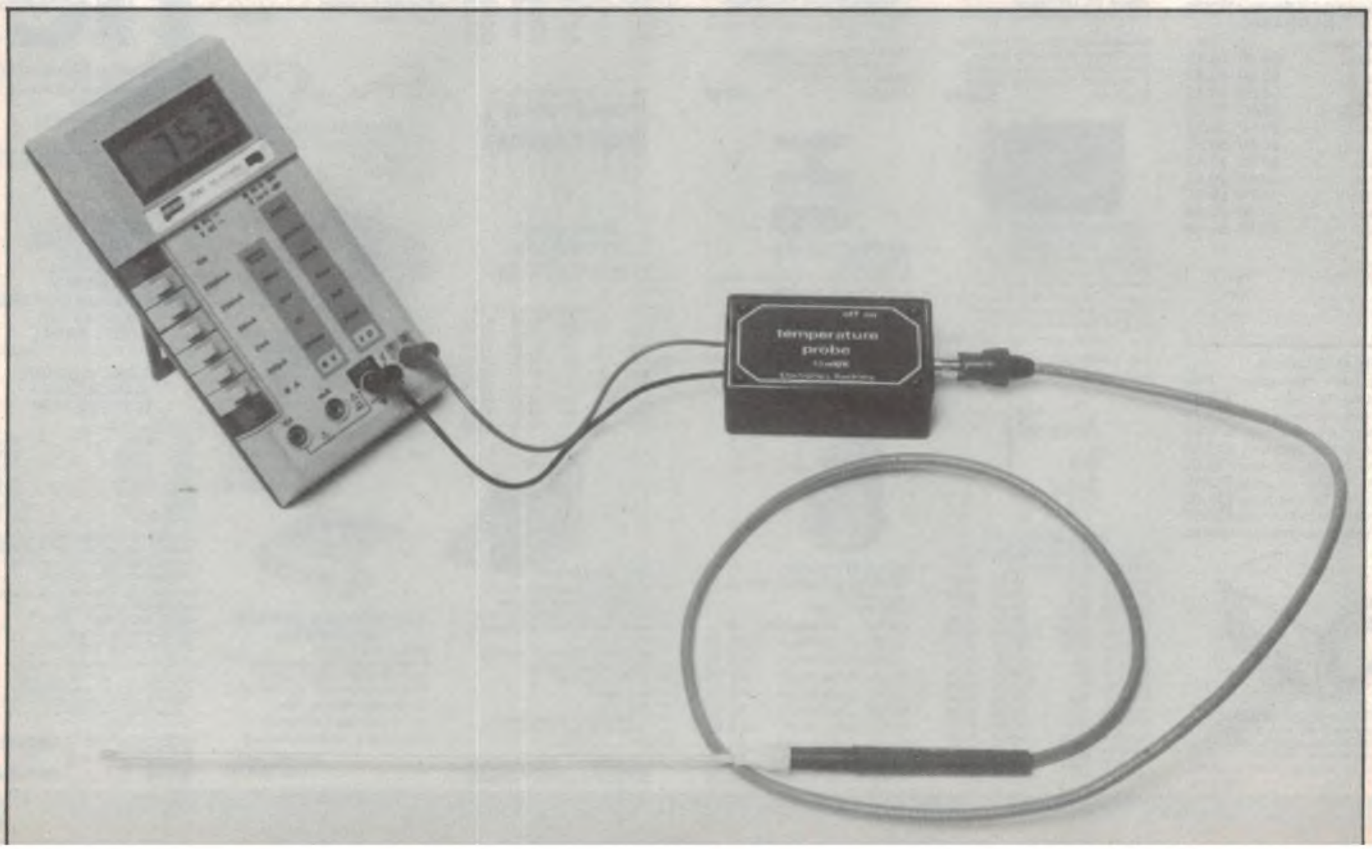
As an electronic hobbyist or perhaps a professional, you really don't need anything very fancy. You mainly want something for the odd occasion when you want to measure temperature as part of an integrated system.

You might want to monitor several 'hot spots' in your car engine compartment, for example, or similarly check the temperature of a power transistor heatsink in various kinds of electronic systems. There are also many applications where you would like to measure temperature as part of normal system operation, and do a bit more with it than just reading it out.

For those people we designed this general purpose temperature probe. It uses easy-to-get components, and can be used with almost any conventional multimeter or electronic voltmeter — whether analog or digital. It's also suitable for building into other projects, where they require temperature sensing.

Essentially this circuit converts tem-

The temperature probe is shown here with an experimental sensor. It uses an ordinary multimeter as display.



perature into voltage; 10mV per degree with 0V for 0°C. It has been tested from –20°C to 120°C, but might well operate beyond these values. The accuracy within this range is approximately 1%.

The probe is designed to run from a 9V battery, but could also be run from a stabilised 9V DC power supply.

As we didn't have an "inbuilt" application for the temperature probe, we built the prototype into a small project case and turned it into an add-on temperature probe for a multimeter.

A diode as sensor

One of the possibilities for sensing temperature is using ordinary silicon or germanium diodes as sensors. The voltage/current characteristics of such diodes, or PN-junctions in general, are strongly temperature dependent. When you run a constant current through a diode, then the voltage across the diode decreases with increasing (junction) temperature.

This temperature/voltage relation happens to be close to linear and is about 2mV/K, where "K" stands for Kelvin, the unit of absolute temperature measurement (0K = –273°C). The figure of 2mV/K might vary slightly for various diodes.

The linearity of this phenomenon makes such diodes excellent temperature sensors. The temperature range is limited to the maximum and minimum operating temperature of the diode.

Circuit details

Using an ordinary diode as a temperature sensor, it doesn't take very much circuitry to build a temperature probe.

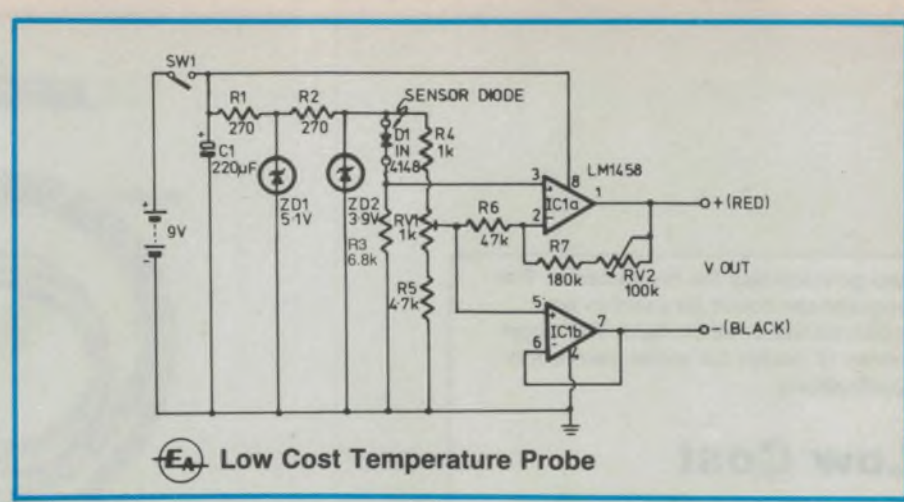
Given: a silicon diode with a range of 0.75V to 0.55V for 0°C to 100°C. Wanted: a temperature probe with a range of 0V to 1V for 0°C to 100°C.

This means that the voltage of the sensor diode has to be shifted (-0.75V) and amplified (-5 times). Hence the circuit as shown in the circuit diagram.

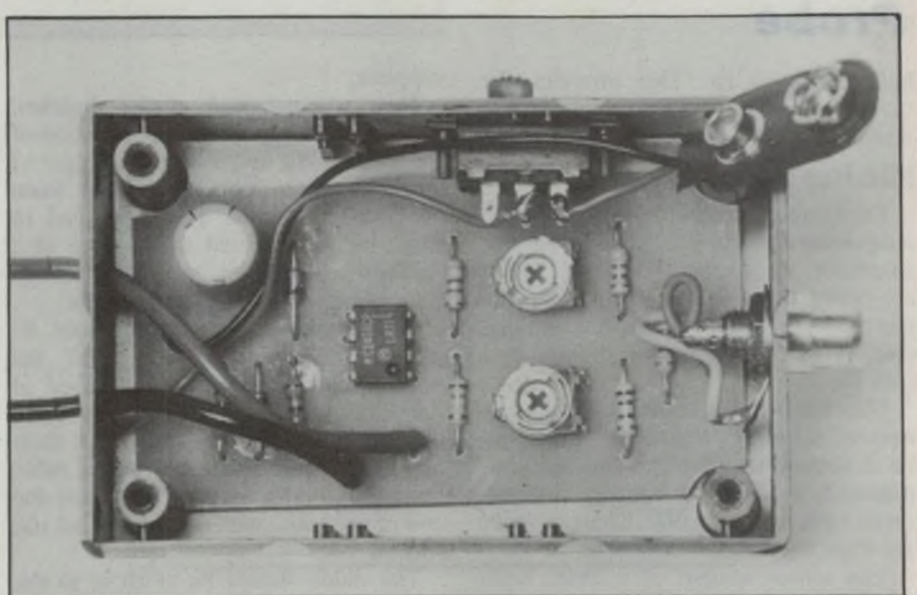
The circuit can be divided into three major parts; a voltage reference, a Wheatstone bridge and an amplifier.

The voltage reference consists of C1, R1, R2, ZD1 and ZD2. Firstly, the 9V from the battery is scaled down to 5.1V by R1 and ZD1. This voltage is scaled down further by R2 and ZD2 to 3.0V.

Only 3.0V from a 3.9V zener diode? Yes, that is possible. In order to save battery power, we've deliberately kept the current in the zener diode low. The result is that the voltage over the zener diode is lower than specified. But the stabilising effect still works quite well.



The circuit comprises a voltage stabilisation network, a wheatstone bridge (with the sensor diode) and a bridge amplifier.



The temperature probe has two adjustments, one for 0°C and one for 100°C.

This two-step voltage stabilisation is necessary as the supply voltage for the Wheatstone bridge should not vary more than a few millivolts. Knowing that the battery voltage drops substantially with age, the battery voltage therefore needs some thorough stabilisation.

Of all the possible values for zener diodes, the 3.3V and 3.9V types provide the lowest effective temperature coefficients in this circuit. We suspect this is because the small negative temperature coefficient of the diode itself (at this voltage) may balance temperature effects in the op-amps.

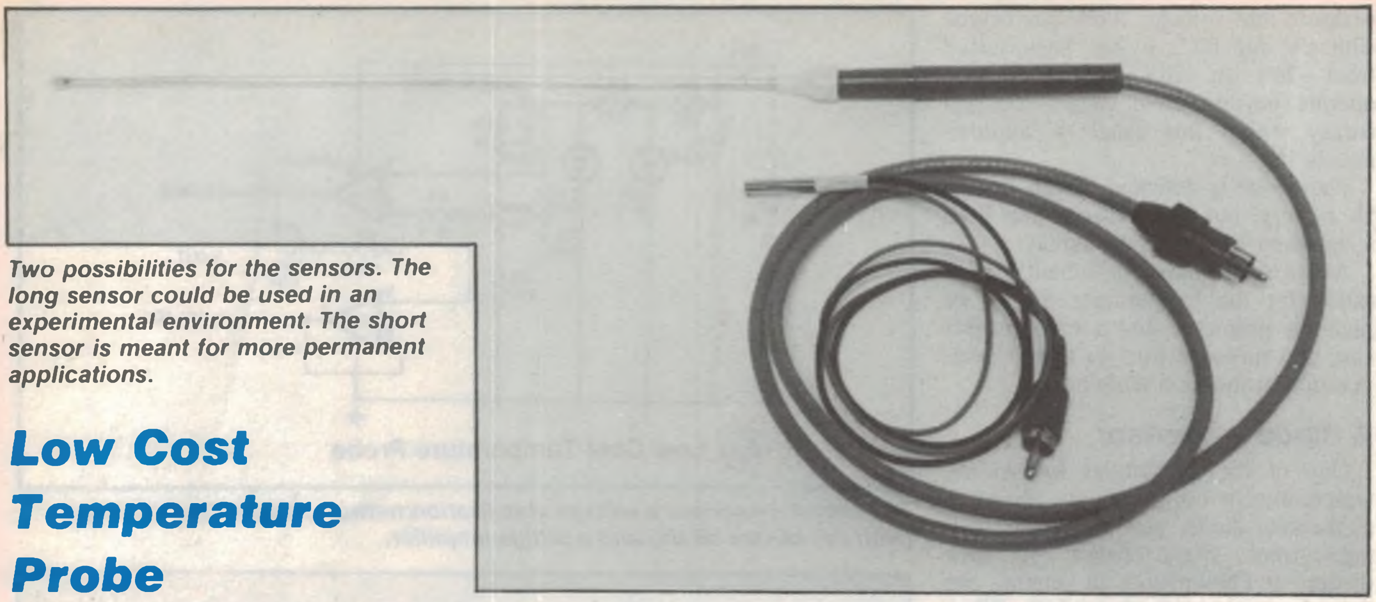
Capacitor C1 compensates for the increasing source resistance of the battery as it ages.

The Wheatstone bridge itself is formed by D1 (the sensor diode), R3, R4, RV1 and R5. The trimpot is adjusted so that the voltage between the cathode of the diode and the wiper of this trimpot is 0V for 0°C. In other words, the voltage across R4 and the top-end of RV1 is about 0.75V (as discussed before).

When the temperature increases, the voltage across the diode will decrease. The voltage between the wiper and the cathode of the diode will therefore increase proportionally with the temperature decrease.

This voltage difference (between the wiper and the cathode) is amplified about five times. This is done by op-amp IC1a, with its gain determined by R6, R7 and RV2. RV2 should be adjusted so that the voltage between the output of IC1a and the wiper of RV1 is 1V for 100°C.

The voltage at the wiper of RV1 is



Two possibilities for the sensors. The long sensor could be used in an experimental environment. The short sensor is meant for more permanent applications.

Low Cost Temperature Probe

buffered by IC1b. This provides the "zero" reference to which the output is referenced.

Making the sensor

The temperature probe consists of the temperature sensor (the diode) and the electronic circuit as described. There are many ways of constructing the actual sensor, depending on the application. We'll describe two possibilities (see Fig.1).

The first one can be used when a permanent sensor is required. This could be in your wine cellar to watch the temperature, in order to improve the matured taste of your 1972 Château Neuf Du Pape (appelation controlée).

This sensor consists of a 20mm brass spacer (as used in projects) with the sensor diode mounted inside. One end of the diode is soldered to the spacer. The other end is soldered to a length of insulated wire. The junction of the diode and the wire is covered with a piece of heatshrink sleeving.

The second wire is soldered to the spacer itself. The two wires are connected to the temperature probe PCB.

The spacer is quite strong and can be mounted to the wall (or elsewhere) as you would mount a cable or tube.

The second sensor is for more experimental or portable and general-purpose use. If we still assume that wine is your second hobby, then you could use this probe to check the temperature of fermenting wine!

This sensor is made of a long (300mm in our case) aluminium tube. It is 3mm in diameter, which is just enough to hold a normal 1N4148 diode. By the way we bought the aluminium tubing at a shop specialising in model aircraft supplies.

Have a good look at the diagram, which should explain the construction of this probe. We first soldered a length of insulated wire (longer than the main tube) to the diode. The other end of this wire we soldered to the core of a shielded cable. We put heat shrunk sleeves around the solder junctions.

We fed the diode with the wire attached through the tube until the unused lead of the diode appeared at the other side of the tube. For good thermal conduction, we put some thermal grease inside that end of the tube. Using the bench vice we squeezed the end of the tube, with the diode lead still sticking out.

The diode should be as close to the squeezed end as possible. Take care however not to damage the diode, which will happen if it's too close to the squeeze.

With a file we rounded off the squeezed end of the tube. Don't go too far however, otherwise you might get a small gap in the probe head — which would then leak.

The next step is to attach the shielding of the cable to the tube. This is a bit tricky as you can't easily solder to aluminium. Firstly we squeezed this end of the tube a bit, in order to stop it from turning around. Then we fed the shielding along the outside of the tube, and wrapped a piece of tinned copper wire around the tube with the shielding. This wire should be wound as tight as possi-

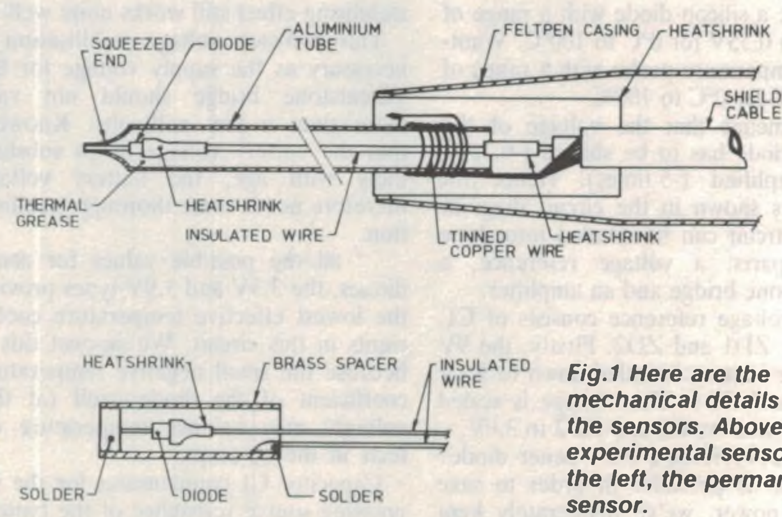
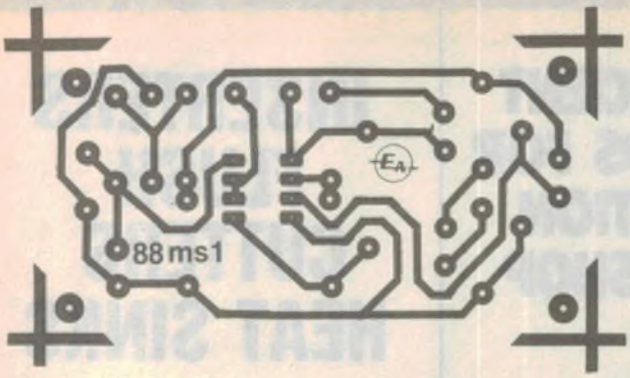
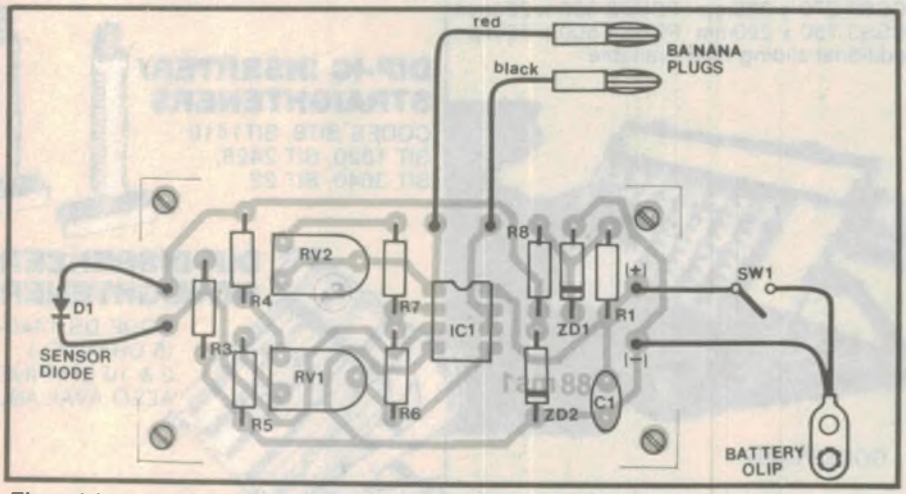


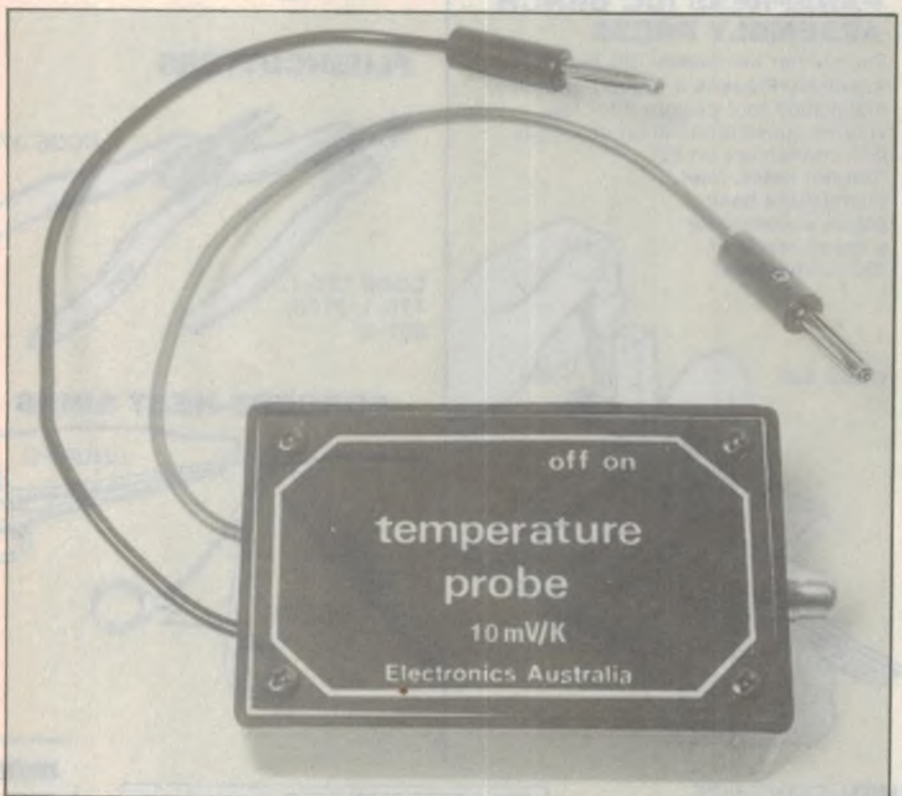
Fig.1 Here are the mechanical details for the sensors. Above, the experimental sensor. At the left, the permanent sensor.



Full size reproduction of the PCB artwork (above) and the panel artwork (right).



The wiring diagram gives details of the assembly. Pay special attention to the orientation of the sensor diode.



This universal temperature probe allows for many different applications.

ble. The two ends were twisted together and soldered, to make the assembly as secure as possible.

The junction of the tube and the shielded cable was covered with heat shrink sleeving, as before.

Finally we rescued an old feltpen from the bin and used its casing to create a rigid sleeve around the cable/-tube junction. At the other end of the cable we mounted an RCA plug.

Construction

The electronics of the probe is built on a printed circuit board (PCB) coded 88ms1 and measuring 38 x 72mm. We mounted the PCB in a small project case as we wanted to use it as an add-on temperature probe for our multimeter. As said before however, the probe has many other applications. If you intend to use it as part of a system, then you might be able to incorporate the PCB in another instrument case.

Start the construction of the probe by assembling the PCB. First mount the resistors, the zener diodes, the trimpots, the IC, and finally the capacitor. Make sure you watch the orientation of the IC, the electrolytic capacitor and the zener diodes.

Very often it is difficult to read the value of zener diodes. It is therefore advisable to keep the two zeners separated from the start, or perhaps even mark them yourself. It would be all too easy to mix them up.

The project case we used measured 28 x 54 x 83mm. The PCB is a bit larger than the four plastic uprights of the case to allow it to fit in easily. To make the PCB fit, we filed its corners in the shape of the uprights (round), after which the PCB fitted nicely in the case. No screws are required.

The 9V battery clip is connected to the PCB with the on/off switch in the "+" lead. The battery lays loose in the case, on top of the PCB. The battery should be isolated from the PCB by ei-

Low Cost Temperature Probe

ther a piece of foam, or otherwise a piece of cardboard.

The sensor is connected to the PCB via an RCA plug and socket. The socket is mounted to the project case, close to the actual connections on the PCB. Take care that you wire the socket up correctly; the diode in the sensor head should be conducting when operating.

The voltage output from the PCB is put out via two test leads. These leads are fed through two holes in the case and are directly soldered to the board.

Finally we made front panel artwork out of aluminium Scotchcal. The temperature probe should now be ready for testing and calibration.

Calibration

Connect the battery to the clip and switch the unit on. With a voltmeter you should measure the voltages across the two zener diodes. They should be 5.1V and 3.0V respectively. If this is not the case, then you should switch the unit off and check for solder faults, polarised components connected in the wrong way around, or cracks in PCB tracks.

Now connect the sensor to the unit and connect the voltmeter to the appropriate leads (red to the voltage input and black to the common input). The voltmeter will read something between +2V and –2V. When you warm up the sensor with your hands, you should see the reading of the meter change. If you haven't encountered any problems yet, you can move on to the calibration of the unit.

For the calibration operation itself you'll first need a bowl of water with plenty of melting ice cubes. Put the sensor into the bowl and stir vigorously for a few minutes. This bath should have a temperature of exactly 0°C. Now adjust the 'zero' trimpot (RV1) for 0V reading on the voltmeter.

The next step is to boil some water and insert the sensor in the boiling water. The water should have a temperature of 100°C, provided that the air pressure is at 1 atmosphere (as it will be if you're at roughly sea level). So unless you're on the top of the Blue Mountains or somewhere, it won't be far from 100°C, and you can adjust the "100°C" trimpot (RV2) for 1.00V reading on the voltmeter.

You could repeat the 0°C calibration, but this shouldn't have changed.

For an exact calibration you should use distilled water for both calibrations, but this is probably gilding the lily for most purposes.

You can easily check whether the temperature probe works alright for other temperatures. For instance the room temperature. At the time of writing, the probe read 21.4°C, which should be about right. You could also check your own body temperature. If the probe reads less than 35.5°C or more than 40.0°C, then you should consider either recalibrating the probe or more dramatically, seeing your doctor . . .

By the way, if you're really planning on using the probe to check whether your kids are running a fever, we suggest that you don't put it in their mouth. Get them to hold it under their armpit for a couple of minutes — it'll be more hygenic, unless you make up a special probe that can be dunked in germicide to kill the germs. Otherwise they might develop a fever after you check their temperature, even if they didn't have one before!

Parts list

1 PCB coded 88ms1, 37 x 71mm
1 project case 25 x 54 x 83mm
1 Scotchcal panel artwork
1 RCA socket
1 pair of banana plugs
1 SPST switch
1 9V battery and clip

Semiconductors

1 LM1458 dual op-amp
1 1N4148 silicon diode
1 5.1V zener diode
1 3.9V zener diode

Capacitors

1 220uF 25VW electrolytic, vertical mount

Resistors (0.25W, 5%)

2 x 270Ω, 1 x 1k, 1 x 4.7k, 1 x 6.8k, 1 x 47k, 1 x 180k
1 x 1k, trimpot horizontal mount
1 x 100k, trimpot horizontal mount

Sensor

1 x aluminium tube 3 x 300mm (see text)
1m shielded cable
1 x RCA plug
heat shrink sleeving

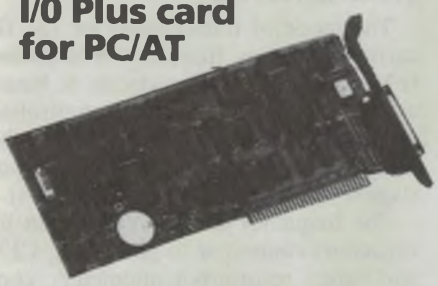
NEC Pinwriter P2200 Printer

This must be the printer bargain of the decade. NEC's P2200 is a letter quality, 24 pin head printer which combines high speed, high quality and professional graphics capabilities. All at a price you can afford.

- 24 pin head for 360 x 360 dots per inch resolution
- Built in tractor feed, optional sheet feeder
- 168 CPS (draft mode), 60 CPS letter quality mode

$695

I/0 Plus card for PC/AT



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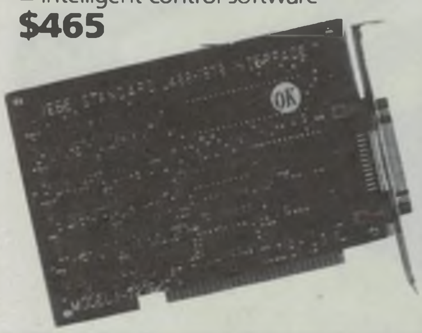
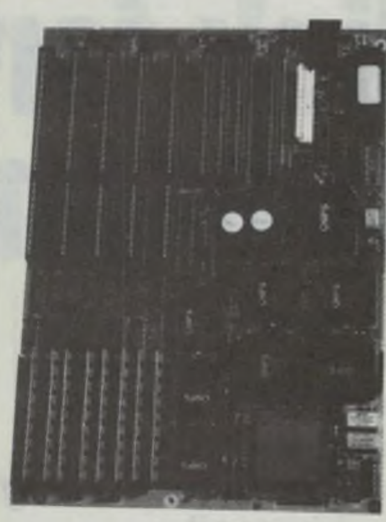


80386 Motherboard



Incredibly compact, fast, powerful – and reliable. This 80386 motherboard is a drop-in replacement for the normal XT sized motherboard, but look at the performance: Drop this board into your PC for a quantum leap in performance!

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$4150 (16MHz)
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12 bit AD/DA converter

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Construction project:

Optical link for stereo headphones

Here's the design for a two-channel optical link which allows you to enjoy high quality sound reproduction on your stereo headphones, without messy and constricting cables. The transmitter unit is easily connected to a TV, hifi amplifier or similar, while the receiver is very compact.

With the advent of personal "walkie" type AM/FM type receivers, cassette players and CD players, the benefits of modern, lightweight headphones as a quality sound reproducing medium have become obvious. Not only do they give you the "big sound" image at whatever volume you wish, but you don't have to burden everyone around you with your choice of entertainment. A truly personal listening pleasure.

You may wish to extend this means of listening to your lounge room or bedroom, so that you can enjoy your favourite TV show or record in the comfort of a lounge chair or bed.

Simple! Just plug the headphones into the TV or hifi, sit back and relax. But oh no! The cord's not long enough. No problem, add an extension; but here we go again. Everybody trips over it, the dog uses it as a bone. Grandma doesn't always see it and ends up with it around her legs, after ripping off both your ears . . .

Here's the answer. A personal headphone receiver with a safe, non-interfering infrared (IR) optical link back to a transmitter at the TV, hifi or whatever. Not only does it solve the problem of long cables, it gives you the ability to listen to your favourite program while the rest of the family enjoy theirs. It's also handy for grandpa who can't hear too well these days. He can set his personal IR headphone receiver to the volume level he likes, without blasting the rest of the family out of the room.

Incidentally the IR optical link described here has been developed in the R&D department of Dick Smith Electronics. Kits for the link will therefore be readily available from DSE's many stores and dealers throughout Australia and New Zealand. Please note, however that the design and PCB artwork are covered by copyright, and may not be reproduced commercially without permission from DSE.

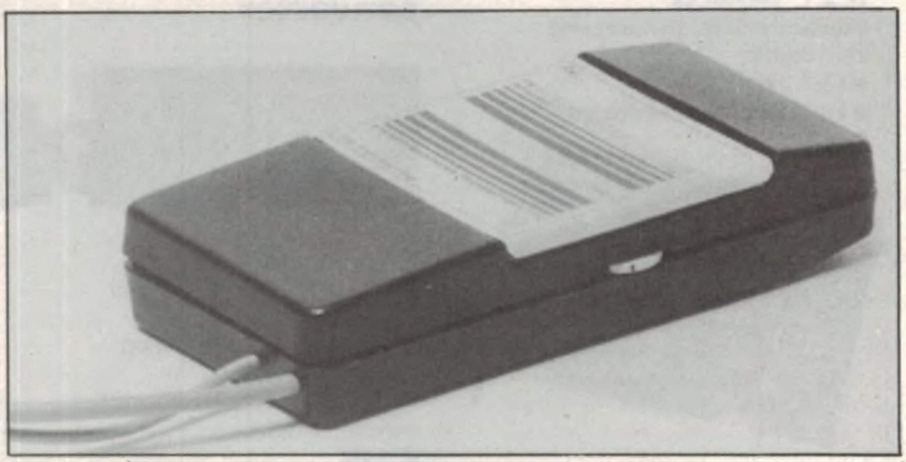
It's used by simply plugging the transmitter into the hifi amplifier's tape out terminals, or the TV's earphone socket. Any similar sound source can be used. It is an extension of your listening pleasure, without the need for hard-wired cable links or the invasion of other family members' listening pleasure.

The range of the system is sufficient for greater than the average sized room. Any number of receivers can be used with the one transmitter; they are simply pointed towards it. The receivers will even work at short range with reflections off walls. The receiver is powered by a standard 9V battery, the transmitter from a 12V power supply or a 9V or 12V battery eliminator.

How it works

The mode of transmission for the IR carrier system is frequency modulation (FM). The transmitter circuit is based around two LM566 voltage controlled oscillators (VCO). The outputs from the VCO's are mixed and fed to an output stage to drive the IR LED's (LED1-8).

The frequency of each VCO is set by capacitors connected to pin 7 (C6, C13) and the resistor/potentiometer connected to pin 6. The right channel VCO (IC1) has components selected to set the centre operating frequency at 110kHz, while the left channel components around IC2 are selected for 256kHz operation. Each output is taken from pin 4, which delivers a triangular waveform. The following RC components act as a simple filter to shape the waveform closer to that of a sinewave.



The transmitter unit, housed in the same compact plastic case as the receiver.

The receiver unit, with typical lightweight headphones. It runs from a standard 9V battery.

Frequency modulation of each VCO is accomplished by feeding the incoming audio signal into pin 5, the voltage control input of the oscillator. This pin is commonly called the modulation input. The resistors R6 (R15) and R7 (R16) set the correct DC operating point for the IC. Capacitor C5 (C12) is added to prevent possible oscillation in the current source. Any change in the voltage at pin 5 will cause a corresponding change in the oscillator frequency. The greater the change of this voltage, the greater the deviation of frequency from the centre point.

The preceding stage to the VCO is a conventional transistor amplifier to provide the necessary signal level and a stable source to drive the modulation input. Control over varying signal source levels is provided by VR1. Even though this control may be loosely termed the volume control, it is in fact the frequency deviation control for the transmitter. Without this control, the incoming audio signal may be too high and cause over-deviation, producing distortion in the receiver. On the other hand, if this level is too low, the signal to noise ratio of the signal at the receiver would be unacceptable.

In order to improve the general signal to noise ratio of the system, the incoming audio signal is given pre-emphasis by adding a bypass capacitor, C4 (C11) to the emitter of the transistor.

After the two carriers are mixed via resistors R9 and R18, the resultant signal is AC coupled to the output stage (Q3, Q4). This stage operates in class A, to provide a linear transmission of the mixed FM signals, in order to keep the intermodulation products at a minimum. The output current into the parallel-series IR LED bank is limited by the 6.8 ohm emitter resistors R21.

To cater to varying power supply inputs, an adjustable voltage regulator setup using a 7805 is used. With a nominal input of 12 volts, the regulator output is set to 9V. For a 9 volt supply, the output is set to 7V. The power supply connected has to have a current capability of not less than 200mA.

To recover the audio signal from the FM carriers, a suitable detector circuit is required. In this case, LM565 phase locked loop (PLL) chips are used. The centre frequency is set by the capacitor C17 (C18) on pin 9 and the resistors VR1 (VR2) and R25 (R26) on pin 8. IC2 decodes the right channel 110kHz carrier, and IC3 the left hand 256kHz carrier.

The signals are fed into pin 3 of each LM565 from the pre-amplifier/filter stages. Resistors R19 and R24 provide the correct operational bias point for the input stages of both PLL's.

The IR signal arriving at the photodiodes PD1/PD2 can be at a very low level, and has to be amplified to meet the input requirements of the LM565s. Two photodiodes are used in parallel to give a wider acceptance angle to the incoming signal. They are wired in a reverse bias mode for this application and are seen by the first amplifier as a varying capacitive source.

A 4069UB CMOS inverter is used as the active element of the amplifier stages. Each inverter is configured in a near-linear amplification mode (for low level signals), with the output fed back to the input via a resistor. This sets the output voltage near half the rail potential present at pin 14. The gain of the amplifier is set by the combination of the feedback resistor divided by the input resistor. Although this mathematical figure is only true at low gain factors, a high value feedback resistor will still set the output bias point at around the centre rail value.

Two stages of gain are provided after the photodiodes (IC1a, IC1b) prior to the filter block. A combination band stop, band pass network separates the two frequencies from the incoming signal. Amplifier sections IC1c and IC1d raise the signal level out of the filter and pass the 110kHz carrier to PLL IC2. Sections IC1e and IC1f similarly amplify the 256kHz carrier for IC3.

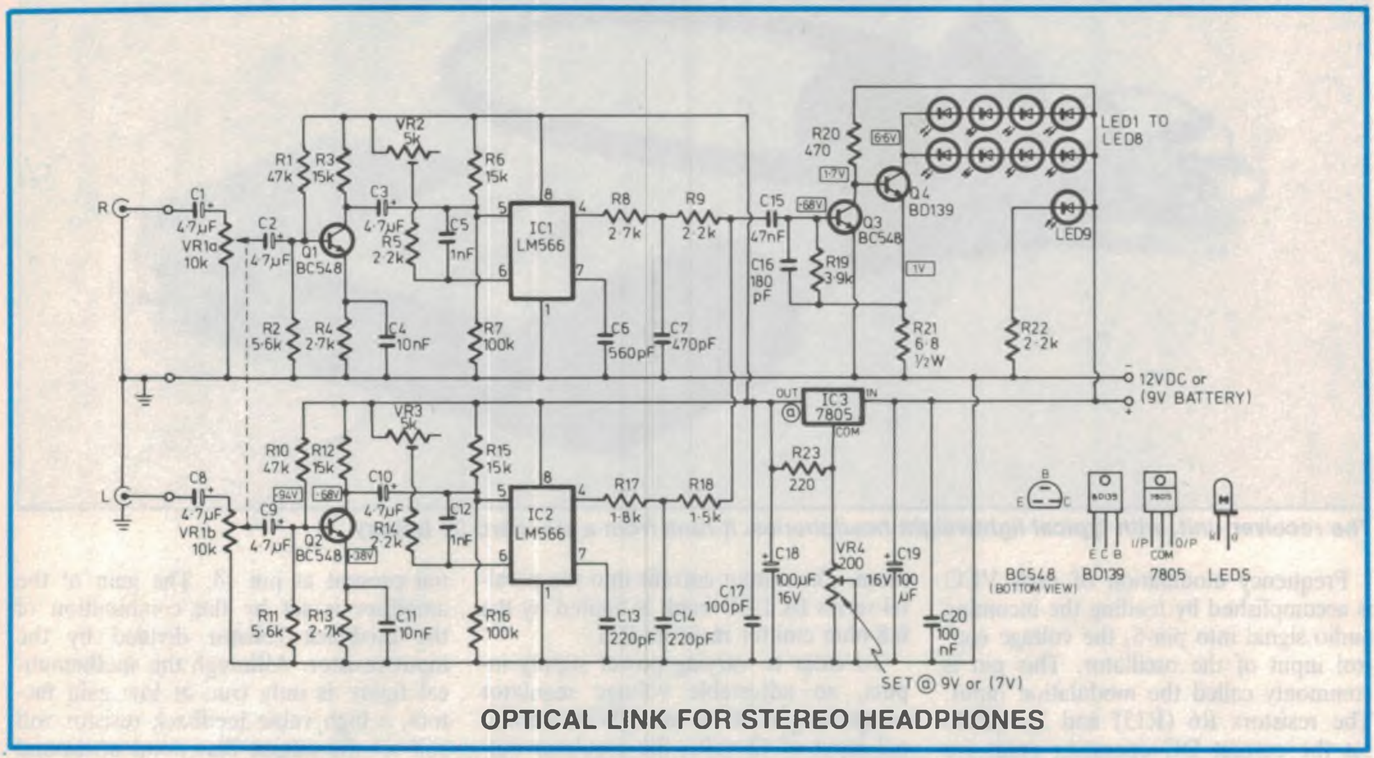
The recovered audio signal from the PLLs also carries some residual carrier. The simple RC filters between the PLLs and the output stages suppress this. De-emphasis is also performed by these filters. The signal level is set by VR3 volume control before entering the LM386 output stage. These amplifiers are only low power and are ideally suited to 32-100 ohm headphone use, but they will also drive high efficiency speakers.

Construction

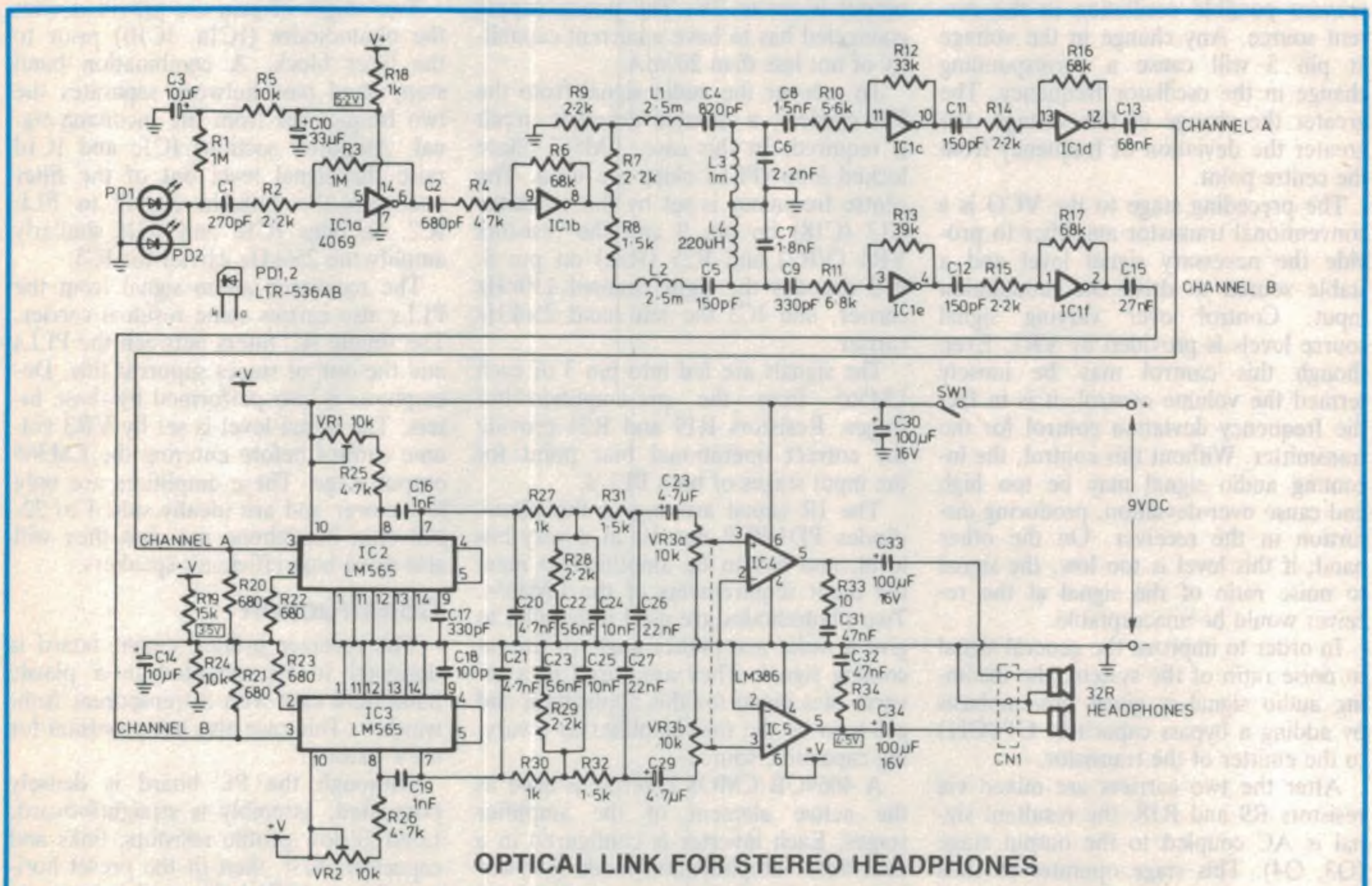
The receiver printed circuit board is designed to be mounted in a plastic hand held case with a transparent front window. This case also has provision for a 9V battery.

Although the PC board is densely populated, assembly is straightforward. Load all low profile resistors, links and capacitors first, then fit the preset horizontal pots, RF chokes and larger capacitors. Next fit the battery lead (red +), switch earphone socket and volume

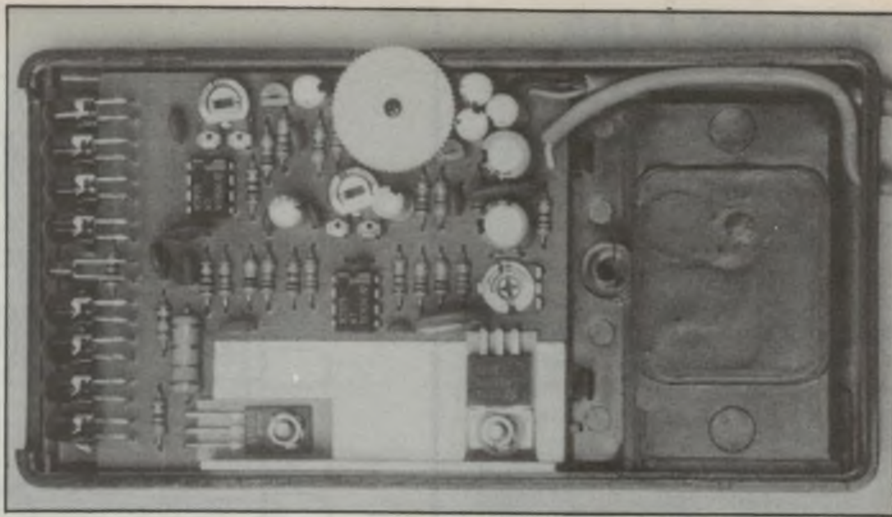
Optical Link for Stereo Headphones



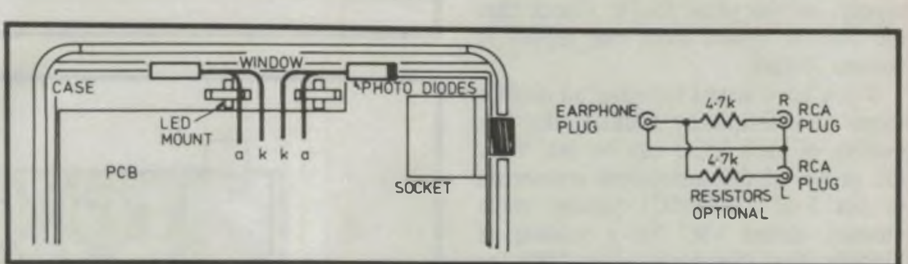
Circuit for the transmitter, which can be operated from either a 9V battery or a 12V DC plug pack supply.



The receiver circuit. At the heart are the two LM565 phase-locked loop chips, which demodulate the 100kHz and 256kHz carriers.



Inside the transmitter unit. Note the row of transmitting LEDs at the left, and the heatsink bracket for Q4 and IC3.



Above left: Details of the way the two photodiodes are mounted in the receiver. Right: A simple adaptor to drive the transmitter from a mono signal.

control. Be careful fitting this control — do not insert it with brute force. Gently push it down to lie flat on the PCB surface. Lastly fit the photodiodes with polarity as shown, and solder at near lead length. These have to be bent when inserted into the case.

For the PCB to sit into the correct position inside the receiver case, the centre peg and the two PCB fingers nearer the front have to be cut off (but not the two at the rear). Use a sharp knife blade or a small pair of side cutters to remove these points.

Now using the completed PCB as a guide, lightly mark the RH edge of the case half where the switch, volume control thumbwheel and earphone socket fall. The final board position is where the front edge is right up to the LED mount brace shoulders, and slightly under the PCB fingers at the rear. Now carefully file out the switch ferrule hole with a small round file. The final hole depth will allow the ferrule to fit snugly into position, so that the PCB fits under the finger and on top of the mount adjacent to it.

Next neatly file out the flat slot for the thumbwheel, and the half round hole for the earphone socket. Carry out this whole procedure carefully and patiently, bit by bit with a trial fit after each cut. The end result should be a snug fit with the board virtually snapping into place.

Now bend the two photodiodes around the LED posts, so that the sensitive surface of each faces towards the front, close to the position of the plastic window. Now bring the top case half to match the bottom by aligning the rear first. Mark this half at the points where the switch, wheel and socket meet. Again carefully file out the area required, with fitting trials at regular intervals. Fit the window into the slot provided.

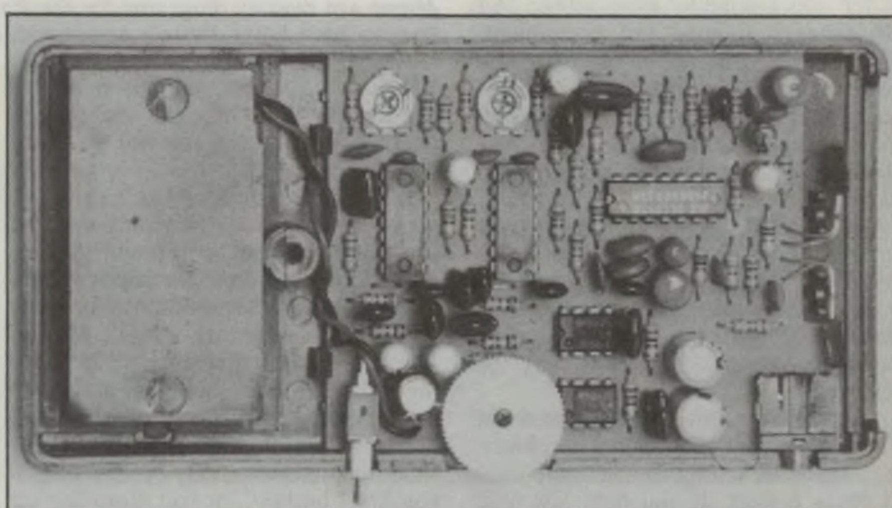
Stick the screen printed aluminium panel to the case with a small amount of contact adhesive, and feed the battery lead into the battery compartment.

The construction of the transmitter is similar to the receiver. Note that transistor Q1, is under the thumbwheel and has to be pushed right into the board to clear the bottom surface. The heatsink is aligned with the edge of the board and the BD139 transistor and the regulator are fitted with insulators. The 7805 regulator also has a nylon insulator fitted to the screw under the nut and washer. Both components have the legs bent at right angles to align with the holes in the PCB, They are secured with M3 x 10mm screws, nuts and washers.

The leads of the IR LEDs are bent at right angles, so that they point out through the window area. Note the polarity before bending. The red LED polarity is different from the others with respect to the bend.

As with the receiver, the transmitter case must be modified by cutting of the centre peg and the two PC fingers. You'll also have to file out the case halves to accommodate the thumbwheel, and drill two holes of suitable size in the bottom case half to allow access of the two cables for the power and audio signals.

The larger two core audio cable holes can be drilled between the battery compartment and the RH edge. The smaller power supply cable hole can be drilled in behind the battery compartment, next to the audio cable hold. Feed the cables through and terminate onto the board. Make the red wire of the audio cable the right hand channel. The centre wire of the power cable is the posi-



Inside the receiver unit. The two preset pots are VR1 and VR2 used to set the PLL centre frequencies for best results.

tive lead. Fit connectors to these cables as you require.

Fit the screened aluminium front panel to the transmitter case with a small amount of contact adhesive.

Setting up

After a complete check of the components placement, orientation and soldered joints, the transmitter can be connected to a power supply. Ideally, a 12 volt @ 200mA supply is suggested, although a 9 volt @ 200mA will operate the system quite well.

Switch on and measure the voltage at the output of the regulator IC3. Adjust VR4 so that this value reads 9V with a 12V supply; or if you are using a 9V supply, set the value to 7V. Check that the current drawn from the supply is around 200mA.

If you have access to either an oscilloscope or a frequency counter, the frequency of each VCO can be set. With the probe of the instrument connected to pin 3 of LM566/IC1 (square wave output), adjust VR2 for a reading of 110kHz (9us). Similarly adjust VR3 for a reading of 256kHz (3.9us) at pin 3 of IC2.

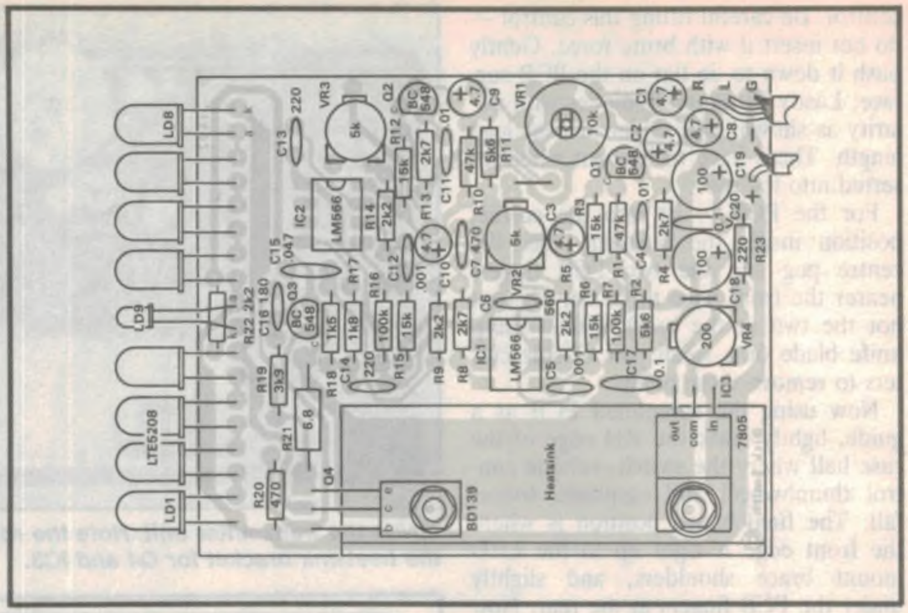
If you haven't these instruments, see the section below for an alternative tuning procedure.

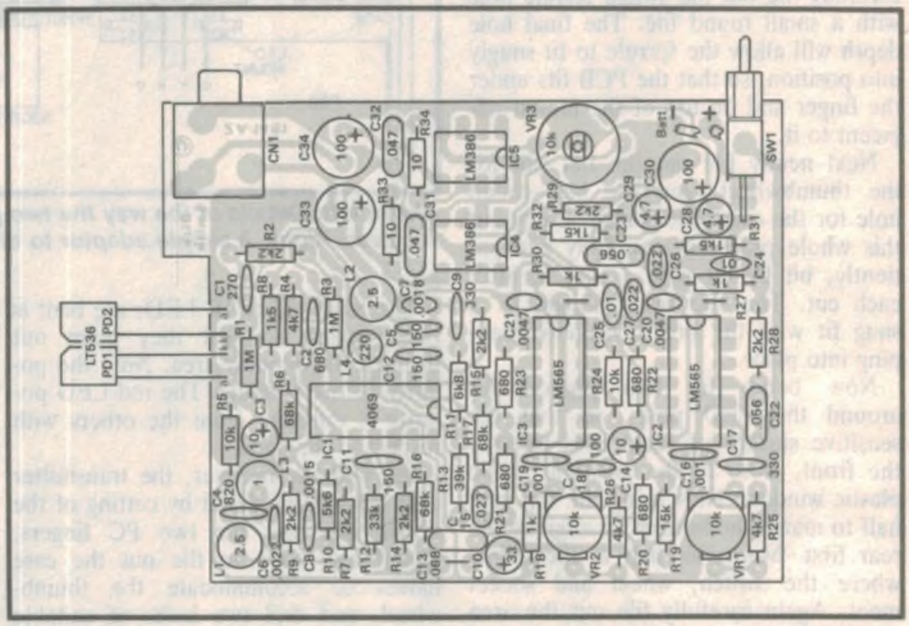
To set up the receiver, again check all component placement and soldering. Connect a 9V battery and headphones. On switch on, with the transmitter off, you should hear noise that varies with direction dependant on the light source that the photodiodes face. The current drawn by the receiver should be around 25mA @ 9V.

Plug the two audio leads of the transmitter into a suitable signal source. An FM tuner is a good test component. Power up the transmitter but leave the volume control set to minimum at this stage. You should hear some change in level of noise at the receiver as the photodiodes are directed towards the transmitter.

With a small screwdriver, adjust each preset pot on the receiver VCOs for minimum noise. Move further away from the transmitter and readjust the controls. Repeat this process so that maximum range and sensitivity is achieved.

If you have previously adjusted the transmitter with a frequency counter, then this final setting should come close to being correct. If you hear low level whistles coming from one channel, slightly adjust the high frequency pot





Above are overlay diagrams for the transmitter (top) and the receiver PCBs. They're both fairly densely populated, so take care!

VR3 on the transmitter board to null out this noise. It may be necessary to readjust VR2 on the receiver to match this change.

If you haven't access to test equipment to set the two frequencies of the transmitter channels, we found that the mechanical position of the wiper of each preset pot in the transmitter was slightly off centre between 11 and 12 o'clock. Use this as a starting point and adjust the receiver to give minimum noise with these settings. Trail and error adjustments should find good results. Some small readjustments may be necessary if you find "birdies", or bad distortion occurring at low levels of program material.

With the basic tuning done, turn up the volume control on the transmitter. The receiver should burst into life with the program signal. This control is set to a point just under where the sound starts to distort on high level passages. This overload point is where the deviation of the FM carrier, modulated by the incoming audio signal, is beyond the limits of the system. This overload point will tend to become more noticeable as the distance between the transmitter and receiver is increased.

Optical filters

The cases used in the DSE kit for this project have a red optical window built into the front. On the prototype system, we found that interference from internal artificial light was minimal provided the receiver was not a long way from the transmitter or far off direction.

Background buzz from fluroescent lights can be heard in weak signal conditions if the light source is in the receiver photodiode acceptance angle. We experimented with linear polarized filter material with the Yz axes crossed. Used as a window, this gave an improvement to the signal to noise ratio but we felt that the added cost was not justified for an extreme condition. For reference, the material used was Polaroid HN32 or HN22. Unfortunately, this material is only available from Polaroid Australia in 300mm x 420mm x 0.7mm sheets.

The receiver has a directional characteristic because of the position of the diodes inside the case. If these diodes were placed outside the case, in front of the window position, a more omnidirectional receiving pattern could be achieved. The diodes could be placed in a back to back arrangement to obtain a wider field of view. However, this creates a problem of housing and the exclusion of all but IR light.

Constructors may wish to experiment with this idea if the directional characteristic of the receiver is a problem in use.

PARTS LIST

RECEIVER

Semiconductors

1 4069uB
2 LM565 PLL
2 LM386 audio amps
2 LT586AB photodiode

Capacitors

1 270pF ceramic
1 680pF ceramic
2 10uF/25V RB electro
1 820pF ceramic
3 150pF ceramic
1 2.2nF ceramic
1 1.8nF metallised polyester
1 1.5nF metallised polyester
2 330pF ceramic
1 33uF/10V RB electro
1 68nF metallised polyester
1 2.7nF metallised polyester
2 1nF ceramic
1 100pF ceramic
1 4.7nF ceramic
2 56nF ceramic
2 10nF ceramic
2 22nF ceramic
2 4.7uF/25V RB electro
3 100uF/16V RB electro
2 47nF metallised polyester

Resistors (all 0.25W, 5%)

2 1M, 7 x 2.2k, 3 x 4.7k, 2 x 10k 3 x 68k, 3 x 1.5k, 1 x 5.6k, 1 x 6.8k, 1 x 33k, 1 x 39k, 3 x 1k, 1 x 15k, 4 x 680Ω, 2 x 10Ω
2 10k 10mm horizontal trimpot
1 10k log pot

Inductors

2 2.5mH RFC
1 1mH RFC
1 220uH RFC

TRANSMITTER

Semiconductors

2 LM566 VCO
1 7805 regulator
3 BC548 transistor
1 BD139 transistor
8 LTR5208 IR LED
1 3mm RED LED

Capacitors

3 4.7uF/25V RB electro
4 10nF ceramic
2 1nF ceramic
1 560pF ceramic
1 470pF ceramic
3 4.7uF/25V 28 electro
2 220pF ceramic
1 47nF ceramic
1 180pF ceramic
2 100uF/16V RB electro

Resistors (0.25W, 5%)

1 x 47k, 1 x 5.6k, 1 x 15k, 3 x 2.7k, 4 x 2.2k, 3 x 15k, 2 x 100k, 1 x 47k, 1 x 5.6k, 1 x 1.8k, 1 x 1.5k, 1 x 3.9k, 1 x 470Ω, 1 x 270Ω, 1 x 220Ω
1 x 6.8Ω 1/2W
1 10k log dual volume control
2 5k 10mm horizontal trimpot
1 200Ω 10mm horizontal trimpot

Miscellaneous

1 case c/w screen and window
1 screened front panel to suit case
1 PCB
1 SPDT PC mount toggle switch
1 3.5mm stereo PCB mount socket
2 TO-220 mica insulators
1 TO-220 nylon insulator
2 M3 x 10mm screws
2 M3 hex nuts
2 M3 flat washers
1 56mm heatsink
1 1m 2 core round shielded cable
1 1m 1 core shielded cable
1 3.5mm stereo plug
2 RCA plugs
1 3.5mm socket
1 9V battery snap

TIMS: prize-winning learning system for communications

In 1986 ***Electronics Australia***, in conjunction with Texas Instruments (Australia), organised a competition to highlight the type of development work being done around Australia, based on TI's TMS320 digital signal processor. This article describes the winning project, called TIMS, and the role of the TMS320 in an educational environment.

by CARLO MANFREDINI & ALFRED BREZNIK

TIMS, short for Telecommunications Instructional Modelling System, is a laboratory teaching system designed to provide electronics engineering students in both introductory and advanced courses with a practical and effective way to model telecommunications systems and techniques. Because of its modular and flexible design, it is also of value for modelling at the post graduate research level.

The concepts behind TIMS go back some 15 years. The original "TIMS" was designed at the University of New South Wales by lecturer Tim Hooper. At the time, the need had arisen for a flexible and modular experimental system for UNSW Electrical Engineering communications courses. Since then, TIMS has become a well known, recognised system for running student experiments.

Despite TIMS' high reputation, only one company in the past years had attempted to market the product. Unfortunately, the system had been so drastically modified that the original concepts of modularity and hence flexibility were lost.

Some two years ago the present authors were approached by Emona Instruments to redevelop and modernise TIMS, in preparation for manufacturing and marketing it as a technologically up-to-date educational system. Being ourselves graduates in communications from UNSW, we were aware of the potential of this project. We were also able to draw on our final-year experience in DSP (digital signal processing) techniques, to extend the original TIMS concept and incorporate DSP capabilities.

TIMS is both a very flexible and highly expandable system, based on the use of standard communications building blocks or modules. These can be patched together according to traditional telecomms block diagram notation, to make up virtually any desired configuration. The operation of individual modules can then be analysed and examined, along with the resulting complete system or functional subsystem.

The basic TIMS system is housed in a 6U height eurocard case with two 19" racks. The lower rack, known as the "system panel", provides the basic facilities for carrying out experiments: message and carrier signals, frequency/event counter, audio amplifier, low pass filter, etc. It also allows signals and messages to be received or transmitted via a trunks network. Signals can be received from either the lecturer, for experiments or examinations, or from neighbouring TIMS bays. Each TIMS system can also transmit signals via the trunks network to a neighbouring TIMS bay.

The upper rack accepts removable modules, which are used to set up the actual experiments. Interconnection between the modules is performed via patching leads.

Using TIMS modules in a communications experiment is quite simple: see Fig.1. Each box in the figure represents a functional module, and it is a simple matter to interconnect the modules according to the block diagram.

In the same way TIMS can be set up to demonstrate and examine other methods of communication de/coding and de/modulation, including SSB, FM, AM TDM, FDM, ASK, FSK, PSK and QASK. All of these can be realistically

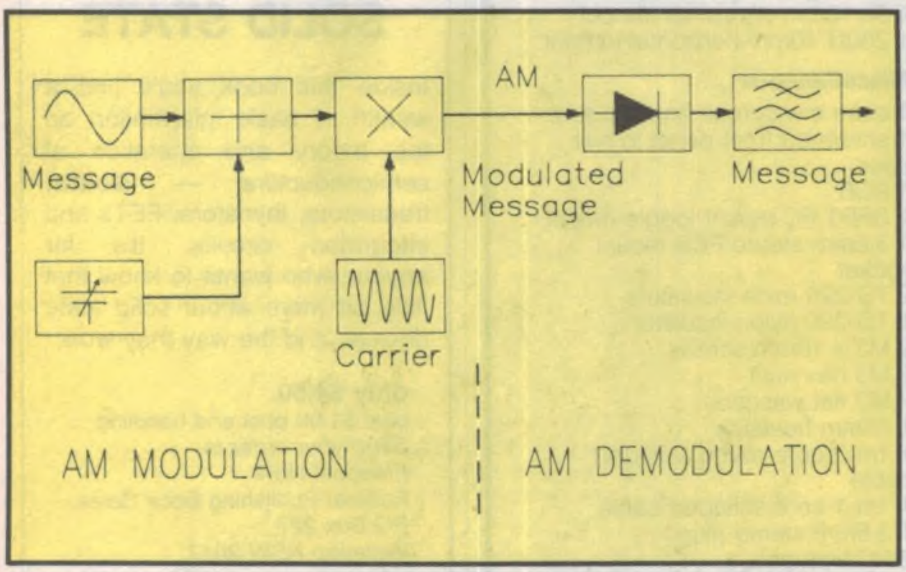
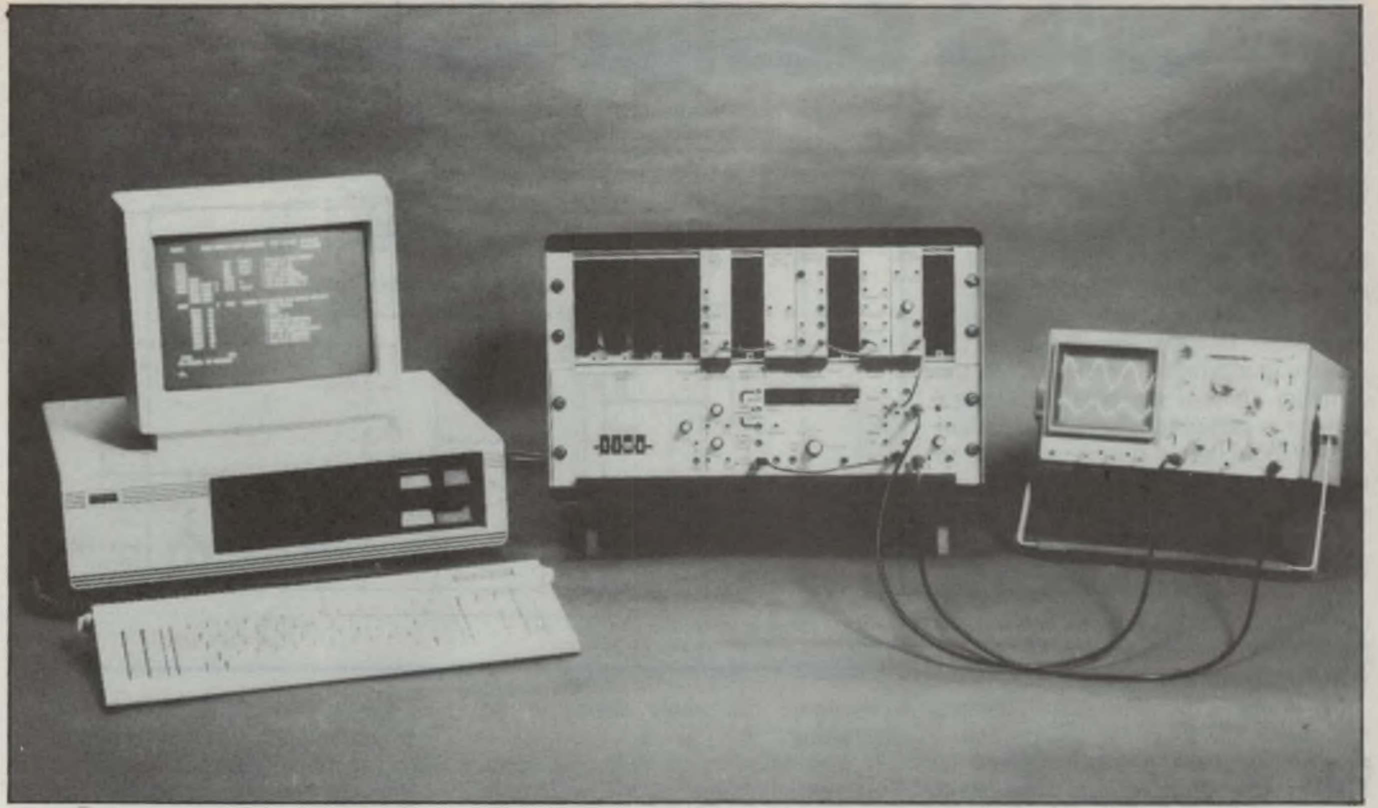


Fig.1: TIMS can very easily be set up to demonstrate a wide range of communications configurations, like this one for amplitude modulation and demodulation.



The basic TIMS system is shown here in the centre, set up with an oscilloscope and a personal computer for demonstrating or examining the operation of a DSP configuration.

modelled, using a 100kHz carrier frequency. 100kHz was chosen in order to keep component costs down, given the wide range of modules.

The removable modules are divided into three groups:

1. BASIC SET

These include an adder, multiplier, phase shifter, variable LPF, 60kHz LPF, audio oscillator, VCO (voltage controlled oscillator), dual audio gate, quadrature phase splitter, pseudo random sequence generator, twin pulse generator, utilities (RC, rectifier and RC, precision rectifier, comparator).

2. EXTENSION SET

Included here are a quadrature switching modulator, SSB filter, integrator, noise generators, harmonic multiplier and 116kHz LPF.

3. DSP SET

This group comprises a TIMS320 Development board, TIMS320 Run board, analog interface board and enhanced interface board.

In designing the TIMS modules considerable care was given to signal-to-noise ratio, to ensure that the waveforms achieved and observed in each experiment relate closely to those expected and predicted by mathematics.

A real advantage of the TIMS system is that users can design their own application specific modules. Provision has also been made for signals to be transferred to neighbouring modules, via the backplane, if required.

The TIMS320 DSP module differs greatly from the discrete electronics modules. Functionally, it can replace many of the other TIMS modules, either singly or collectively. For example, a rectifier program may be combined with a low pass filter program to create an AM demodulator. In advanced courses, students can be asked to write their own applications programs.

In introductory courses students can run tutorial programs after calculating relevant coefficients or other parameters, from theory. Thus they can compare the differences between the actual measured results and theoretical predictions. In addition they can compare the performance of a discrete electronic module versus its DSP equivalent. Whilst mathematical functions can be precisely implemented on the TIMS320 module, there is an inherent bandwidth limitation due to program execution time.

The TIMS320 Development board has been specifically designed for student use. It has an easy to use monitor program: features include a facility for assembled program code to be serially downloaded into its RAM for execution. Any computer system with a TMS320 assembler may be used for this task. Other operations such as memory examine and change, memory upload, and fill RAM are also available. These ensure program entry and debugging is quick and uncomplicated.

The TIMS320 module communicates with the outside world through one of two analog interface boards (AIBs). The primary design aim of these boards was not to limit the performance of the TMS32010 through slow or poor resolution ADCs and DACs. A cost effective solution was to use 12-bit converters, having A-D conversion times of 5us.

As well as A to D and D to A conversion, the AIBs provide other facilities, such as: digital inputs and outputs, toggle input switches, access to TMS320 interrupt control pins, and software controlled sampling rate clock.

We believe that our TIMS system, through its use of rack-based modules and incorporating the latest DSP capability, provides students and lecturers in electronics with a comprehensive but inexpensive laboratory resource.

The TIMS system is being manufactured locally and marketed by Emona Instruments, which is well established and experienced in the fields of test instruments and teaching systems for educational institutions. For further information, please contact the company at 86 Parramatta Road, Camperdown 2050. Telephone (02) 519 3933.

Circuit & Design Ideas

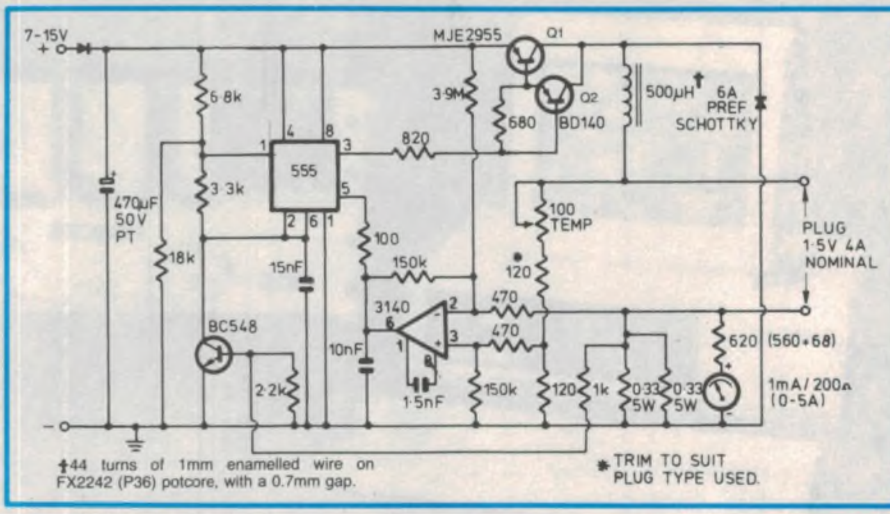
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Glow plug regulator

This glow plug regulator is intended to actually set the temperature of a model aircraft engine's "glow" plug to optimum, despite engine and battery conditions. It does this by using the positive temperature coefficient of the platinum alloy in the plug. The plug's element is placed in a bridge circuit and a feedback control system attempts to maintain a preset resistance value despite other circumstances.

All this results in easier starting and longer plug life.

The circuit uses the switching regulator principle to convert 12 volts, used for electric starters, to the 1.2 to 1.5 volts needed by glow plugs.



My design is the outcome of attempts to improve the ETI 1516 "Shure Start" project (June 1983), which seemed to have a few shortcomings. The main problem, I discovered was that the potcore inductor had no air gap specified, despite having to pass up to 5 Amps DC. This of course results in core saturation and hence poor and inefficient performance.

The new circuit employs a gapped potcore inductor of lower value using a smaller (hence cheaper) core. This meant operating the switching regulator at a higher frequency (6kHz typ), again to prevent saturation, in turn requiring a redesign of the switching drive circuit.

Changing to a collector output Darlington stage provides much faster switching times and minimises the dissipation in Q1. Several resistor and capacitor value changes were also needed, to optimise the whole device to my satisfaction.

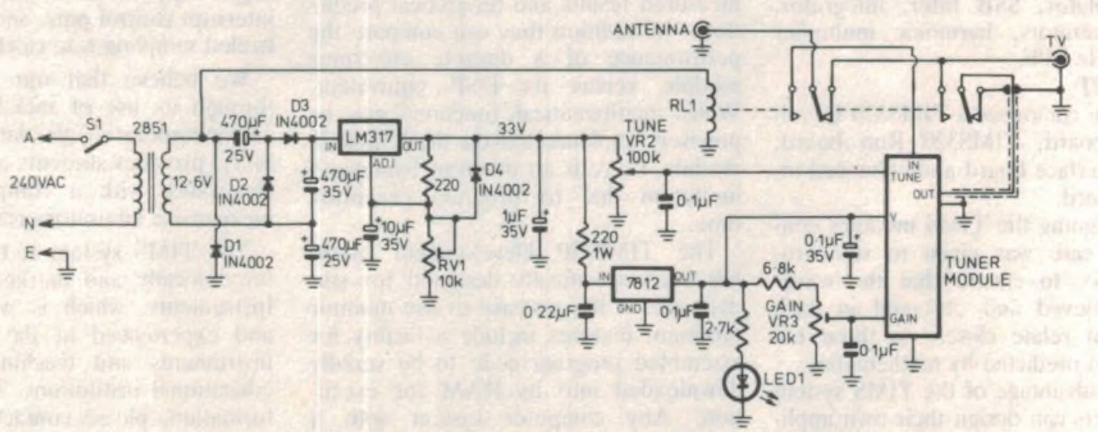
It now operates as originally specified, providing fine control over glow plug temperature despite varying conditions in the engine.

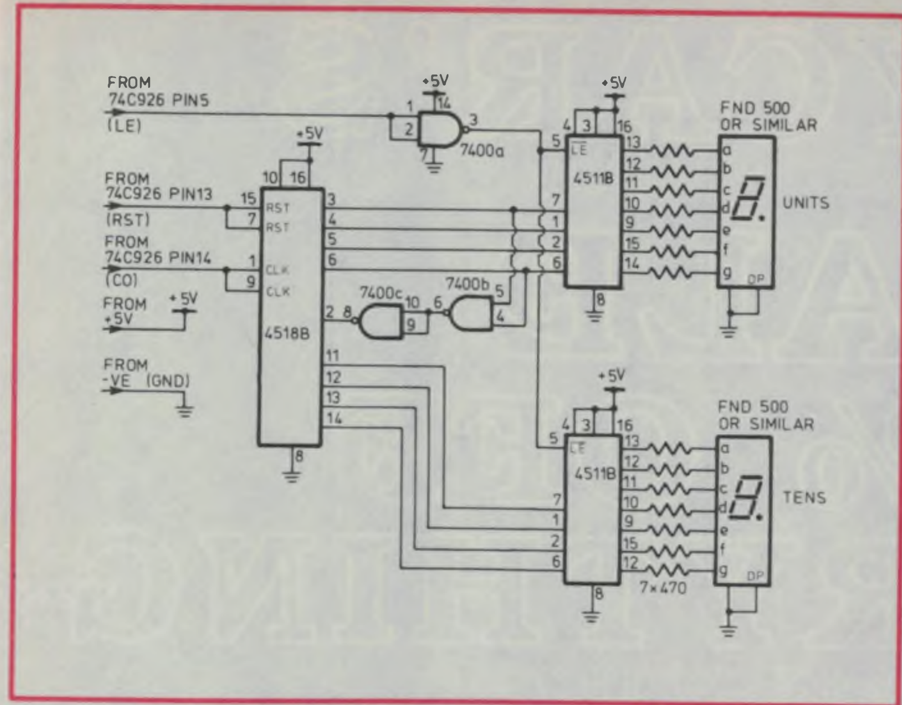
My regulator has been in constant weekly use for ten months without a hitch. It was constructed using 0.1" Veroboard for all components except the pot, potcore and Q1. Everything fits neatly in a medium size (UB 3) jiffy box using the lid to mount the board and act as heatsink for Q1. I fitted the meter on the plastic part, along with the pot in the centre and potcore inductor inside held with a brass bolt through the end.

The potcore as mentioned, needs to be gapped and this can be done easily with two annular "gaskets" made from cardboard of the right thickness. These are placed between the two halves before bolting them together — gently! Be sure to put a gasket in the centre as well as the outside rim of the core, or else it is likely to crack when tightened. (The voice of experience!)

In use you merely set the 100-ohm pot to obtain the correct colour, and hence temperature of the plug while removed from the engine. To test correct operation try blowing hard on the plug; the colour should hardly change and the current meter will rise sharply. Note the current and install the plug. A flooded engine is indicated by a current increase. When the engine is running it will drop back to a low value. Your plugs will last longer with this device, as overheating after the engine starts is avoided.

Phil Allison,
Summer Hill, NSW. **$30**





Expanding range of Capacitance Meter

Some time ago I constructed your 4-digit Capacitance Meter (August 1985). However, I found that the range of the uF range was too small, so I devised this circuit to add another two digits. This now gives me full scale readings of: 9999.99uF, 99999.9nF and 999999pF. The modification is very simple to construct and fit, and is very cheap.

Clock pulses are fed into the dual counter (4518B) from the carry output (pin 14) of the 74C926 in the original circuit, advancing counter 1. When counter 1 is at a count of 9 (8 & 1), the "8" and "1" lines are added and fed into counter 2's enable input. This advances both counters to change the tens. Counter 2 is then disabled and counter 1 continues to count. The RST signal just resets the counters while the LE signal is inverted so as to latch the displays at the right time.

Power for the additional circuitry is obtained from the meter and fed to the chips. All other signals can be taken from the base of the 74C926, under the board and routed to the circuit.

I mounted the two new displays between the left most digit and the power switch. There's just room to do this.

Note: The 7400 was used as this was available. A 4011 CMOS chip will do equally well.

George Sutherland,
Buderim, Qld.

$25

Automatic switching for UHF converter

I recently built the UHF converter (EA April 1985). The procedure of changing from VHF to UHF (or viceversa) involved three steps: change the channel on the TV, switch power to the converter, operate the bypass switch (by groping around the back of the converter). In order to simplify the procedure, I decided to replace the bypass switch with a 12V DPDT cradle relay (e.g., Dick Smith S7012) that would operate when the power switch in the converter was operated.

The bypass switch S2 was removed and the relay was Araldited to the rear panel. The contacts were wired as for the switch (see circuit).

The relay coil was powered from the bottom section of the voltage tripler. Under load, the voltage across diode D1 is about 13V. The relay could have been powered from the 12V regulator; however as both voltage regulators would have to handle the extra 40mA, the power dissipation in both would be significantly increased.

Ian Johns,
Wanniassa, ACT

$15

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Resonant Frequency	60Hz (was 80Hz)
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Magnet Weight	40 oz
Net Weight	3610 grams (was 3520g)
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Over 100 watts rms, frequency 4-30kHz.
No crossover required. Especially suited to Hi Fi.
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MOTOROLA Model 1005A

90mm SUPER HORN
Perfect for use where long throw is needed. PA's and musical instrument use. Frequency response 3.8-28kHz ±3dB, maximum input 25V rms (100W amp power), no crossover required.
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MOTOROLA Model KSN 1025A

60 x 150mm Rectangular
Widest frequency range of the piezo horns, otherwise similar to the CT-2026.
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This exponential horn has a full 90° horizontal dispersion angle. With harmonic distortion of less than 1%, this unit is ideal for Hi Fi use. Frequency response 3 - 30kHz ±3dB, maximum input 25V rms, no crossover required.
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NOW $22.95

LESS 15% $19.50

SAVE $7.40

NEW '88

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Same to look at as Model 1005A (CT-1910) but handles 75 watts. SPL 96dB.
Cat. CT-1908

ONLY $14.95

LESS 15% $12.70

NEW '88

MOTOROLA Model KSN 1089A NEW MODEL

3" Direct Radiating Tweeter
Looks like a normal 3" cone tweeter. Great for car sound and Hi Fi.
Cat. CT-1906

ONLY $9.95

LESS 15% $8.46

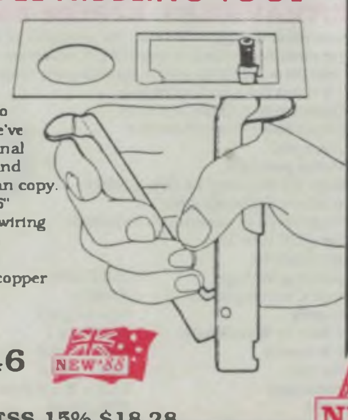
THE ORIGINAL ADEL NIBBLING TOOL BACK AGAIN

BORN IN THE USA

How things change. You can now purchase from Jaycar the original American Adel nibbling tool. Due to price rises from Asian countries we've been bale to direct import the original tool (which we sold 10 years ago) and sell it at the same price as the Asian copy.

- Cuts holes - any shape over 7/16"
- Notches clearance for plugs and wiring
- Trims undersize holes to fit parts
- Suitable for steel up to 18 gauge, Aluminium 16 gauge, plastic and copper

Cat. TH-1765



ONLY $29.95

LESS 15% $25.46

NEW '88

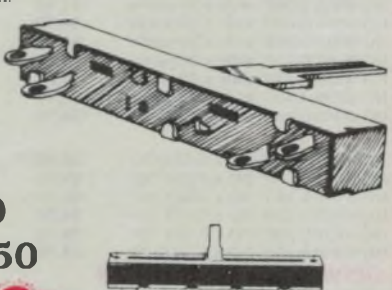
Replacement Punch
Cat. TH-1766 $21.50 LESS 15% $18.28

SLIDER POT PACK

You don't see this very often. A pack of 20 slider pots in assorted values as listed below for only $10. That's only 50¢ each. The majority in the pack have been selling for $5.50 each.
Here's what you get:

	Value
50K log 45mm x 5	$19.75
500K lin 45mm x 2	$7.90
250K lin dual 45mm x 1	$5.50
5K lin dual 60mm x 2	$11.00
100K lin dual 60mm x 2	$11.00
250K lin dual 60mm x 8	$44.00
TOTAL VALUE	$99.15

Cat. RP-3903



FOR ONLY $10

LESS 15% $8.50

NEW '88

DIRT CHEAP!!

LEDS 10mm

DIRECT IMPORT SAVES YOU MONEY

10mm LEDs - NOW AT AFFORDABLE PRICES

Red	Cat. ZD-1956
Green	Cat. ZD-1957
Yellow	Cat. ZD-1958
Orange	Cat. ZD-1959 (NEW)

WAS $1.95 ea
NOW $1.50 ea
LESS 15% $1.28
10 up $1.30 ea
LESS 15% $1.11

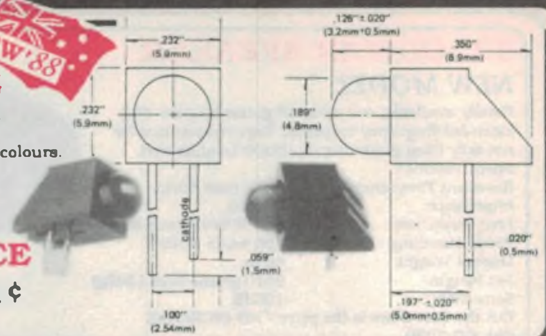
LED and HOLDER FOR PCB MOUNTING

NEW '88

These are basically a 5mm LED mounted in a plastic housing specifically designed for PCB mounting. Available in the 4 standard colours.

Red	Cat. ZD-1780
Green	Cat. ZD-1781
Yellow	Cat. ZD-1782
Orange	Cat. ZD-1783

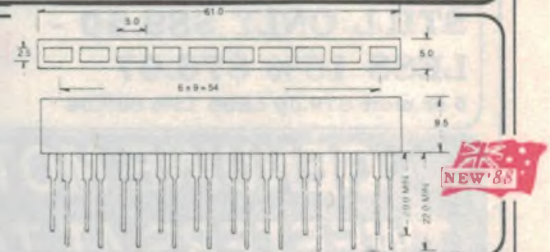
ALL THE SAME PRICE
48¢ ea LESS 15% 41¢
10 up 42¢ LESS 15% 36¢



LED BAR GRAPH

Jaycar has introduced this great LED array for our 1988 new product line-up. It has 7 green and 3 red rectangular 5mm x 2.5mm LEDs mounted in a black housing. Ideal for VU metres or where any easy visual clipping level is required.
Cat. ZD-1702

$4.25 LESS 15% $3.61
10 up $4.00 ea LESS 15% $3.40



LOWER PRICES ON ULTRA BRIGHT LEDS

DIRECT IMPORT SAVES YOU MONEY

DIRT CHEAP!!

(ALL RED)		WAS	NOW
200mCd	Cat. ZD-1790	99¢	79¢ LESS 15% 67¢
		10 up 90¢	10 up 70¢ Less 15%
500mCd	Cat. ZD-1792	$3.75	$2.50 LESS 15% $2.12
		10 up $3.50	10 up $2.30 Less 15%
1000mCd	Cat. ZD-1793	$7.95	$4.95 LESS 15% $4.20
		10 up $7.50	10 up $4.50 Less 15%

STD BAR - FINALLY RELEASED

NEW '88

The STD Bar for your telephone will be available sometime in January. It appeared in our catalogue but we were afraid to release it due to to the safety aspect of 000 emergency number. We have solved this problem, and the new model will allow emergency calls through on the 000 number, but will stop standard STD calls (except Tasmania). Cat. YT-6540

$34.95 LESS 15% $29.70

15% OFF EVERYTHING SALE

BISHOP GRAPHICS - LESS 15% OFF ALL PRICES

As demand for greater PCB density increases so does the need for a more professional approach to PCB design. To help in this regard, Jaycar stocks a comprehensive range of PCB artwork materials from BISHOP GRAPHICS of the USA. This material is both dimensionally stable and accurate which, enables you to produce complex layouts with greater accuracy. (Very necessary for LSI, for example). Once your artwork has been produced you can make your own board.

PRE-SPACED PADS

HG-9906 0.100" dia 1.58mm 240 pads $5.60
HG-9907 0.100" dia 1.91mm 140 pads $5.60
HG-9908 0.156" dia 2.54mm 150 pad $5.60

DIL PATTERNS

HG-9909 14 PIN 32 symbols	$5.60
HG-9910 16 PIN 32 symbols	$5.60
HG-9911 18 PIN 28 symbols	$5.60
HG-9912 24 PIN 12 symbols	$5.60
HG-9913 28 PIN 12 symbols	$5.60
HG-9914 40 PIN 8 symbols	$5.60

DIL PATTERNS - NARROW CUT

HG-9918 14 PIN 32 symbols	$5.60
HG-9919 16 PIN 32 symbols	$5.60
HG-9920 40 PIN 8 symbols	$5.60

BLACK ARTWORK TAPE

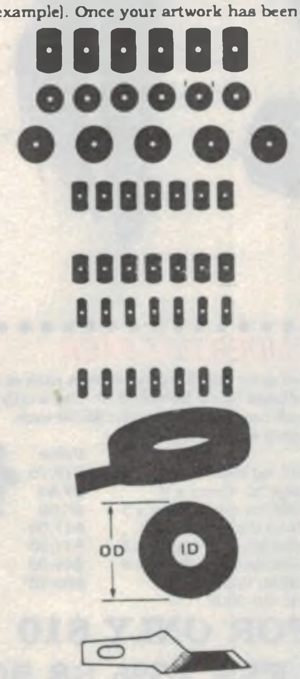
HG-9930 0.026" wide x 20 yards	$3.95
HG-9931 0.031" wide x 20 yards	$4.25
HG-9932 0.040" wide x 20 yards	$4.25
HG-9933 0.050" wide x 20 yards	$4.25
HG-9934 0.062" wide x 20 yards	$4.30
HG-9935 0.080" wide x 20 yards	$4.30
HG-9936 0.093" wide x 20 yards	$4.30
HG-9937 0.100" wide x 20 yards	$4.30
HG-9938 0.125" wide x 20 yards	$4.30
HG-9939 0.200" wide x 20 yards	$4.30
HG-9940 0.250" wide x 20 yards	$5.75

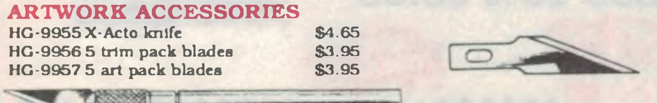
DONUT PADS

HG-9941 0.080" OD x 0.031" ID	$4.30
HG-9942 0.100" OD x 0.031" ID	$4.30
HG-9944 0.125" OD x 0.031" ID	$4.30
HG-9945 0.156" OD x 0.031" ID	$4.30
HG-9947 0.200" OD x 0.031" ID	$4.30
HG-9948 0.250" OD x 0.031" ID	$4.30

ARTWORK ACCESSORIES

HG-9955 X-Acto knife	$4.65
HG-9956 5 trim pack blades	$3.95
HG-9957 5 art pack blades	$3.95





PRESSURE SENSITIVE COPPER TAPE

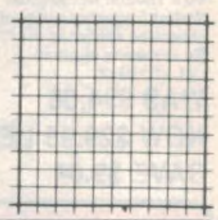
Ideal for repairing damaged or broken semiconductor traces on a PCB.
Use to modify circuitry on existing PCB's.

HG-9901 0.031" wide x 6ft	$4.30
HG-9902 0.050" wide x 6ft	$4.30
HG-9903 0.100" wide x 6ft	$5.35

ARTWORK FILMS POLYESTER

Always use a background grid during printed circuit artwork and layout preparation to ensure maximum accuracy on the final PCB.
10 x 10 grid, matt on one side - 0.003" thick.
This is the material you lay your pattern on.

HG-9959 8.5 x 11" pack of 2	$4.25
HG-9960 11 x 17" pack of 2	$7.50



ULTRAVIOLET EPROM ERASER

If you need to regularly erase the contents of EPROM's then this is your most cost-effective solution. It will erase up to 9 x 24 pin devices in complete safety to your eyes and your chips, in around 40 minutes for 9 chips (less for less chips).

- Erase up to 9 chips at a time
- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures thorough erase
- Engineered to prevent UV exposure
- Long UV tube life

Specifications

Operating Voltage	240V 50Hz
Power Consumption	8 watts
Capacity	9 to 24 pins
UV Source Wavelength	253.7nm
UV Intensity	6.4mW/cm²
Tube Life	3000 hours
Dimensions	21.7 x 8 x 6.8cm
Weight	670 grams

Cat. XE-4950
$99.50 LESS 15% $84.58

24 TO 12V CONVERTER

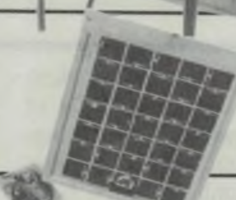
Ref: Silicon Chip Dec '87
Well suited to run 12 volt appliances from 24 volt.
Can deliver up to 5 amps.
Complete kit
Cat. KC-5017

$59.00 LESS 15% $50.15

SOLAR GENERATOR

Ref: ETI Dec '87
This is a cheap, no fuss way to trickle charge a 12V car battery.
PC board and parts.
Cat. KE-4730

$12.95 LESS 15% $11.00



HIGH IMPEDANCE AC/DC MILLIVOLTMETER

Ref: EA Dec '87
This kit will measure AC and DC signals down to a couple of millivolts, with negligible circuit loading. Complete kit with case and meter.
Cat. KA-1695

$46.50 LESS 15% $39.53

UNIVERSAL SPEED CONTROL & LAMP DIMMER

Ref: Silicon Chip Dec '87
Use for control of drills, fans, electric blankets, soldering irons or a dimmer. Complete kit with box, mains leads, etc.
Cat. KC-5016

$18.95 LESS 15% $16.11

JAYCAR No1 FOR KITS

OCTAVE EQUALISER MODULE

Ref: AEM Dec '87
This one octave EQ module is suited for PA and professional use. Kit supplied with all components, pots, PCB. No box or hardware.
Cat. KM-3064

$49.95 LESS 15% $42.46

PASSIVE "BANDPASS" SUBWOOFER

Ref: AEM Sept '87
After much interest in this project, we wil have available the 3mH inductors. The woofers, speaker terminals, cable and innerbond are normal stock lines.
P25WO-08 10" woofer
Cat. CW-2136

$196.00 each LESS 15% $166.60

3mH Inductor **LESS 15%**
Cat. CX-2640 **$11.48**

$13.50 each

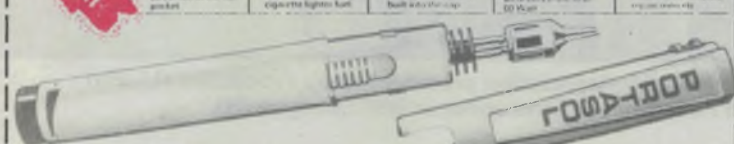
PORTABLE GAS SOLDERING IRON

- No cords, batteries or gas bottles
- Heavy duty, tip temperature up to 400°C
- Adjustable temperature, equivalent to 10-60 watts
- Hard working, up to 60 minutes continuous use
- Refills in seconds, uses standard Butane gas lighter fuel
- No leakage current to sensitive circuits
- Made in Ireland

Cat. TS-1420

$39.95 LESS 15% $33.96

DIRT CHEAP!!



SCOOP PURCHASE!! 2nd PURCHASE

MICROPROCESSOR CONTROLLED /SOLENOID OPERATED HI FI CASSETTE DECK MECHANISM

We have managed to purchase a second batch.
They are slightly more expensive but still represent an absolute bargain.
You guessed it, another Jaycar buy far, far below manufacturers cost where you buy at a normally silly price because other people have lost heavily.
This time its a VERY HIGH QUALITY cassette deck mechanism that cost over $35 US in 1000 lots! This JAPANESE MADE mechanism is deck only - i.e. a door is not fitted nor are there buttons. The deck is not operated by mechanical buttons and all control is by electric signals, therefore the deck could easily be software controlled.
The deck also features an air damper cylinder for soft eject, massive capstan flywheel, Hi Fi head and excellent specs. (see below).
This deck is ideal as either a fast high capacity PC memory storage or as a retrofit to an existing cassette deck to improve performance.
Worth at least $80, grab one for ONLY

$29.95 LESS 15% ONLY $25.45

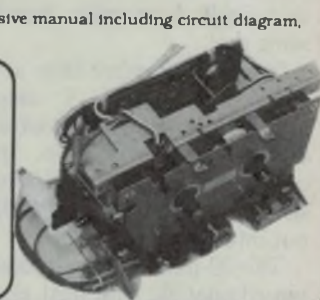
Cat. AC-1590
SPECS:

- 4 track, 2 channel Philips compact cassette deck
- Tape speed 4.75cm/sec
- Wow and flutter <0.12% RMS
- Winding time 110 sec FF & REW C-60
- Working volts 9 - 15V
- Supplied with 12 page comprehensive manual including circuit diagram, truth table, etc.

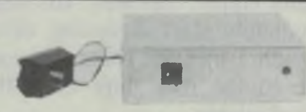
DIRT CHEAP!!

TURN YOUR SURPLUS STOCK INTO CASH!!

Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout for sources of prime quality merchandise.
CALL GARY JOHNSTON OR BRUCE ROUTLEY NOW ON (02) 747 2022



TV COLOUR BAR & PATTERN GENERATOR



Ref: EA October 1987
This generator will produce: colour bars, red screen, white screen, black screen, crosshatch, vertical lines and horizontal lines and dot patterns - 8 patterns in all!
Separate outputs for RF (channel 0 or 1), composite video, horizontal and vertical sync pulses. The sync pulses are available in both positive and negative going logic.
The Jaycar kit includes all specified (or equivalent) components including punched and screened front and rear panels, plastic instrument case etc.
Cat. KA-1691

$159.00 LESS 15% $135.15

JAYCAR JVE-1 VIDEO DETAIL ENHANCER

MADE IN AUSTRALIA
Connects between 2 VCRs to improve the quality of a recording of an original tape. 625 line PAL-D frame unit. Can be used as a distribution amplifier.
Cat. AV-6501

$79.95 LESS 15% $67.96

Power pack MP-3020
$12.95 LESS 15% $11.07

Jaycar ELECTRONICS

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$50	$99.99	$ 6.50
OVER $100		$10.00

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Silicon Valley NEWSLETTER . . .

Competitors both claim first quasi 1-megabit EEPROM

If you didn't know any better, you'd think Xicor and Seeq Technology are the same company operating under two brand names. In reality they are two fierce competitors. But apparently by sheer coincidence, both companies announced the world's first EEPROM chip with 1 megabit density, on the same day.

Ironically, neither firm actually has a true "monolithic" 1 megabit chip. Those chips are still about a year or so away from introduction. Instead both companies introduced devices that consist of four 256K EEPROM modules put into one chip package.

The 32-pin chips were designed to be pin compatible with next year's "real" 1 megabit chips. This way, customers can immediately start designing new products with 1 megabit chips and easily upgrade to the real chips once they become available.

At Seeq Technology, marketing manager Rich Norris said the simultaneous introduction was purely coincidental. "We were surprised ourselves when we opened the paper and found both stories side by side."

Apparently both firms felt they had to make a "bridge" product available to their — mostly military — customers. "Customers will be able to accelerate the introduction of their next-generation memory intensive systems," explained Xicor's executive vice president, Ari Schifrin.

The chips are priced around $US1750 each in quantities of 100 or more — scarcely suitable for consumer products!

Seagate expands on-shore production

Reversing a four-year trend to move disk drive-related manufacturing and assembly operations to South-East Asia, industry leader Seagate in Scotts Valley announced plans to open a large facility in Watsonville, just south of Silicon Valley. Seagate plans to hire as many as 2000 people when the facility opens next spring.

During the past three months, Seagate also reversed a two year trend of steadily increasing profits, as earnings took a 40% dive from $US24.5 million a year ago to $14.8 million. Sales, however, continued to climb and reached $US226 million, up from $US189 million.

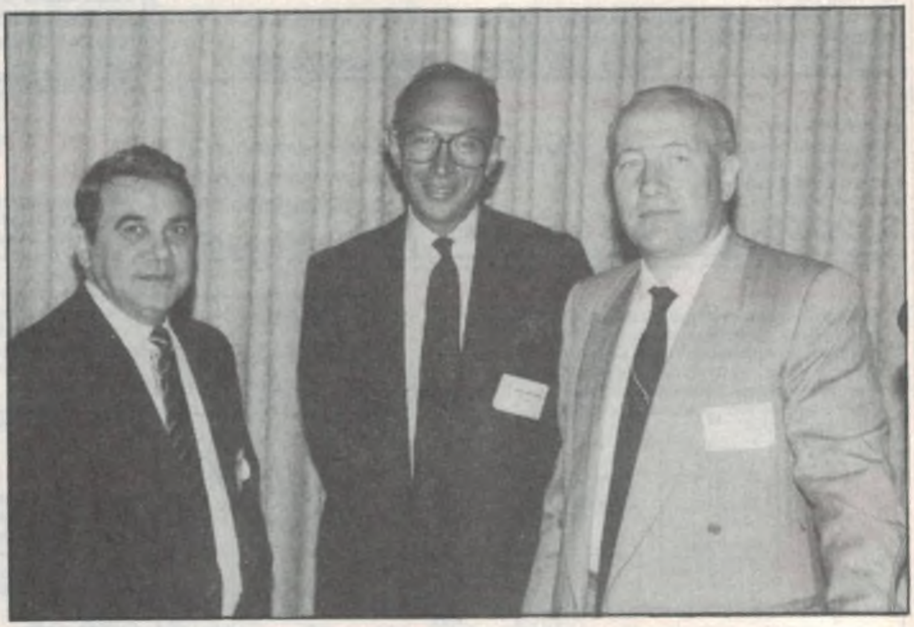
Seagate said the new Watsonville facility will specialise in the production of thin film media, a critical component that allows Winchester disk drives to read and write vastly more data on a magnetic disk than is possible with older techniques.

For its thin-film heads, Seagate currently relies on a plant in Fremont in Silicon Valley. The Watsonville plant will be "a large clone" of the Fremont facility, said company chairman Al Shugart.

The thin-film manufacturing process is very complex, which is the main reason Seagate wants to keep it near its headquarters in Scotts Valley. "There is no advantage to producing thin film offshore," said industry analyst Ron Elijah.

Seagate needs the much larger thin-film production capacity from the Watsonville facility because the growth in sales of its new thin-film-based drives is outpacing the growth in older product lines.

SIA predicts upturn in semi industry



Semiconductor Industry Association president Andy Procassini (L) with chairman Irwin Federman (C) and speaker Wilf Corrigan (R).

After a largely dismal first six years, the worldwide semiconductor industry can look forward to mostly healthy growth through 1990 when the market will reach an annual sales volume of $US45 billion, according to LSI Logic chairman Wilf Corrigan, who presented the outlook for the chip industry at the Semiconductor Industry Association's annual forecast dinner in Santa Clara.

The SIA expects the current upturn to continue throughout 1988 when sales will jump another 17.9% to $US39 billion. In 1989, however, the recovery will slow down to just 7.5%, to $US40.7 billion, but sales will pick up steam again in 1990 with an anticipated growth rate of 11% to $US45 billion.

In the past, the SIA forecasts have often been overly optimistic compared to those of leading market research firms. But this time, they appear very much in line with the other predictions.

LSI Logic introduces 100,000-gate ASIC technology

LSI Logic has announced a breakthrough in high-end gate-array design capability, with its "Compacted Array Plus" family of chips. These put as many as one million transistors and 100,000 useable gates onto a single chip.

LSI Logic chairman Wilf Corrigan said the new technology is "a significant milestone" that will have a major impact on the ASIC, gate array, and systems markets.

The announcement will not have an immediate effect on the bulk of today's ASIC market where the majority of designs require just 10,000 to 15,000 gates. But in high-end application areas such as digital signal processing, artificial intelligence, image processing, speech recognition and synthesis, the ability to put 100,000 gates on a single chip may stimulate companies to develop exotic new products. In some cases, entire new companies may be started up as entrepreneurs will try to put this level of system integration to use. "There are many system architectures just waiting for the right technology to come along," Corrigan said.

Some of the key features of the LCA 100K Compacted Array Plus chip include gates with an effective length of just 0.7 microns. In all, one million transistors are crammed onto the chip, which measures 15mm on each side. They will be produced using a 3-layer metal interconnect process. The high-speed HCMOS process will enable the chip to produce gate delays of just 460 picoseconds.

LSI Logic pioneered the use of memory on an ASIC chip two years ago with the introduction of a 50,000 gate capability. The new chips will have room for up to 32K of RAM and 128K of ROM memory. Output buffers feature 1-24mA slew rate control.

The introduction of the LCA 100K technology is two years ahead of schedule, Corrigan said. When the company introduced its 50,000 gate capability in 1985, it didn't expect to have the 100K capability available until 1990.

IBM, National buying back stock

Like many other companies, IBM has announced it is planning to take advantage of the huge drop in the firm's stock price by buying back an additional $US1 billion worth of its own stock, increasing its total stock buy-back to $US3.5 billion for the year.

In all, IBM has 604 million shares outstanding. Under the earlier program, which has almost been completed, IBM had planned to buy back around 19 million shares. The additional $US1 billion will allow Big Blue to buy back another 8 million shares at the current rate of around $US115. Just before the crash, IBM's shares were trading as high as $US175 per share.

Meanwhile, National Semiconductor said it is buying back 10 million of its 107 million outstanding shares. National's stock has fallen from a high point of $23 to $9.80.

In addition to a good investment, companies hope the reduced number of shares on the open market will protect them against possible hostile take-over attempts.

Intel loses latest battle to stop NEC's V20-30

Intel suffered another setback in the firm's efforts to prevent NEC from selling its V20 and V30 microprocessors in the United States, as a Federal judge in San Jose issued a temporary restraining order preventing Intel from taking its case to the US Customs Service.

Intel asked the US Customs Service to confiscate all V20 and V30 microprocessors shipped into the US as these processors contain microcodes which Intel claims are illegal copies of its 8086 and 8088 chips.

The V20 and V30 microcodes have been the target of a heated court battle between the two firms. Federal Court Judge William Ingram in 1986 ruled in Intel's favour on the issue of whether copyright laws apply to microcodes. But since then NEC has been able to effectively prevent Ingram from rendering his decision on the question whether NEC illegally copied the Intel microcodes.

National & Silicon Compiler develop first compiler-designed VHSIC chip

National Semiconductor and Silicon Compiler have announced they have developed the first 1.2 micron VHSIC chip using a silicon compiler process.

The random logic circuit demonstrates that National's VHSIC process is successfully installed on Silicon Compiler's "Genesil" system. According to National, any Genesil user can now access National's VHSIC silicon foundry services.

The VHSIC chip was developed under a contract from a number of military services and institutions. The first batch of wafers produced with the compiler systems had a yield of 54%.

"We have met one of the major objectives of this contract, aimed at dramatically reducing both development time and cost of VHSIC chips while ensuring design accuracy," said Fred Smith, program manager at National.

"This contract has established an important link between the VHSIC system design community and the 1.2 micron CMOS processing technologies," added Silicon Compiler vice president Clem Meas.

US Customs to block Sharp Z8 processors

In a blow to Sharp's semiconductor operation and some of its customers, the US Customs Department announced it has decided to confiscate all shipments of Sharp's Z8 microcontroller to the US, as well as disk drive controllers, modems, add-on boards, and other products entering the US that contain the Sharp chips.

The Customs decision comes at the request of Zilog in Cupertino, which has charged that Sharp has illegally copied the microcode of its Z8 microcontroller.

In 1981, Zilog licensed Sharp to build a 2K ROM microcontroller using the Z8 microcode. But since then, according to Zilog spokeswoman Dotty Wanat, Sharp has violated the licensing agreement by using the microcode in other versions of the chip which feature more ROM. While Zilog has tried to negotiate a licensing agreement for the other chips, Sharp according to Wanat "has chosen to see it a different way."

Like Intel, Zilog believes Sharp used the microcode of its "Z" family of microprocessors as the basis for its own processor chips. Zilog estimates that so far this year, Sharp may have sold as many as 100,000 of its microprocessors in the US, either directly or incorporated into end-products.

NEW! NEW!

5¼" DISK STORAGE (DD50-L)

Efficient and practical. Protect your disks from being damaged or lost!

Features
- 50 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- Contemporary Design

Cat C16025 **only $14.95**

COPY HOLDER (YU-H32)

- Adjustable arms allows easy positioning
- Copy area 9½" x 11"
- Sliding line guide
- Clamp mounting

C21062 .... **$39.95**

5¼" DISK STORAGE (DD100-L)

Efficient and practical. Protect your disks from being damaged or lost!

Features
- 100 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact ABS plastic base
- Contemporary design

C16020 **only $19.95**

COPY HOLDER (YU-H33)

- Copy area 9½" x 11"
- Sliding line guide
- Flat metal base

C21060 **$39.95**

JUMBO 5¼" DISK STORAGE (DD120-L)

If you have lots of disks, you'll appreciate the extra capacity of this disk storage unit when it comes to locating a particular disk.

Features
- 120 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact plastic base

C16028 **only $24.95**

DUST COVER

Keep your computer and accessories free of dust and grime while not in use.

XT* Cover Set (C21066) **$14.95**
AT* Cover Set (C21068) **$16.95**

3½" DISK STORAGE (DD80-L)

- Holds up to 80 x 3½" diskettes
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact plastic base
- Contemporary design

Cat. C16038 **only $24.95**

KEYBOARD DUST COVER & COPY HOLDER

- Combines two functions in one set
- Flexible clamp can be attached to most brands of keyboards
- Made of clear acrylic plastic
- Overall size: 449 x 180mm

C21064 .... **$29.95**

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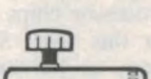
- Restores order to your work area without occupying extra space
- Feeds and refolds paper under the printer automatically
- Adjustable paper deflectors ensure smooth flow of paper
- Made of moulded plastic
- Suitable for most printers

C21058 (80 column) **$69.95**



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Converts 5¼" single sided floppy disks to double sided by placing an appropriate notch in the floppy disk jacket.

C21070 **$9.95**

PRINTER STANDS

- Restores order to your work area
- Conveniently stacks paper printout in document tray automatically
- Made of black plastic coated steel
- Suitable for most printers
- Excellent value at these prices!

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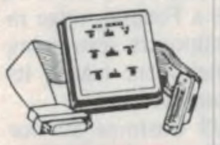
It only takes a minute amount of dust dirt or magnetic oxide particles on your drive heads to cause problems errors, downtime or an expensive service call. Regular use of a head cleaner will keep your drive free of trouble causing dirt and help keep your system up and running. These disk cleaners are simple to use, and include cleaning solution and instructions.

CAT.No.	SIZE	PRICE
C12560	3½"	$6.95
C12555	5¼"	$6.95
C12851	8"	$14.95



RS232 FAST CABLER

Makes RS232 interface configurating fast and simple. 3 slide switches enable line swapping functions positive and negative voltages are displayed on 6 incolour LED's.

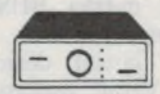
SPECIFICATIONS:
Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable.
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR)
Switches: 3 Slide switches to swap leads
Power: Interface power
Enclosure: Black high impact plastic
Dimensions: 85 x 95 x 30mm

X15710 **$145**

SENDATA DIRECT CONNECT MODEM

- CCITT V21 300 baud full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer
- LED display for Power, TX, RX, CD
- AC power adaptor included
- DB25 pin connector
- Telecom Approval N° C83/37/1045

Cat. X19120 .... **$295**
(SOFTWARE FOR VIATEL ... $95)



2 & 4 WAY RS232 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 Cat X19120 **only $59**
4 WAY Cat X19125 **only $79**

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2 & 4 WAY CENTRONICS DATA TRANSFER SWITCHES

Save time and hassles of constantly changing cables and leads around with these inexpensive data transfer switches. These data switches support the 36 pin centronic interface used by Centronics, Printronics, Data Products, Epson, Micronics, Star, and many other printer manufacturers.

- 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
- Bale locks are standard

2 WAY (X19130) **only $59**
4 WAY (X19135) **only $79**

RS232 DATA SWITCH WITH TESTER

- No power required
- Ideal for 1 computer to 2 peripherals or 2 computers to one peripheral
- 25 pin RS232 "D" connectors
- Six dual coloured LED indicators showing certain flow status:

T.D. Transmit Data
R.D. Receive Data
R.T.S. Request To Send
C.T.S. Slear To Send
D.S.R. Data Set Ready
D.T.R. Data Terminal Ready

- Size: 200(W) x 68(H) x 150(D)mm

Cat X19110 .... R.R.P. $169
Our Price $149

CPF CONTINUOUS POWER FILTER SPIKE ARRESTOR

The Fortron CPF Filtered Electronic Spike Protector provides a protective electronic barrier for microcomputers, printers, telephone systems and modems electronic typewriters, audio and stereo systems and other sensitive electronic equipment.

The CPF provides protection from dangerous electrical spikes that can cause anything from obvious damage (like immediate equipment failure) to less obvious harm that can drastically shorten a system's life.

CPF's superior circuitry design and semi conductor technology responds instantly to any potentially damaging over-voltage, ensuring safe trouble free operation.

Additionally, CPF's filtering capability helps eliminate troublesome and annoying interference, general hash created by small motors, fluorescent lamps, and the like that threaten the performance and shorten equipment life of unprotected electronic components.

SPECIFICATIONS:
Electrical rating: 220-260 volts (AC) 50Hz 10 Amp
Spike/RFI Protection: 4,500 amps for 20m/second pulses
Maximum clamping voltage: 275V differential mode

Cat. X10088 .... **$69.95**

IBM* XT* COMPATIBLE COMPUTERS $795*

Check these features and our prices. We're sure you'll agree they're exceptional value for money!

- Assembled in Australia!
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(Switchable 4.77/8MHz Turbo versions available for an extra $50)

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256K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Parallel Port. (Includes Timer Disk) **$995**

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2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Serial, 1 Parallel Port. (Includes Timer Disk) **$1,095**

20 M/BYTE HARD DISK COMPATIBLE COMPUTER

20 M/Byte Hard Disk, 360K Disk Drive, 1 Serial, 1 Parallel Port. (Includes Timer Disk)

Single 360K Floppy Disk Drive .... **only $1,750**
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IBM* AT* COMPATIBLE $2,795

Assembled & Tested in Australia!

- 1 M/Byte Main Board
- 1.2 M/Byte Floppy Disk Drive
- Colour Graphics Display Card
- Floppy & Hard Disk Controller
- Printer Card and RS232
- 200W Power Supply
- 6 MHz
- 80286 CPU
- 8 Slots
- 20 M/Byte Hard Disk
- Keyboard
- 6 Months Warranty

IBM* BABY AT* COMPATIBLE .. $2,595

- 1 M/Byte Main Board
- 1.2 M/Byte Floppy Disk Drive
- Colour Graphics Display Card
- Floppy & Hard Disk Controller
- Printer Card and RS232
- 200W Power Supply
- Switchable 8/10/12 MHz
- 80286 CPU
- 8 Slots
- 20 M/Byte Hard Disk
- Keyboard
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Dimensions: 360(W) x 175(H) x 405(D)mm

IBM* COMPATIBLE CARDS

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XT compatible, simply plugs straight in to your computer!
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Cat. X18003 .... $145

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RS232 Card (without cable)
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Cat. $139

(AT COMPATIBLE)

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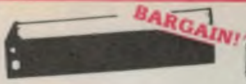

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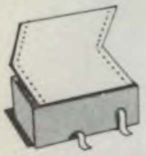
CP80, BX80, DP80, BX100, MB100
ALL A CRAZY LOW $9.95

PRINTER RIBBONS TO SUIT EPSON MODELS...
MX100, FX100, RX100 (Cat C22002) $19.95
MX70/80, FX70/80, RX70/80 (Cat C22031) $10.95

CANON A-50 PRINTER
- Serial Impact Dot Matrix
- 180 C P S
- Near Letter Quality Mode
- 1 4K Buffer

Cat C20045 .... $595



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Quality paper at a low price! 2,500 sheets of 60 gsm bond paper
Cat C21003 11 x 9½" $49.95
Cat C21005 15 x 11" $67.95

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- 120 C P S
- Pica or Elite character set
- Print Modes: NLQ, Dot Graphics, Proportional Font, Draft
- Proportional Printing
- Reliable and Compact
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- Logic Seeking
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Cat C20035 .... only $595

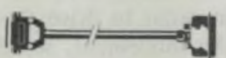
APPLE* COMPATIBLE SLIMLINE DISK DRIVE
Compatible with Apple 2+
Cat X19901 Normally $225
SPECIAL $179

APPLE* IIC COMPATIBLE DISK DRIVE
(including cable .... only $199
(*Apple is a registered trade mark)

CPA-80 PRINTER
Dot matrix, 100 C P S only $375

3¼" EXTERNAL DRIVE
- 720K formatted capacity
- 37 way D type connector fits directly onto drive controller card
- Compatible with IBM* PC/XT
- Requires DOS 3 2 or greater
- Size 266(D) x 104(W) x 75(H)mm

.... only $395



PRINTER LEAD FOR IBM*
- Suits IBM* PC XT and compatibles
- 25 pin "D" plug (computer end) to Centronics 36 pin plug

Cat P19029 1.8 metres $17.95
Cat P19030 3 metres $22.95

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"NO BRAND" DISKS!!
Now you can buy absolute top quality disks that are also the cheapest in Australia! They even come with a 5 year guarantee, which indicates the quality of these disks. So why pay 2-3 times the price for the same quality?

Bulked packed, D/S D/D without boxes, or brand name, just their white paper jacket, index labels and write protects

5¼" D/S "NO BRAND" DISKS FROM $0.85 EACH!!

1-9 PACKS	10+PACKS	100+PACKS
$10ea	$9ea	$8.50ea

(SEND $2 FOR SAMPLE DISK!)
(TAX EXEMPT PRICES LESS $1 PER PACK)

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1-9 PACKS	100+PACKS	100+PACKS
$29 (PER PACK)	$28 (PER PACK)	$27.50 (PER PACK)

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(TAX EXEMPT PRICES LESS $4 PER PACK)

VERBATIM DISK SPECIALS!
All prices 10 disk boxes!

Description	1-9 boxes	10+boxes
3½" 1S/2D	$44.95	$42.95
3½" 2S/2D	$46.95	$43.95
5¼" 1S/2D	$22.00	$21.00
5¼" 2S/2D	$26.00	$24.00
5¼" 2S/4D	$75.00	$70.00
5¼" 2S/HD	$42.95	$41.00

MICRODOT 5¼" DISKS!

DESCRIPTION	1-9 BOXES	10+ BOXES
5¼" S/S D/D	$14.95	$13.95
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(SEND $2 FOR SAMPLE DISK!)

MONITORS FROM $119

SAMSUNG TTL 12" MONITOR
- High contrast, non-glare screen
- Excellent value for money!

SPECIFICATIONS:
Picture tube: 12" diagonal 90° deflection
Mode: TTL
TTL input signal:
Polarity: TTL Positive
Level: 4V p-p + − 1 5V
Impedance: 75ohm
Video bandwidth: 16MHz (− 3dB)
Scanning frequency:
Horizontal: 18 432 + − 0 1KHz
Vertical: 50HZ + − 0 5%
Active display area: 216(H) x 160(V)mm
Display characters: 80 characters x 25 lines
Input connector: 9 pin connector
Controls:
Front; Power ON/OFF, Contrast
Rear; V-Hold, V-Size, Brightness
Internal; Vertical Linearity, Horizontal Linearity, Horizontal Width, Focus
Power supply: 110/120V 60Hz 220/240V 50 Hz
Dimensions: 308(W) x 297(H) x 307(L)mm
Weight: 7·3Kg
Shipping weight: 8 3Kg

Cat.No	Description	Price
X14500	(GREEN)	$189
X14502	(AMBER)	$189

SAMSUNG 12" 20MHz COMPOSITE MONITOR ONLY $129
FEATURES...
- High contrast, non-glare screen
- High resolution 80 or 40 character display

SPECIFICATIONS...
Picture tube: 12" diagonal and 90° deflection
Phosphor: Available in Green (P39) or Amber
Video input signal: Composite Signal
Polarity: Negative Sync
Level: 0 5V-2 0Vp-p
Scanning frequency:
Horizontal: 15 734 KHz + − 0 1%
Vertical: 60Hz
Video bandwidth: 20MHz
Active display area: 216(H) x 160(V)mm
Display character: 80 characters x 25 rows
Input terminal: RCA Phono Jack
Controls:
Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size
Inside: H-Width, H/V hold, H/V linearity, Focus
Power supply: 110/120V 60Hz 220/240V 50Hz
Dimensions: 308(W) x 307(H) x 297(L)mm
Weight: 7 3 Kg
Shipping weight: 8 3 Kg

Cat.No	Description	Price
X14514	(GREEN)	$129
X14516	(AMBER)	$129

10 OR MORE ONLY $119ea

SAMSUNG 12" FLAT SCREEN COMPOSITE MONITOR ONLY $179
FEATURES...
- Flat, high contrast, non-glare screen
- High resolution 80 or 40 character display
- Tilt/swivel base
- Compatible with Apple* and IBM* colour composite signal

SPECIFICATIONS...
Picture tube: 12" diagonal and 90° deflection
Phosphor: Available in Green or Amber
Video input signal: Composite Signal
Polarity: Negative Sync
Level: 0·5-2 0Vp-p
Impedance: 75ohm
Scanning frequency:
Horizontal: 15 734 KHz + − 0·1%
Vertical: 50-60Hz
Video bandwidth: 20MHz
Active display area: 216(H) x 160(V)mm
Display character: 80 character x 24 rows
Input terminal: RCA Phono Jack
Controls:
Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size
Inside: H-Width, H/V hold, H/V linearity, Focus
Power supply: 110/120V 60Hz 220/240V 50Hz
Dimensions: 310(W) x 307(H) x 300(L)mm
Weight: 8 1 Kg
Shipping weight: 9 6 Kg

Cat No	Description	Price
X14510	(GREEN)	$179
X14512	(AMBER)	$179

SAMSUNG 12" TTL/COMPOSITE MONITOR ONLY $179
FEATURES...
- At last a monitor with both TTL and Composite modes!
- High contrast, non-glare screen
- High resolution, 80 or 40 character display
- Swivel/Tilt base

SPECIFICATIONS...
Picture tube: 12" diagonal and 90° deflection
Phosphor: Green (P42)
Video input signal: Composite/TTL Switchable
Polarity: Negative/Positive
Level: 0 5 - 2 0Vp-p/4 0 + − 1 5Vp-p
Impedance: 75ohm, more than 6 8K ohm
Scanning frequency:
Horizontal: 15.75 KHz + − 0 1%/18 432KHz + − 0 1%
Vertical: 47-63Hz
Video bandwidth: 20MHz
Active display area:
Composite 206(H) x 160(V)mm
TTL: 216(H) x 160(V)mm
Display character: 80 characters x 25 rows
Input terminal: Phono Pin Jack 9 pin D-Sub Connector
Controls:
Outside: Power Switch, Contrast, Brightness, Signal Select, V-Hold, V-Size
Inside: H-Width, H/V linearity, Focus, H/V-Shift
Power supply: 110/120V 60Hz 220/240V 50Hz
Dimensions: 308(W) x 297(H) x 307(L)mm
Weight: 7 3 Kg
Shipping weight: 8 3 Kg

Cat No	Description	Price
X14509	(GREEN)	$179

THOMSON EGA MONITOR
Top quality high resolution EGA monitors with a space-age design

SPECIFICATIONS:
CRT: 14 inch (360mm) diagonal, 90 degree deflection
Display Size: 245(H) x 180(V)mm
Phosphor: P22, non glare, tinted screen
Dot Pitch: 0 31mm
Video Bandwidth: 18 MHz
Resolution: 15 75KHz - 640 x 200
21 85KHz 640 x 350
Input Signals:
1 RGBI - positive, H(+), V(+)
2 RrGgBbI - positive, H(+), V(−)
Input Impedance: TTL Level (330 ohms)
Dual Scanning Frequency:
Horizontal 15 75 KHz or 21 85 KHz + − 10Hz
Vertical 50 - 60 Hz
Connector: 9 pin, D-type
Size: 312(H) x 363(L) x 380(W)mm
Weight: 10 8 Kg (Net)

X14525 .... $895

SAKATA 13" RGB COLOUR MONITOR
High quality IBM* compatible monitors, great with VCR's too!

SPECIFICATIONS:
CRT: 13", 90° deflection colour
Input Signal:
Video Signal Separate video signal
Video Positive
Sync Positive
Input Level TTL Level
Scanning Frequency:
Horizontal 15 7KHz
Vertical 60Hz
Display Size: 245(H) x 182(V)mm
Resolution:
Horizontal 640 dots
Vertical 200 lines
Size: 343(H) x 362(W) x 421(D)mm
Weight 11 6kg

Cat X14530 .... $695

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Errors and omissions excepted

VISA

Clock readout for Omega-derived frequency standard

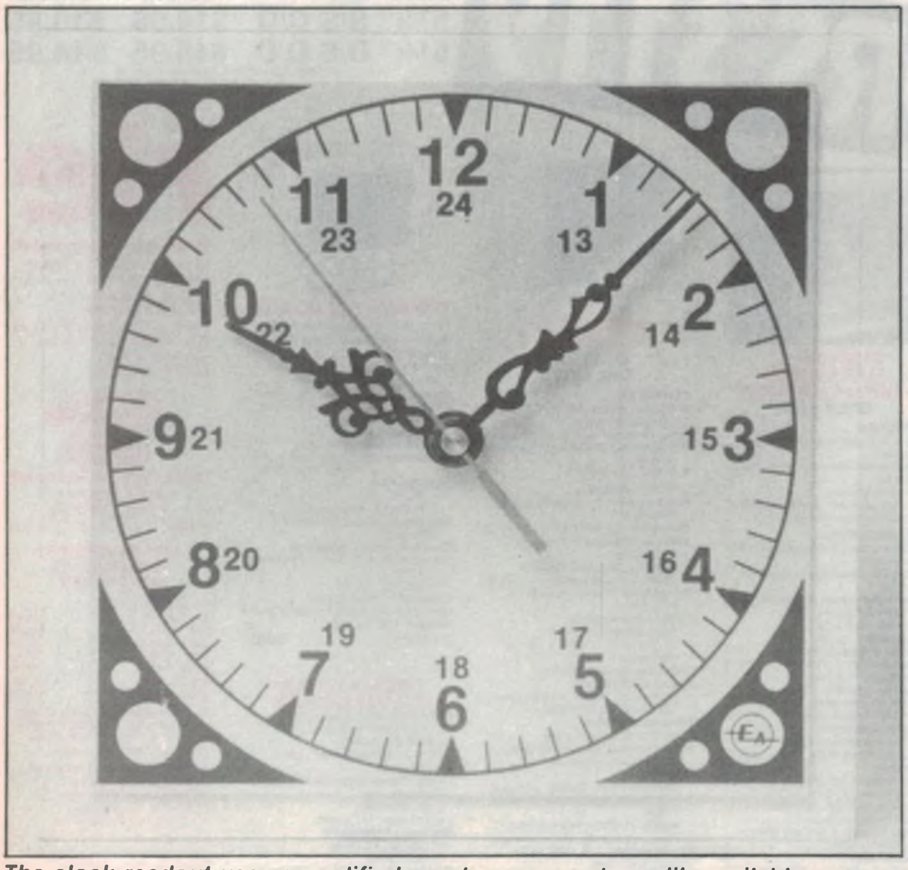
Here are details of a clock which can have a very high degree of accuracy, potentially that of the Omega navigation signal itself: within a few parts in 10^{10}.

by IAN POGSON VK2AZN

Since describing the Omega Derived Frequency Standard in the May 1987 issue, we have had enquiries about the possibility of describing an accurate clock locked to the Omega system. This would seem to be the next and obvious step to take.

Having established the standard as far as it was taken at the time, it is actually a relatively simple operation to extend it so that we have a clock as well. All that is needed is a PC board with three decade dividers, output driver circuits and of course, a clock readout mechanism. Some simple modifications are also needed on the original unit to accommodate the addition.

After some consideration, it seemed that the best way to provide a suitable readout mechanism would be to use one of the many quartz clocks now available quite cheaply in retail outlets, modifying it for the purpose. So I took the plunge, purchased a unit and proceeded to make a careful inspection of its workings. The exercise proved the idea to be a viable proposition, and the modifications necessary will be described later on.



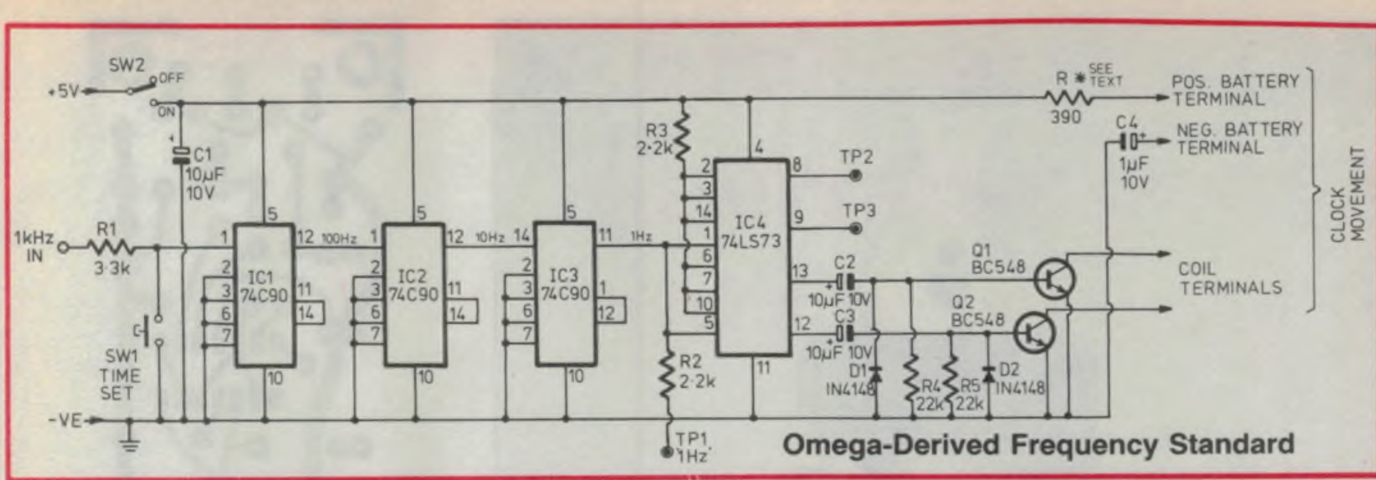
The clock readout uses a modified quartz movement, readily available.

A check with the CRO showed that in order to drive the stepping motor of the movement, we need alternating — polarity pulses at one second intervals, with a pulse width of 50ms or so. Let us now take a look at the circuit and see just how this has been achieved.

We have to divide down from 1kHz, which is the lowest division provided on the Omega Frequency Standard. This is done with three 74C90 decade dividers. This gives us an output of 1Hz, or one pulse per second. The alternating seconds pulses already referred to, are provided by passing the seconds pulses through one half of a 74LS73 dual J-K flip-flop. These pulses appear at the Q-bar and Q pins 12 and 13.

The 74C90 decade dividers were chosen on the score of current economy but 74LS90s may be used if you wish. On the other hand, a 74C73 J-K flip flop proved to be unreliable in its operation. The movement would fail to operate for a couple of seconds and then resume again. As 100 per cent reliability is called for, it was found that the 74LS73 functioned reliably.

In order to reduce the 50-50 duty cycle of the flip-flop outputs, they are AC coupled via 10uF capacitors, each to the base of a BC548 switching transistor. The collectors of the transistors are connected one to each end of the stepping motor coil, thereby giving the required toggle action. The capacitors just referred to, as well as the other two may be ordinary aluminium electrolytics. Tantalums were used in the proto-



The circuit of the readout, which is driven from the 1kHz output of the Omega-derived frequency reference.

type, but the choice is up to the individual.

The two inputs of the 74LS73 are connected together. The two unused outputs are brought out on the PC board and marked as "test points". They may be used as one thinks fit. They can be useful to check the circuit operation on a CRO, or they may be used to drive another output circuit for a second movement.

Another test point is provided from the 74LS73 inputs, via a 2.2k resistor. This is very useful in setting the time accurately against an outside reference.

Two switches are provided for setting up and adjustment. A single pole toggle switch in the +5V rail is used to start and stop the movement as required. A momentary "on" push-button switch interrupts the 1kHz input so that the movement can be set close to the correct time. More about that a little later on.

Four connections must be made between the PC board and the clock movement. These include the connections for the two ends of the stepping motor coil, and one from the +5V supply via a 390 ohm resistor to that point in the clock which is designated as the positive terminal for the battery. The fourth connection is from the negative rail, via a 1uF capacitor to the negative battery terminal of the clock.

So far, we have only made passing mention of the quartz clock movement itself. Selecting a suitable one can be a bit tricky and to some extent the reader must be left to his or her own devices. However, some comments to follow should help to come up with a satisfactory result.

There are many different makes of movements used in "kitchen" and other similar types. Many of these movements would be suitable for our purpose, the problems being mainly of a mechanical nature.

With most of these movements, if not all, the movement proper is housed in a small plastic case. The first challenge is to remove the cover to gain access to the "works". Some covers are quite easy to remove while others offer quite a bit of resistance. Having got the cover off, the next question is one of gaining access to the stepping motor coil terminals. On some models, the appropriate soldered joints are easy to get at. On the other hand, if this is not the case, then more than likely easy access may be made to pins 3 and 5 of the 8-pin DIL IC. These points go to the coil.

To help readers make a choice, here are some suggestions based on my own experience. I purchased a quartz kitchen clock from one of the Target Supermarket stores, bearing the brand "Equity" and costing about $15.00. This is a very easy one to work on. The coil terminations are also easy to get at.

A second unit which I decided to investigate is one which comes as a movement only, along with a set of hands. This unit is also easy to get at as far as the outer cover is concerned, but the coil terminals are not so easy to get at. At the same time, provided one is careful with the working parts, (wheels, etc.) no trouble should be experienced. To get at the coil terminations, the whole unit has to be removed from its case and turned upside down. Having soldered suitable fine insulated wires to the terminations, the whole unit must then be reassembled.

This latter unit is available from a number of electronics supply outlets, such as Altronics, David Reid Electronics, Jaycar Electronics, Geoff Wood Electronics, etc. This movement is the one which we have shown in the photograph(s).

If you elect to use the separate movement, then you will need a dial and a set of hands. A set of hands comes with the unit and after having been shortened to suit, these are the ones used on the prototype. The dial which we used, is one which was featured many years ago in an Electronics Australia article. It is suitable for any 12 hour clock but it is also calibrated so that 24 hour time may be read off quite readily. This dial may be obtained from Geoff Wood Electronics and possibly others.

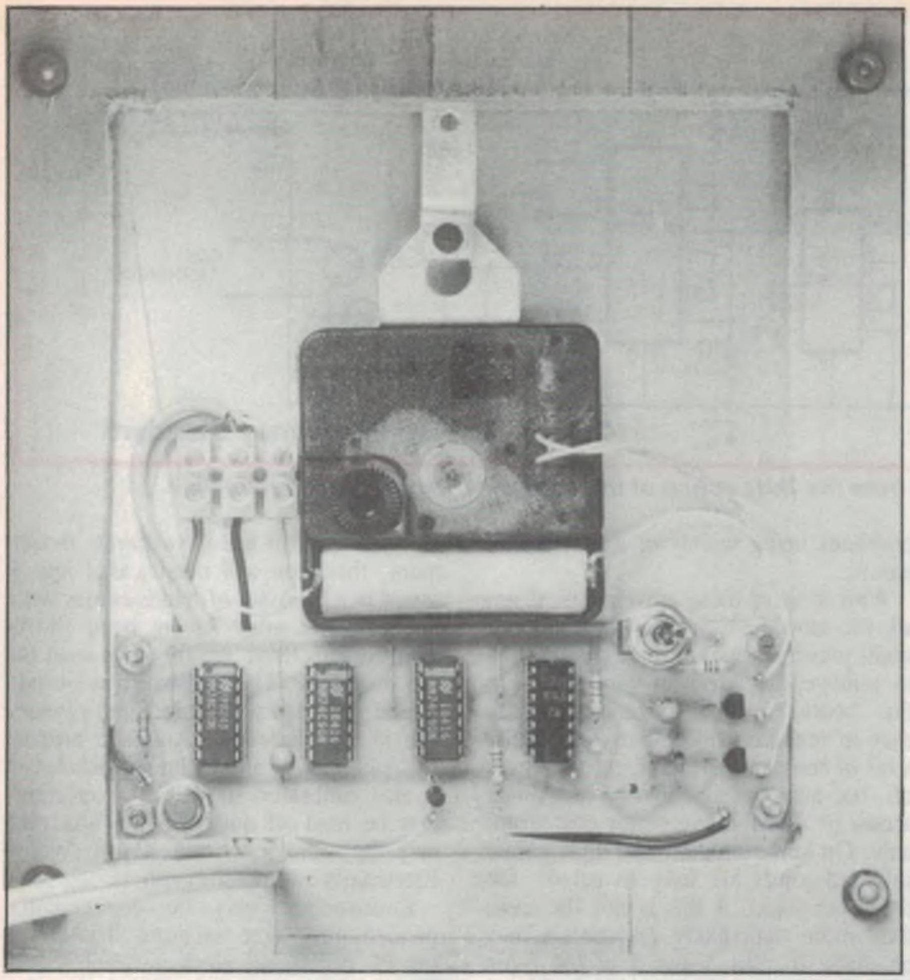
Construction may be conveniently divided into three sections. These are the PC board, the clock movement and the necessary simple additions to the Omega Derived Frequency Standard. Let us begin with the PC board.

Before starting the actual assembly of the board, more than likely you will need to enlarge the holes on the board for the two switches. Having done this, it is a good idea to start with the small items first. Start with the four links, followed by diodes, resistors and capacitors.

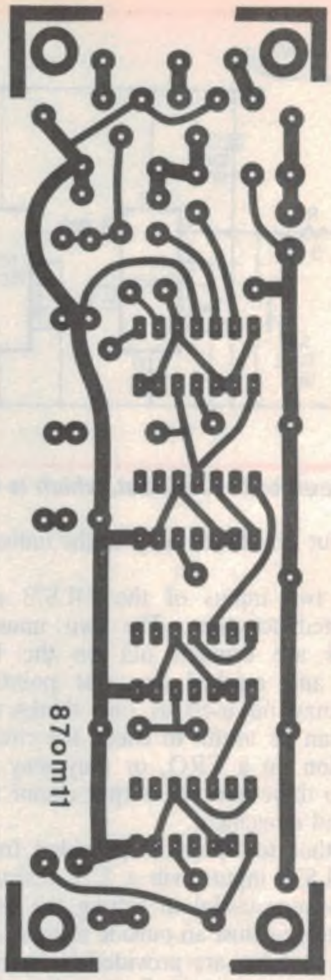
There are ten pins on the board for test points and external connections. These should be added, along with the transistors. Adding the ICs and the two switches completes the PC board.

We used sockets for the ICs, but these may be regarded as optional. Be sure to install all semiconductors and polarised capacitors with the correct polarity. Once all parts have been mounted, go back over the board and check for possible errors. In particular, check component type and polarity and check the underside of the board for solder bridges, etc.

Now for the connections to be made to the clock movement. While there is not a lot to do here, it should be stressed that the job must be approached with a certain amount of care.



Inside the readout, showing the modified quartz clock movement and the small driver PCB.



The etching pattern for the driver PCB, reproduced actual size.

It would be quite easy to lose a vital wheel or damage some part — which could lead to extra expense!

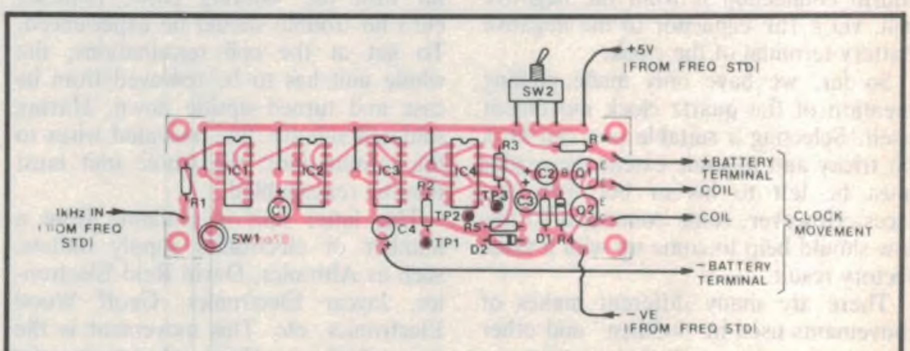
Remove the wheel at the back used for setting the hands — it should pull straight off. Carefully inspect how the cover is fixed before attempting to remove it. Some have one or more screws, in addition to the usual moulded clips. The one used on the prototype has no screws and the cover may be removed quite easily.

Having removed the cover, take a good look at the wheels, etc., so that you will know where to put them back! The purpose of this exercise, is to gain access to the two ends of the coil. With the one used on the prototype, these connections are not readily accessible. You will need to remove the wheels and very carefully lift the rest of the assembly and turn it over.

Using a soldering iron with a fine tip, solder a length of fine insulated hookup wire to each point of the coil terminations. Having done this, the assembly may now be restored. The next question is how the new leads are to be got to the outside of the assembly. In other words, if there is a slot or opening in the back cover, then this may be used to thread the leads through. Naturally this must be done without fouling any of the works.

If no such means of egress exists, then a hole or holes must be drilled in the cover at some convenient position. In the case of the prototype, there are four small holes in the moulding which were originally provided for a start-stop switch, which is not fitted to this unit. I used a small drill to open up two of the holes so that a lead could be brought through each, and this worked out very well.

The other two connections are simply to each of the terminals normally used for a battery. The actual type of metal used for these contacts will determine their solderability. Some may be soldered quite readily, but others, no. The prototype comes under the latter category.



The overlay diagram. Use it as a guide to assembly.

The problem was solved by making up a "dummy" battery out of a piece of wooden dowel. I wrapped the dowel with a short piece of masking tape to improve the appearance. The two leads destined for the battery terminals had a solder lug soldered to each one. It was then an easy operation to insert the dowel and at the same time, put each solder lug in place so that it was clamped in position.

The question of where to locate the PC board is largely a matter of individual preference. After having fixed the clock movement to the dial with the centre fixing nut, I mounted the PC board on the back of the dial and below the clock movement. I used four countersunk head, 1/8in Whitworth screws for fixing. The heads of the screws I actually glued to the back of the dial with rubber cement. This worked out quite well. The whole unit I mounted in a simple box covered with a plastic laminate. All this may be seen in the picture.

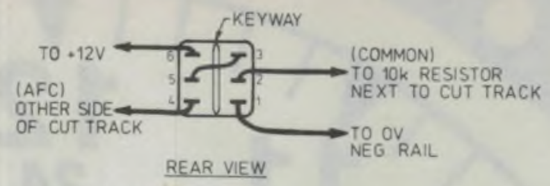
Before we can put the clock into operation, there are some modifications and additions to be made to the Omega Derived Frequency Standard. We need to take the +5V supply and negative rail from the unit to supply the clock PC board. Also, the 1kHz signal from the unit is needed to drive the external clock dividers.

With the two switches provided on the clock PC board, it is possible to set the time to within about 20 milliseconds. If this is accurate enough for your purpose, then the next modification will not be needed.

For those readers who wish to set the clock to as close as one or two milliseconds, then it will be necessary to cut that track on the PC board which conveys the control voltage to the crystal oscillator and add a 3-position toggle switch.

I brought out the 5V supply and the 1kHz signal via a 5-way DIN socket and plug. I used the centre pin for the common and the two outer pins were used for the +5V and the 1kHz signal.

On the back panel, I punched out a 5/8inch diameter hole, between the centre line of the panel and the power transformer. With the socket fitted, the 1kHz signal and negative rail connection may be picked up at the appropriate output socket on the front panel. Run a piece of shielded audio cable and terminate it on the DIN socket. The +5V supply may be picked up from the 0.1uF capacitor near pin 7 of IC11. The DIN plug must be wired to suit the terminations at the socket. I used a length



Wiring of the switch which must be added to the frequency standard to allow setting the clock accurately.

of shielded stereo cable from the plug to the clock PC board.

In order to set the clock accurately, we must be able to override the AFC signal to the crystal oscillator. A 3-way toggle switch is fitted on the back panel, between the centre and the antenna socket. Cut the copper track at the end of the 10k resistor nearest to pin 1 of IC12. The end of the 10k resistor goes to the common point on the switch, and the point on the other side of the cut goes to the switch contact corresponding with the centre position of the switch.

Of the remaining two connections on the toggle switch, one is taken to the negative rail, which may be picked up at the antenna socket; the other is taken to the +12V supply and this may be picked up at pin 16 of IC12. These switch connections are shown in the diagram.

With the switch in the centre position, the crystal frequency is under the control of the AFC voltage. With the switch to the negative rail or 0V, the crystal oscillator will run slow and with the switch to the +12V, the oscillator will run fast.

Having satisfied yourself that all is well, we are now in a position to put the clock into operation. At this point is is most important to bear in mind that the hands of the clock should NOT be pushed around with the fingers but always the hands must be adjusted with the knurled wheel at the back of the movement. Failure to observe this could result in the gear wheels being stripped.

With the Omega Derived Frequency Standard already running and with the toggle switch on the PC board set to the "off" position, plug the DIN plug into its socket. Now turn on the toggle switch. The clock should start. Observe the operation of the second hand. The action should be reasonably vigorous but not too much so. In other words, it should be similar to the normal operation if the movement were being operated from a battery as originally intended. If the action is too weak or too vigorous, then the 390 ohm resistor should be varied accordingly. I found the 390 ohms to be right for both movements which I have used.

Assuming that all is well, let the second hand run until it reaches zero and turn off the switch. Against a time signal, say VNG, just a second or two prior to the long pip, switch on. The clock should start and be running a second or so fast.

Now comes the rather delicate part needed to set the time more closely. While listening on the seconds pulses, quickly operate the push-button switch on the PC board. This stops the clock

Parts list

1 PCB, code87/om/11, 125 x 38mm
1 Quartz clock movement (see text)
1 clock dial
1 SPDT miniature toggle switch
1 3-way miniature toggle switch (C & K type 7211)
1 push-button switch (normally open)
1 5-pin DIN socket
1 5-pin DIN plug
4 14-pin IC sockets
1 3-way terminal block
10 PCB pins
2 solder lugs

Semiconductors

3 74C90 decade counters
1 74LS73 dual J-K flip flop
2 BC548 transistors
2 1N4148, 1N914 diodes

Capacitors

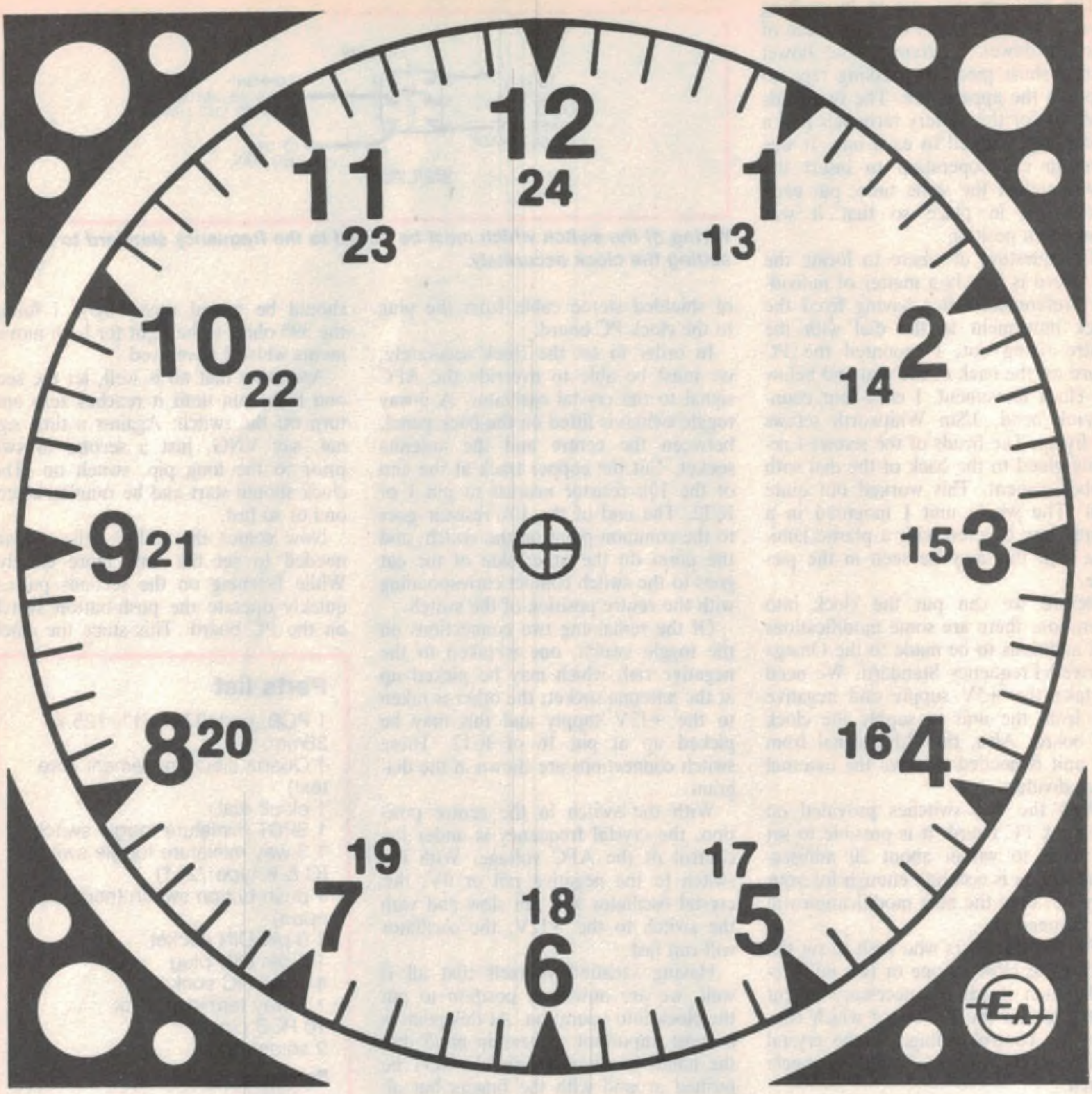
3 10uF 10VW tantalum or aluminium electrolytics
1 1uF 10VW tantalum

Resistors (5%, 0.25W)

1 390Ω
2 2.2k
1 3.3k

Miscellaneous

Hookup wire, single shielded cable, stereo shielded cable, tinned copper wire, screws, nuts, solder.



A full-size reproduction of the clock dial. This can be used to make a Scotchcal dial identical with the author's.

while the switch is operated. Keep pressing until the clock second hand and the appropriate seconds pulse appear to coincide.

If you wish to set the time closer than this, then you will need a dual trace CRO. Feed the seconds pulses from the test point into channel 1 of the CRO and synchronise the trace to it, remembering that we are interested in the NEGATIVE-GOING edge of the pulse. Feed the time signal into channel 2 of the CRO. Set the CRO timebase to say 10 or 20ms per division.

If the clock is still a little fast, the whole of the time signal will appear on the screen. If this is not so, it is better to reset the clock so that this condition exists. The time difference is measured along the timebase from the beginning of the trace on the left of the screen, to the start of the time signal. Your clock is fast by that amount. Having set the time to about 20ms or so fast, do not attempt to bring it any closer with the push-button.

We can now ADVANCE or RETARD the clock by operating the switch on the back of the main unit. In this case, we wish to retard the clock and so we set the switch so that 0V is fed to the crystal oscillator. It will take several minutes or so, depending on how much adjustment is needed. In the meantime, watch the display on the CRO. When the time signal just reaches the left hand end of the trace, switch back to the AFC position.

Your clock is now set very close to the right time. If you wish to get it any closer, then you must take into account the transmission delay of the time signal being used. And that is another story!

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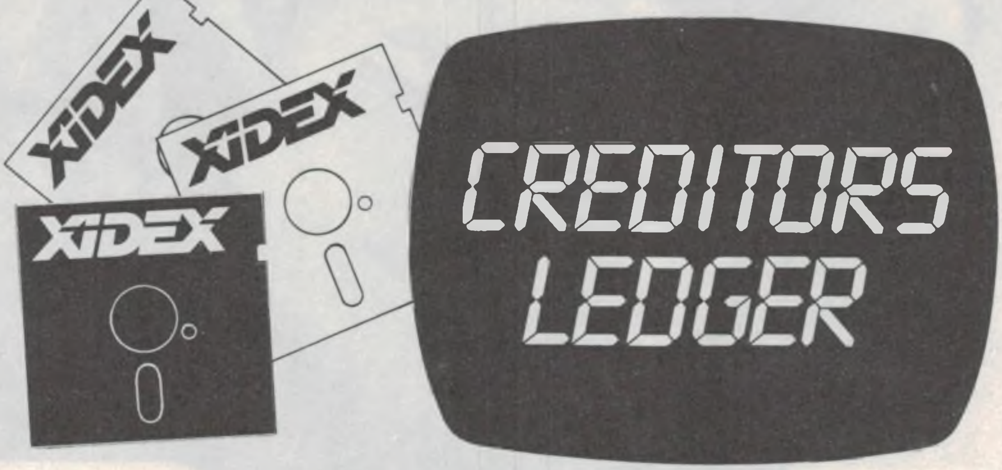

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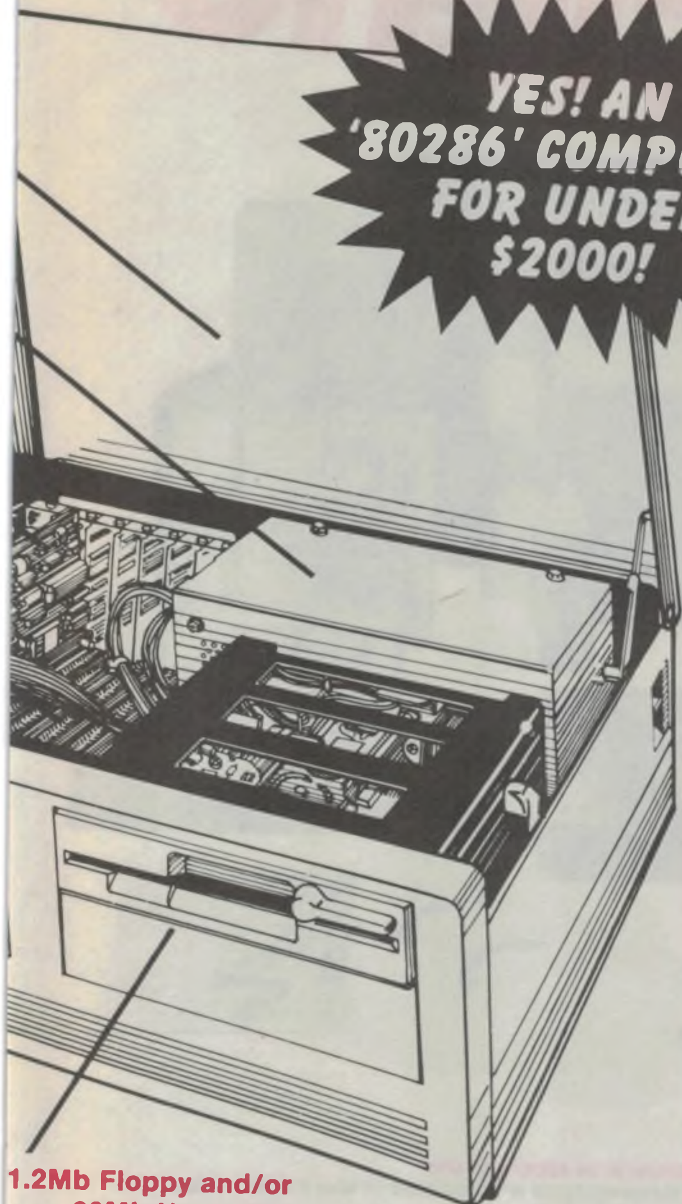

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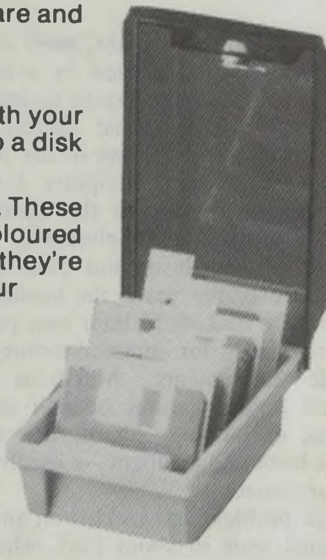

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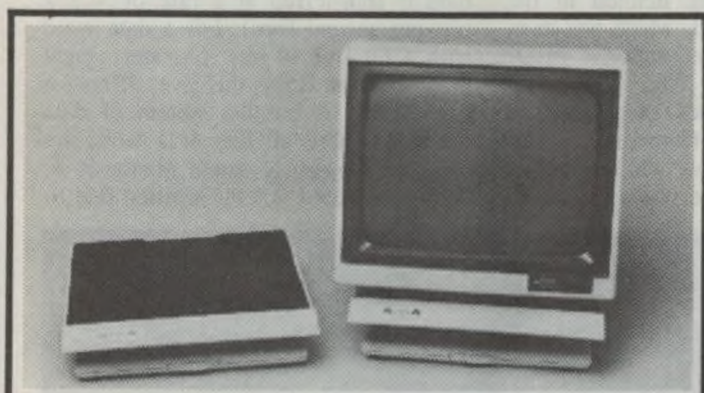

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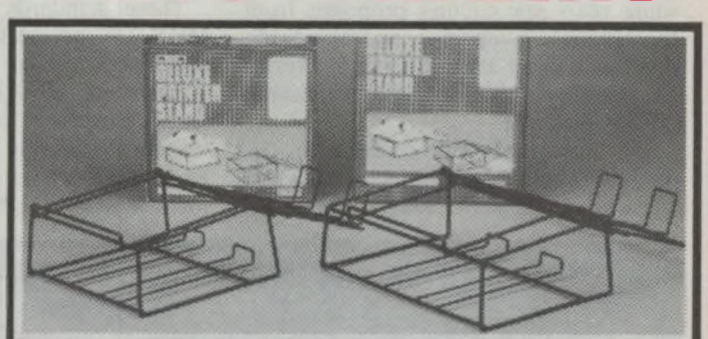

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Inside MIDI

There's been a quiet revolution in the use and manufacture of electronic musical instruments, and it's all due to a new communications standard that appears as a few innocent sockets on the rear panel.

by ROB EVANS

At some time or other, most readers will have been frustrated by a lack of standardization when trying to interface two devices. From that special thick toasting bread not fitting in the pop-up toaster, to a new computer terminal that refuses to talk to the mainframe system; incompatibility abounds.

The music industry has been no exception over the years, the manufacturers rigidly sticking to their own particular standards for interconnecting electronic instruments. Musicians were forced to use various oddball adaptor boxes, or purchase all of their equipment from one company — hardly satisfactory solutions.

This problem was tackled on an international scale in about 1981, when the U.S. firm Sequential Circuits Incorporated proposed a universal communication standard for synthesizers. The ensuing years saw counter proposals from the Japanese companies, and worldwide discussion in an attempt to find a versatile standard, that would not become quickly obsolete.

The result of this remarkable co-operation between manufacturers is the Musical Instrument Digital Interface standard, or as it is more commonly known; MIDI. More remarkable still, is the thorough manner in which this system has been implemented into the current generation of electronic musical instruments. From home organs to home computers, MIDI can be found in virtually any microprocessor based equipment designed to be associated with music.

What is MIDI?

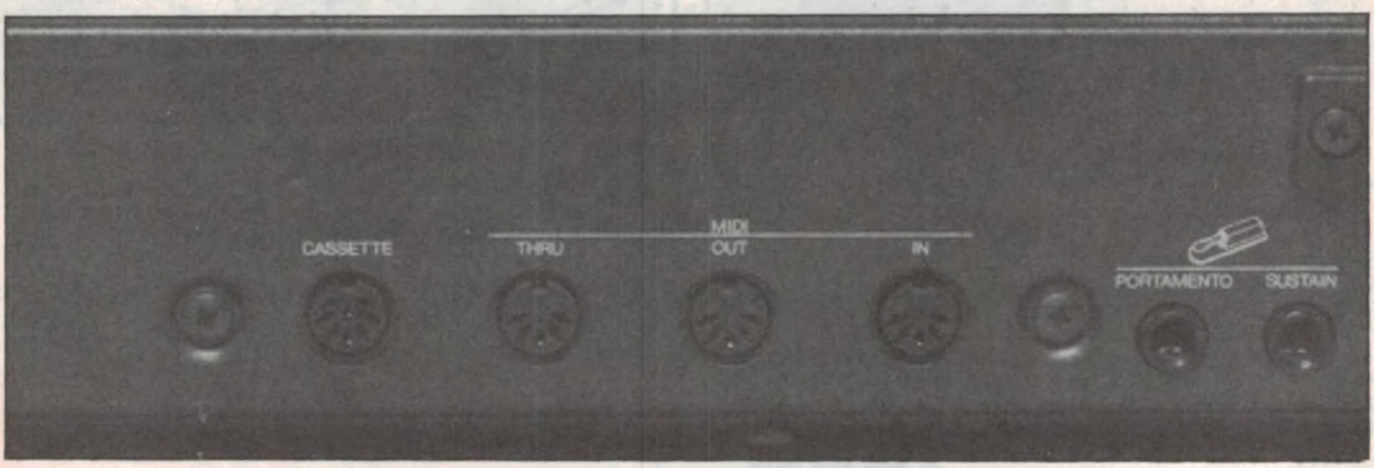
MIDI is basically a communications link. This is probably the understatement of the year, considering the effect it has had on the music industry. But leaving the musical implications aside for the moment, MIDI can be seen simply as the hardware and software standards that are used for communication between computer-based musical instruments.

These standards are defined in the MIDI 1.0 specification, which has been developed by the International MIDI Association (IMA). This publication lists the various codes that apply to standard musical performance events (e.g.,"note on"), and the electronic manner in which these codes are transferred.

Basically, MIDI is an *asynchronous* serial data link, not unlike the RS232 standard that may be familiar to many readers (see EA Reference Notebook; October 1987 issue). Each digital bit of the information code is sent one after the other, as a data "stream" along a single circuit. These bits are arranged in groups of eight to form the code word, and are preceded by a "start" bit and followed by a "stop" bit or rest period (see Fig.1).

The start and stop bits of the MIDI format are necessary due to the asynchronous, or intermittent nature of the data. A start bit (always a space or low logic level) announces the arrival of a code word, triggering the receiver timing circuits. Whereas the stop bit (always a mark or high logic level) allows the receiving circuitry to ready itself for the next code word. This next word could arrive at any time depending on the density of the transmitted data, or in the practical sense, the intensity of the musical information. Indeed, a couple of "stabbed" chords and manipulation of the pitch bend facility on a synthesizer will cause quite a flurry of activity on the MIDI bus.

To reduce timing delays between master and slave instruments, MIDI data is transferred at a rate of 31.25k bits per second (bps). For a data word with a total of 10 bits (one start, eight data, and one stop), this gives 320us for each word. A parallel system of data transfer, where all bits of a word are sent simultaneously would obviously be faster, but could not be justified due to



Typical rear panel of a MIDI equipped synthesizer, showing the MIDI connectors.

the expense and complexity of a multi-wire system. In the chaotic pre-MIDI days, the Roland Corporation had the 14-pin DCB (Digital Communication Bus) standard fitted to their instruments. Although this system worked well, the rapid acceptance of MIDI finished its career in one quick blow!

MIDI hardware

MIDI devices are connected together via a shielded two wire system, terminated in 180 degree, 5-pin DIN type connectors. The receiver circuitry is floating ("ground" not connected), and isolated by a high speed opto-isolator (see Fig.2). This technique ensures the safety of the receiver electronics, and removes the possibility of earth loop hum and other interference being induced in the system.

When a MIDI "out" is connected to a MIDI "in", a 5mA current loop is established if a low logic level is present; conversely, no current flows during a rest period (high logic level). This arrangement is opposite to normal current loop practice where current flows during a logical high, providing line failure indication. The MIDI system is only "active" (current flowing) during a transmitted message, each instrument being unaware of the other during rest periods. This enables re-patching of the system without the havoc created by breaking a current loop.

The MIDI 1.0 document also specifies a MIDI "thru" facility, which delivers an exact replica of the signal received at the MIDI "in" connection. Although optional, this facility is almost always included to allow the user to "daisy chain" a number of instruments in series.

MIDI data codes

The actual codes transmitted in the MIDI system generally have a multi-byte format, due to the large range of the transmitted variables. The first byte is termed the *Status byte*, and defines the type of message being sent. This will tell the receiver software how to deal with the following bytes, which are called (you guessed it!) the *Data* bytes. As further identification, the Status bytes have the most significant bit (MSB) set to 1, whereas the Data bytes have the MSB set to 0.

MIDI messages may be configured to apply to a specific instrument of a multiple system, by means of the MIDI Channel number. This number is inherent in the Status byte as the last four bits, with a range of 1 to 16. These types of transmissions are loosely called

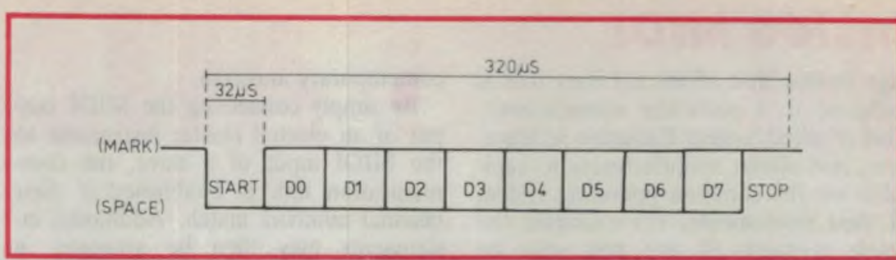


Fig.1: The MIDI data word format. MIDI data is transmitted at 31.25 kilobits per second.

Channel messages, while general information transmitted for all channels are designated *System* messages.

A common example of a MIDI Channel message is the simple transfer of note information. When one MIDI keyboard instrument is driving another, depressing a note key on the master keyboard will induce the appropriate sound from the slave. The 3-byte message sent in this situation is configured as follows:

1001nnnn 0kkkkkkk 0vvvvvvv

Where: 1001 is the code for "note on". : nnnn is the MIDI channel number (range:0-15 for channels 1-16). : kkkkkkk is the note (range:0-127). : vvvvvvv is the key velocity (range:0-127).

In a synthesizer, the key velocity code is derived from the time taken for the key to be depressed its full distance. With logarithmic scaling, this time is roughly proportional to how hard the key has been played. Therefore the key velocity data may be used to control the resulting note volume, providing player dynamics. The code range is 1-127, defaulting to 64 for instruments without this facility. Code 0 indicates "note off" (see MIDI code table).

If a Middle C note (code 60) was depressed with a moderate velocity (say, code 64), and the instrument programmed to send on MIDI channel 5 (code 4), the resulting MIDI message would be:

10010100 0011100 01000000

An example of a System message is the MIDI Clock code, which is sent by a master sequencer (or computer) to synchronize a time related slave device, such as another sequencer or drum machine. This message is sent regularly at a rate of 24 clocks per quarter note, and is not MIDI channel specific. Of course, a clock has no relevance to a standard synthesizer, and will be ignored. As stipulated by the MIDI standard, the one-byte clock transmission will appear as: 11111000.

Although the MIDI 1.0 document is an absolute specification, it has a mes-

SUMMARY OF MIDI STATUS BYTES

Status D7 . . . D0	No. of Data Bytes	Description
Channel Voice Messages		
1000nnnn	2	Note off any event
1001nnnn	2	Note on any event (velocity 0=note off)
1010nnnn	2	Polyphonic key pressure/after touch
1011nnnn	2	Control change
1100nnnn	1	Program change
1100nnnn	1	Channel pressure/after touch
1110nnnn	2	Pitch wheel change
Channel Mode Messages		
1011nnnn	2	Selects channel mode
System Messages		
11110000	****	System Exclusive
11110sss	0 to 2	System Common
11111ttt	2	System Real Time

Notes

nnnn: channel code = channel number –1
e.g., 0000 is channel 1, 0001 is channel 2, e.t.c.,
*****: any number of bytes, followed by End of System Exclusive flag (11110111).*
sss: 1 to 7
ttt: 0 to 7

sage format that allows for data that is exclusive to a particular manufacturer. This is called System Exclusive information, and allows manufacturers to capitalise on the common operating system of their instruments. For example, the entire memory of one unit may be transferred to another in a couple of seconds (MIDI memory dump). This information could not be interpreted by an instrument from another company, and therefore has a two-byte "preamble" containing the manufacturers identification number. The actual data may be of any length, but must be followed by a one-byte System Exclusive End code. This system removes any temptation for manufacturers to compromise MIDI compatibility by the use of non-standard codes.

The above examples show only a few of the many messages available; the MIDI specification has suitable codes for virtually any music related event. A full listing and discussion of these MIDI messages is available in the MIDI 1.0 document, although a summary of Status bytes appears on page 123.

MIDI applications

Electronics has infiltrated most aspects of life, and musical instruments are no exception. A standard system that enables these common devices to communicate opens new doors for the contemporary musician.

By simply connecting the MIDI output of an elected master instrument to the MIDI input of a slave, the communication link is established if their channel numbers match. Additional instruments may then be arranged in "daisy chain" fashion by connecting a slave instrument's "thru" output to the following slave's "in" socket (see Fig.3). This basic configuration enables a musician to easily create unique sound textures and huge "walls of sound", without leaving the comfortable piano stool!

In fact, the whole MIDI protocol is very "user-friendly", requiring few programming steps to establish a large MIDI network. This is because a slave instrument simply accepts and processes data as it appears at the MIDI "in" port, even if its keyboard is being played at the same time. In effect, a MIDI equipped synthesizer reacts to MIDI messages as if they had originated from its own control panel or keyboard.

Similarly, the MIDI "out" socket is always active, sending messages as the keyboard and controls are used.

Synthesizers are now becoming available in a "keyboardless" form, virtually identical to the version with a keyboard, but produced in a rack mount cabinet. These units are called Expander Modules, and are more cost and space efficient. To upgrade a system, the user simply connects the expander module to the master keyboard via a MIDI link, remotely controlling all performance aspects.

Currently available modules often have multi-timbral capabilities, which is ideal for sequencing applications (see Glossary). An example of this is an eight-voice polyphonic instrument (eight separate sound generators), where each voice may be assigned to a different sound and MIDI channel. The sequencer is then able to control eight independent, monophonic sound sources from the one unit, via eight MIDI channels.

A typical example of a complete MIDI system is shown in Fig.4, although many other configurations are possible. It consists of a master keyboard, a number of expander modules, a drum machine, and a sequencer.

In such an arrangement the sequencer is the centre of activity, recording MIDI messages sent from the master keyboard, and playing them back to the entire system. As the messages for each section of a composition are recorded into the sequencer, a MIDI channel may be nominated, which will then be inherent in this information (see MIDI codes). When played back, the slave modules will "look" for messages corresponding to their set channel, therefore responding to different sections of the composition.

The sequencer will also transmit regular MIDI clock codes in sympathy with its internal tempo clock. This informa-

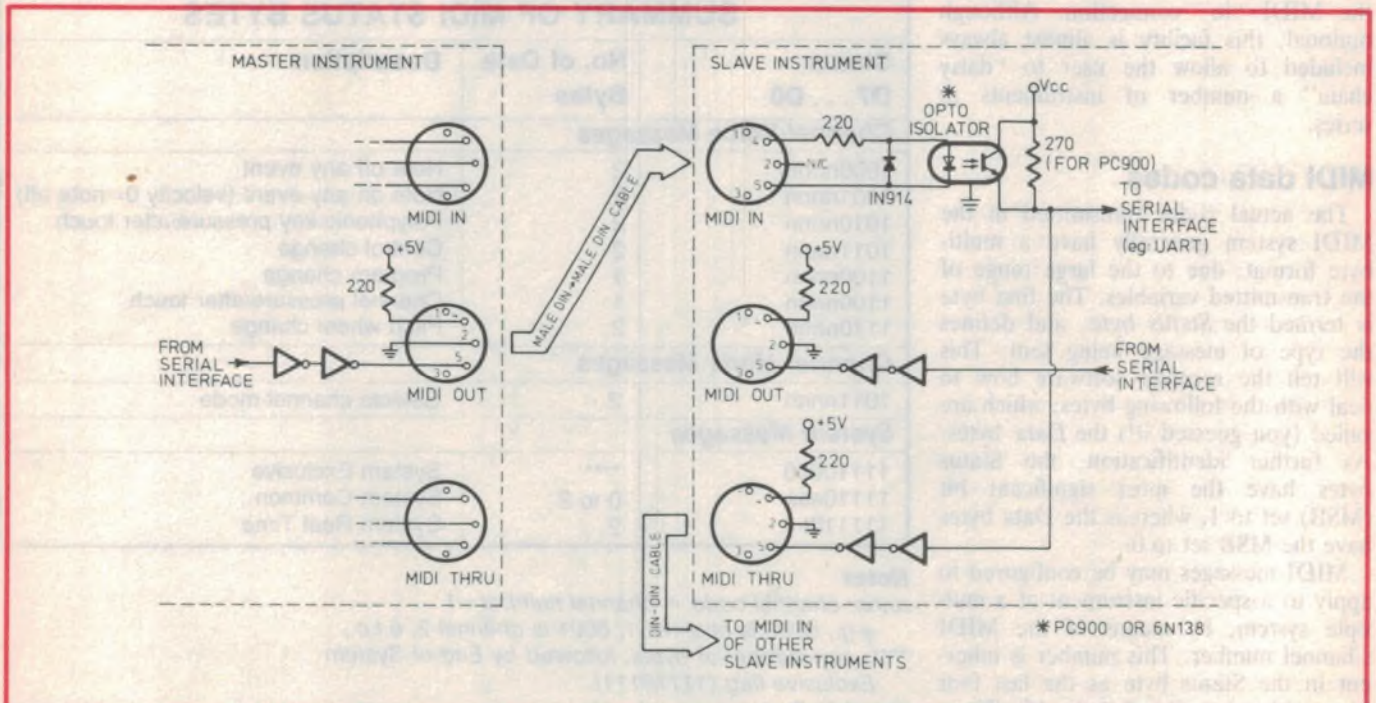


Fig.2: Standard MIDI interfacing circuitry. Data is transferred via a 5mA current loop.

tion is interleaved with all other messages, and interpreted by the drum machine as its tempo clock, synchronising the whole system.

Such a system is quite powerful, although still rather primitive when compared to the facilities of some contemporary recording studios. The studio MIDI system may reach as far as the ubiquitous mixing console, where channels and outputs are programmed to mute under the control of the master sequencer.

Even recently produced signal processing equipment, such as delay and reverb units carry substantial MIDI facilities. By interfacing them in a MIDI system, many of the parameters may be altered on call, or as part of a sequence. The proverbial one man (or woman) band takes on a new meaning with the MIDI protocol!

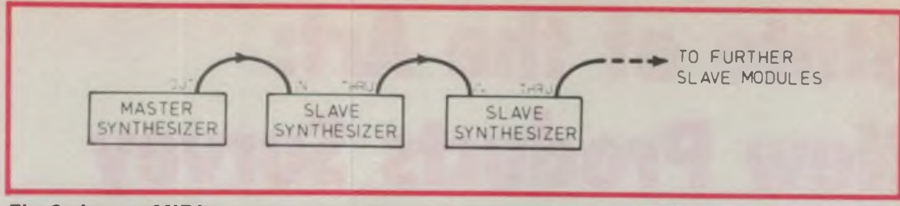


Fig.3: Large MIDI systems may be implemented by simply "daisy chaining" a number of instruments in series.

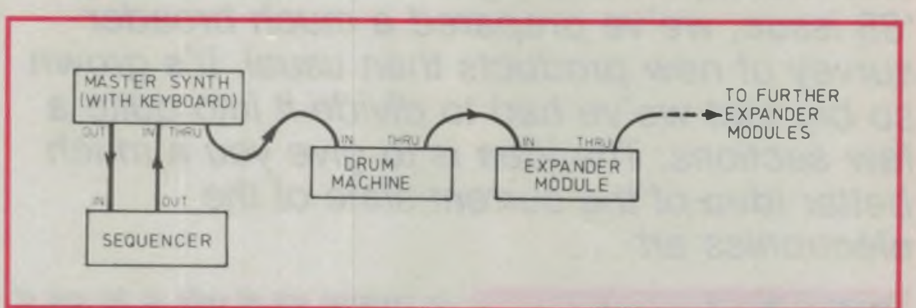


Fig.4: An example of a complete MIDI system capable of programming and playing entire musical compositions.

Computers and MIDI

Without computers there is no MIDI, for every device that communicates via this system is microprocessor based. The common Personal Computer is obviously in this category, and therefore should be able to exchange information with MIDI instruments. This fact has been exploited by a number of small companies, who are now producing MIDI conversion kits and appropriate software for some popular computers. Amongst others, software is available in Australia for the Commodore 64, the Apple II, Apple Macintosh, and IBM PC or compatibles.

A home computer coupled to a MIDI interface can be a powerful music composition tool and sequencer. Music may be composed, displayed, edited, played and printed with one composite software package on a common PC. In fact, the implemented software will generally set the limits of its performance. Conversely, a manufacturer's dedicated sequencer is often more user-friendly and reliable, particularly when compared to a home developed interface and software package (this is based on personal experience!).

Designing MIDI interface hardware is assisted by the slightly odd MIDI baud rate of 31.25kbps. This rate is based on an even division of common computer clock rates (1MHz divided by 32, 2MHz divided by 64, and so on). This enables the processor clock to be divided easily by the internal dividers of a serial interface chip (e.g., Motorola 6850 ACIA). Some computers already have a suitable serial port, and with the appropriate clock division, are capable of transmitting MIDI information directly.

The future

As early as 1984, some manufacturers were critical of perceivable delays encountered when transferring MIDI note data. These delays creep into the proceedings when a large number of notes are sent to a number of instruments, along the same line. At 320us per word and 3 words per MIDI note message, it takes about 1ms to transfer a single note. If the master instrument is sending different 5-note chords to each slave instrument (not an unusual situation), we already have about a 15ms delay. This time can easily increase if continuous multi-byte information, such as Pitch Bend messages are sent simultaneously. Although these delays are not a problem for a real-time performance (that is, a human performer actually *playing* the master keyboard!), large sequencer-based systems can be affected.

In extreme cases of high information density, the data crowding reaches the extent of effectively "saturating" the MIDI bus. Not surprisingly, the whole system grinds to a halt. Some of the more expensive sequencers solve this problem by providing a separate serial interface and MIDI out socket, for different MIDI channels. This means that each output socket will transmit MIDI information for only one channel, and is connected to only one slave instrument.

The IMA people may have envisaged these problems when developing the MIDI 1.0 specification, for it states that successive messages of the same type may be sent without a Status byte. If notes are turned off by sending a note-on command of zero velocity, then the note-on Status need only be sent at the beginning of a note data stream. What was 3 bytes for note-on and 3 bytes for note-off, becomes 2 bytes for each. Not much difference you might say, but it could eliminate the proverbial straw!

In general use, these crowding and delay problems rarely appear and MIDI has an ensured future. A whole industry has emerged to supply contemporary musicians with MIDI software, interfaces, and general MIDI manipulation equipment.

The MIDI explosion has even prompted the development of new musical instruments, such as MIDI transmitting devices based on percussion, wind, and stringed instruments. From the performance aspect, a musician no longer has to hide behind a bank of instruments (although he may want to!). All that is required to run a large number of MIDI equipped instruments is one versatile MIDI control device. EA

GLOSSARY

SYNTHESIZER: Electronic musical instrument capable of synthesizing naturally occurring sounds, or constructing unique timbres.

SEQUENCER: Machine with a memory system able to record, edit, and playback the electronic codes for musical time related events (notes etc.).

DRUM MACHINE: A dedicated sequencer arranged to control internally generated drum or percussion sounds.

State of the Art: New Products Survey

This month, in keeping with our special Digest '88 issue, we've prepared a much broader survey of new products than usual. It's grown so big that we've had to divide it into quite a few sections. The idea is to give you a much better idea of the current state of the electronics art . . .

Office Equipment & Computers

Low cost video phone

The space age video phone has at long last become a reality at affordable prices, thanks to Hong Kong's Bondwell International.

The Bondwell instant image phone took nine months to develop and has received favourable attention throughout the world since sample production began in mid 1987. Currently Bondwell is seeking FCC and PTT approval before embarking on more extensive marketing exercises.

The video phone consists of an expanded telephone keyboard with a small video screen and a video camera. The telephone itself is like any other standard telephone and is connected to the normal telephone network, except that it can also exchange images when linked with a computer or another instant image telephone.

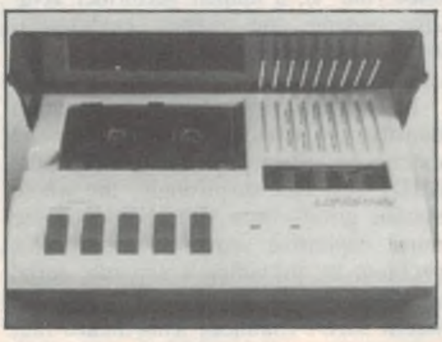
A password check has been incorporated into the system which can be used to turn the camera on remotely for an instant check, to see whether the people or premises are all right at the end of the telephone line.

For further information contact the Hong Kong Trade Development Council, 71 York Street, Sydney 2000.

Advanced answering machine

A Hong Kong manufacturer has announced a new telephone answering machine, the compact model 1100 from ANS-MATE (Golden Source Electronics), which uses a voice chip, to do away with the cassette normally providing the out-going message. The new design is a sleek, one-cassette version with an expanded message capacity.

The built-in voice chip records a personalised outgoing message which can be as long as 16 seconds, to give full instructions to the caller on how to leave a message. The outgoing message can be played back and checked at the touch of a button.



Incoming messages are recorded on a single standard cassette, which is voice-activated, instead of having a fixed duration for incoming calls, saving on tape length and allowing an increased message capacity.

The machine can also be used to monitor incoming calls and screen out those that should best be avoided or postponed.

Other features include an LED Call indicator, and tone verification which notifies the user of the beginning of a message, the end of a message, and end of all the messages received.

Looking ahead, Golden Source Electronics is also developing an answering machine that is free of all cassettes. The Deckless Telephone Answering Machine will make full use of microprocessors and integrated circuits to substitute for the space consuming cassette deck.

For further information contact the Hong Kong Trade Development Council, 71 York Street, Sydney 2000.

Telex-datacomm terminal

Sydney based communications house Offcom has released an enhanced version of its TOSBox, which can manage and transmit messages by both Telex and direct dial-up lines. Further enhancements have been made to the system's software which converts it into a message management system.

The portable PC style unit can be connected to both telex and telephone lines simultaneously, and interconnected with a wide range of host computer systems, and/or to a PC based local area network.

Files written anywhere in the network, including on the TOSBox keyboard, itself can be sent to the TOSBox and automatically queued according to priority for despatch by either telex or telephone.

Depending on the traffic of the user, the TOSBox can be manually operated or run automatically in background mode, collecting and despatching messages from organisation "mail boxes" and answering and printing out incoming messages.

The TOSBox is also a fully operational PC/XT compatible computer and can be used for PC applications while the Telecommunications function continues in background mode.

For further information contact Offcom, 28 Chandos Street, St. Leonards 2065.

High speed fax

Priced in the middle of the range, the Toshiba 6330 facsimile machine can memorise 99 fax numbers, including ten one digit memories, with world-wide compatibility. It has a high speed operation and can increase transmission speeds when "talking" to other Toshiba units, making savings on international interstate calls.

In addition the delayed unattended transmission facility means messages can be sent at off-peak rates. Thirty sheets of outgoing information can be stacked and sent automatically to a number of destinations by pre-timed transmission.

The 6330 has an easy push button operation, supported by a LCD display which prompts the operator ensuring error free operation. The sending/-receiving logs record nine details and a self-diagnosis display isolates any malfunctions.

The 6330 has OMR (optical mark reading) dialling, which means an OMR sheet can be prepared with start instruction, abbreviated number, group mode, resolution required and number of pages. This OMR sheet then activates any function on the fax without supervision.

Further details from Toshiba Australia, 84-92 Talavera Road, North Ryde 2113.

Apple/IBM compatible PC

The new Logo TrackStar computer runs all software written for both the IBM PC and the Apple II — something in the order of 30,000 software packages worldwide.

The Trackstar runs the massive library of software written for the Apple II series, including the II, II plus, IIc and IIe family. On the IBM side, the TrackStar is fully compatible with the massive range of IBM PC software, including wordprocessors, databases, spreadsheets and publishing programs.

The machine should find particular application in scientific and educational institutions, where both types of computers have strong followings. The TrackStar can perform double duty here and offers a high degree of "obsolescence proofing" for institutions still keeping their Apple IIs, despite the large range of IBM software they would like to run.

For those who already own an IBM PC, TrackStar upgrades are also available, to allow a PC to run Apple software.

For further information on TrackStar contact Logo Computer Centre, Suite 303, Henry Lawson Business Centre, Birkenhead Point, Drummoyne 2047.

Printer sharer

Advanced Components has released a range of Auto Sharing Devices. The MP, MS Series can automatically share one peripheral with many computers.

An alternative to expensive networking, the MP, MS Series are extremely easy to use as they do not require special software changes, control codes or switch settings for operation. All control and switching logic is totally automatic and handled within the unit.

Print commands are issued just as if the printer is directly connected to the computer.

The Auto Sharing Devices are not restricted to any particular operating system or software, which makes the MP & MS Series well suited to any business or school environment.

For further information contact Advanced Components, PO Box 78, Coldstream 3770.

Pocket modem

Advanced Components has released the HM-3120P Pocket Modem. Measuring 3-7/8" x 2-7/8" x 15/16", the modem is so small that it fits into your pocket and can be directly plugged in the RS-232 serial port.

Despite the small size it is a full Hayes-compatible 1200bps modem and it can be powered by an ordinary "216" type 9V battery. It supports both Bell 103/212A and CCITT V.21/ V.22 protocols for communication at 0-300 and 1200bps using ordinary dial-up phone lines.

The Pocket Modem supports the extended "AT" modem command set, including call progress detection, and is Hayes compatible. As a result, it may be used with dozens of off-the-shelf communications software programs.

The modem auto-dials phone numbers using both tone and pulse dialling methods. A built-in speaker permits phone line monitoring. It also auto-answers a call, and automatically selects the correct matching speed and protocol.

With its miniature size, the Pocket Modem is suitable for use with laptop and handheld computers as well as with desktop personal computers, terminals, minicomputers, and mainframes.

For further information contact Advanced Components, PO Box 78, Coldstream 3770.

High volume fax

Top of Toshiba's fax range is the TF-341/TF-341M, a high-speed fax transceiver with one megabyte of memory and many other features.

Capable of handling a high volume of information, the TF-341 series is really a communications centre. It can store up to 100 destinations (30 one touch, 70 are two-touch) and capable of being simply programmed to send documents to these numbers; and will even re-dial if necessary.

It can handle up to A3 document sizes and reproduces on B4 or A4. It can store up to 60 pages of information and when talking to a compatible Toshiba machine it can transmit this information at a greatly increased transmission rate.

Other features include reduction, multi-polling, a 16-level gray scale system (to enable transmission of photographs) security code for polling, operator call, call back message and remote diagnosis. Additional features are sequential and relayed multi-addressing, and mailbox.

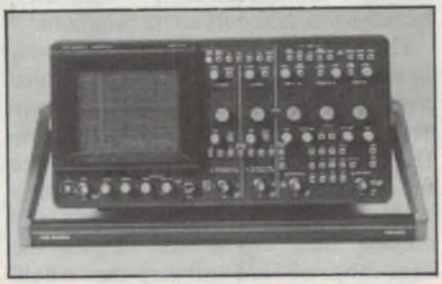
The mailbox feature allows the TF-341M to receive confidential documents and store them in its one megabyte memory until the correct password is entered. The machine notifies the receiver that it has a confidential document for a particular person and only they can access it.

The TF-341 optical mark reading capabilities, which when used in conjunction with the machine's 30-page automatic capacity make it well suited for high-speed volume transmissions.

Further information from Toshiba Australia, 84-92 Talavera Road, North Ryde 2113.

New Products Survey

Test Instruments



Portable 400MHz oscilloscopes

A new series of VHF oscilloscopes from Philips Test & Measurement offers a bandwidth that breaks the 400MHz barrier. With this extended bandwidth, the PM 3295A series has the performance to cover a wide range of measurement requirements on advanced equipment in many different fields. The new range also includes the PM 3285A series models, which have the same performance in an economic 200MHz instrument.

The wide bandwidths are matched by a writing speed of 4 div./ns (2 div./ns for 200MHz models), which reveals fast single-shot signals and low-repetition rate phenomena. The risetimes of only 0.9ns (1.75ns on 200MHz models) ensure detailed display of even the fastest transients for complete and reliable waveform presentation and analysis.

The new instruments are easy to operate, thanks to an Autoset function that automatically sets the amplitude range, timebase speed, trigger functions and screen position for any input signal at the touch of a single button.

Redesigned on-screen alphanumeric indications provide an instant and unambiguous alphanumeric read-out of cursor measurements like amplitude, time, frequency and ratios, as well as scope settings for signal input conditions, amplitude, main/delayed timebases and triggering.

A wide range of inputs can be handled by the sensitivity range of 1 mV/div. — 5V/div., while a choice of 50 ohm or 1M ohm input impedances ensures signal display with maximum freedom from disturbances.

Both 400 and 200MHz models can be supplied with a memory for 75 complete front-panel settings (PM 3296A and PM 3286A, respectively). These settings are stored in non-volatile memory, and can be recalled instantly whenever required using an infra-red remote control unit.

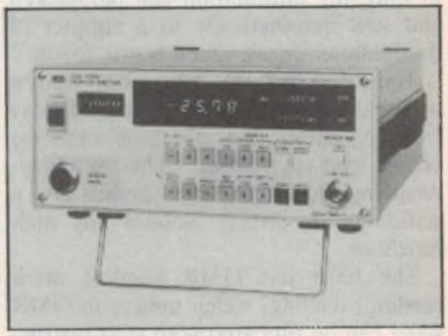
For further information contact Philips Scientific & Industrial, 25-27 Paul Street North, North Ryde 2113.

RF power meter

ACL Special Instruments has released the JRC Model NJL-70W microprocessor based programmable portable RF Power Meter.

The meter can measure a wide range of power from –70dbm to +20dbm in the bands from 10MHz to 26.5GHz, in conjunction with the NJL-71 series power sensors.

This multi functional power meter is designed for automatic zeroing and calibration, compensation for loss and gain, comparative measurement for any refer-



ence, and storage and recall for setting data by the use of a back-up memory.

All the functions are available by simple push button operation and the meter is portable for use with an external 12 volt source.

Further information is available from ACL Special Instruments, 27 Rosella Street, East Doncaster 3109.

125MHz pulse generator

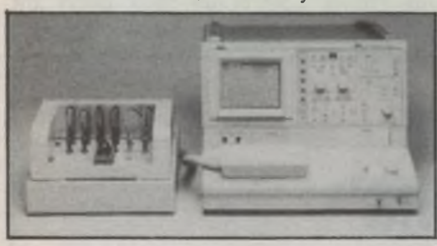
A versatile pulse generator with repetition rate variable from 1Hz to 125MHz and a choice of fixed 2,1.5 or 1ns risetimes has been introduced by Philips Test & Measurement. The PM 5785 has a wide choice of external trigger and gate functions, full control of pulse repetition rate, duration and delay, a presettable high-speed burst option and dual normal/complementary output with choice of bipolar, positive or negative pulses. Settings error indicators simplify operation.

The choice of fixed high-speed transition times and output pulse forms, makes the PM 5785 well suited to a wide range of digital applications in research, production or service. The 2, 1.5 or 1ns risetimes are equivalent to 1.4ns, 1ns or 700ps for ECL work, (with 20% to 80% of pulse amplitude, transition-time definition).

Output impedance back-matching absorbs more than 95% of reflections from mismatched loads, to provide very clean pulses under practically all conditions. There is a choice of four output-level ranges from 0.2 to 5V to match different circuit requirements.

Triggering, duration and gating can all be controlled externally. A burst option is presettable from 1 to 9999 pulses. The number of pulses is set directly on the front panel and can be triggered manually or remotely via the external input.

For further information contact Philips Scientific & Industrial, 25-27 Paul Street North, North Ryde 2113.



High power curve tracer

Tektronix is introducing what it claims is the first curve tracer able to test high power semiconductor devices at current up to 400 amperes, with 3,000 watts of power and 3,000 volts.

The Sony/Tektronix 371 Curve tracer will allow component designers, manufacturers and end users to evaluate two- to three-terminal devices, including power diodes, bipolar power transistors, power MOSFETs and thyristors.

The programmable instrument enables users to stimulate devices and then display, measure and store their DC parametric characteristics for further analysis. Both the "off" and "on" parameters such as the forward current transfer ratio and safe pulsed operating area can be tested at up to 400 amps. Measurements can be made using grounded-emitter or grounded-base configurations.

The instrument uses a non-volatile bubble memory and a GPIB interface to offer the advantages of automatic operation for faster and more reliable results with less operator training.

For further information contact Tektronix Australia offices in each state.

Upgraded digital multimeters

Philips has significantly upgraded the specifications and performance of its Series 18 range of digital multimeters, while maintaining the same competitive price level.

Valuable features like input protection up to 2.5kV, a bargraph display mode that offers 'better than analog' read-out performance, closed-case electronic calibration and wideband RMS measurements are now incorporated in all of the three Series 18 models.

A choice of three models — PM 2518, PM 2618 and PM 2718 — covers all the required functions for every application — from general-purpose testing through communications and digital measurements, right up to R&D use. These instruments combine easy portability with all the features and performance expected of no-compromise testbench meters.

Further information from Philips Scientific and Industrial, 25-27 Paul Street North, North Ryde 2113.

Hand tachometers

Jaquet has released two hand tachometers: the DHR906, and optical, non contact instrument for speeds from 10 to 100,000rpm; and the DHR903, a mechanical contact instrument that can measure from 10 to 20,000rpm or linear speeds from 1.0 to 2000m/min using the appropriate snap on driver. Both feature LCD displays.

Each instrument has three measurement ranges with automatic selection. Indication is provided for measurements above and below range and of low battery power. Battery life is approximately 120 hours. The instruments feature one button operation with automatic switch off after one minute. A self tester is incorporated and the last reading remains stored until the next measurement is made even when the instrument is switched off. Gate time is 0.7 sec for speeds of 100rpm and above.

The instruments have a sturdy metal body for protection against mechanical stress and electrostatic interference. A carrying case is supplied which holds the instrument and accessories.

For specification sheet and prices contact Electromark, P.O. Box 184, Mortdale 2223.

PROM programmer

The Diamond Systems Flexeprom is a new versatile low cost programmer designed for IBM PCs and compatibles. Capable of programming just about any EPROM, CMOS EPROM, and EEPROM directly, it can also program a wide range of MPUs and TTL PROMS with the addition of simple adapters.

The Flexeprom has been designed to make future expansion to new devices simple and economic. It uses an innovative configuration mechanism in which device pin definitions, their sequences and other parameters such as FAST/NORMAL are defined in a user editable configuration file allowing the user to "program the programmer" to program any device not in the original menu.

The PC host software is comprehensive and easy to use. Programming commands can all be queued with an alert sounded when all operations are complete. A comprehensive screen based editor is included, which shows the buffer data in both hex and ASCII representation. Other commands allow disk file I/O and more.

The Flexeprom is a self contained portable RS232 interfaced unit. It has been designed and is manufactured in Australia by Diamond Systems and is covered by a 12-month guarantee.

Further details from Diamond Systems, PO Box 105, Hurstbridge 3099.

New Tools & Production Gear

Pocket tester

The new Volt Stick from Wattmaster Alco resembles a rather chunky pen, but instead of a nib it has a plastic tip which illuminates red as soon as it detects the presence of AC voltage. This can be anything in the range of 100 to 1500V AC. It operates from 2 standard 1.5V (AAA) batteries and features advanced electronic circuitry which amplifies the magnetic field that surrounds a conductor carrying a current.

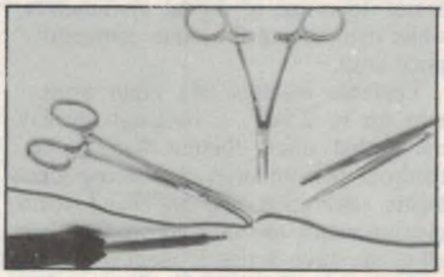
The Volt Stick is absolutely safe to use as there is no metal contact and no current flow required for the tip to glow red. In areas of high current there is no need to even touch the conductor. Its sensitivity is such that it illuminates red at 5mm distance from 2.5sq.mm conductor carrying 240V AC.

Applications include locating breaks in cables and detecting blown fuses. It also identifies faulty switches in-line and voltage carrying cables in junction boxes.

For further information contact Wattmaster Alco in each state, or at 11 Rachael Close, Silverwater 2115.

Rachet lock heatsink

Scope has added to its catalogue of soldering accessories two forcep type heatsinks. 160mm curved and straight models are available featuring a rachet lock, while a separate 130mm tweezer



complements the range.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042.

SMD placer also solders

Specifically designed for prototyping, rework and small production assemblies, the Weller Pick Place Solder (PPS) unit is a most versatile SMD station. As a complete work and rework station, the Weller PPS is a precision working tool.

Built around a hot plate work station, the articulated working arm pivots easily for exact placement of surface components. Components can be stored and selected from a controlled carousel tray, or delivery spools behind the work bench.

The Weller PPS is suited to both soldering and desoldering operations. Various Weller CSF (Chip Suck Feet) are available for specific component use.

For further information contact Cooper Tools, PO Box 366, Albury 2640.

Anti-static service kit

The new 3M 8501 Static-Dissipative Portable Field Service Kit quickly eliminates potentially hazardous static charges and provides a static-free working surface, when working on static sensitive electronics.

The kit has five components, and is

claimed to be one of the most comprehensive, efficient static-dissipative portable field kits available.

The work surface is a red mat constructed from static-dissipative material, and is 0.05x56x61cm (.021x22x24 inches) in size. Two pockets are stitched on the mat's bottom edge, each being 20x28cm (8x11 inches) in area. A female snap for the kit's ground cord system is located in the lower corner of the pocket.

One of the 8501 Portable Field Service Kit's major advantages is its light weight. This is largely due to a new heat-bonded, three layer material used in the work mat's construction. It is extremely flexible over a wide range of temperatures, but is also very tough and durable.

Further information is available from 3M Australia, 950 Pacific Highway, Pymble 2073.

New type of power saw

The Bosch PFZ 550E all-purpose saw, which has been a knock-out success in European and other countries recently, does handyman jobs that are impossible with conventional saws and can reach into awkward spots where no other power saw can go.

A full range of Bosch saw blades ensures that this powerful, 550 watt all-purpose saw can slice through just about anything — from the toughest timber to steel, fibreglass, plastic, plaster and expanded concrete.

With a special bi-metallic blade, the PFZ 550E can even saw at an angle or cut flush with a surface.

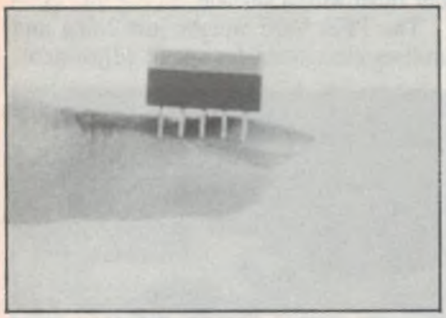
The PFZ 550E weighs just 2.6kg and utilises electronics for speed adjustment.

It looks like no other saw, yet performs the roles of a hand saw, jigsaw, chain saw, or other type of conventional power saw.

It is purely practical in design and can be controlled with equal ease by left or righthanders to cut quickly and neatly through wood up to 150mm thick and steel up to 8mm thick.

Further information from Bosch tool stockists, or Robert Bosch Australia, Cnr Centre & McNaughton Road, Clayton 3168.

New Components



Ultraminiature relay

Claimed by National to be the smallest polarized relay in the world, the TQ series measures only 14mm long, 9mm wide and 5mm high. This is much smaller than the popular DIP reed relay and offers the additional advantage of two changeover contact sets, a feature rarely available economically in a reed relay.

The TQ relay fits into a 10 pin DIP socket and is available with single side stable or 2 coil latching functions. Operate time is approximately 0.5ms, while contact bounce is less than 0.21ms due to the provision of bifurcated contacts.

Contacts, although rated at 30V DC at 1 amp and are suitable for dry circuit applications such as audio or thermocouple switching.

The TQ relay is completely sealed and is available in coil voltages from 3 to 24V DC.

For further details contact RVB Products, 242 Huntingdale Road, Huntingdale 3166.

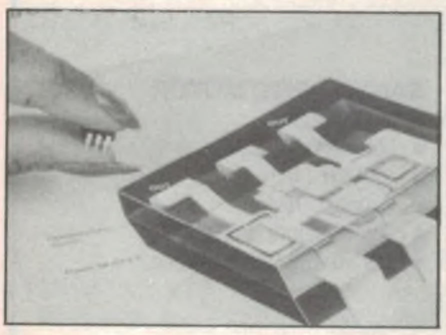


Photo-MOS relay

Claimed by Matsushita (National) as the first serious challenge to the reed and mercury wetted relay in high speed switching, this tiny 6-pin DIP Photo-MOS unit can handle AC and DC signals from microvolts up to 400V at currents up to 150mA. Some versions will switch up to 600mA at 40V DC.

Photo-MOS is driven exactly like a standard relay with the exception that outputs may be paralleled to increased the current handling or used in series to handle higher voltages with true load sharing capability.

Photo-MOS's "On" resistances of less than 0.25 ohms and "OFF" leakages of less than 1 microamp come very close to hard contact relay characteristics but with the advantage of no bounce.

For further information contact RVB Products, 242 Huntingdale Road, Huntingdale 3166.

Connectors, probes

Obiat Pty Ltd has been appointed authorised distributors of the Coline (UK) range of RF co-axial connectors, adaptors, shunts, terminations, attentuators and leads as well as the complete range of test lead sets, stackable leads, multimeter test probes, high voltage probes, RF probes, fused probes, BNC patchcords, BNC flying leads, logic probes and oscilloscope probes.

Replacement probes with bandwidths from 10MHz to 300MHz and lead-lengths to 3 metres are available to suit almost every make and model of oscilloscope available, including but not limited to models from Tektronix, Hewlett Packard, Gould, Philips, Trio, Hitachi etc.

For brochures and probe replacement recommendations contact Obiat, 129 Queen Street, Beaconsfield 2015.

Pushbutton Codeswitches

High precision Kelvin Varley, dual pushbutton codeswitches are now available in the GEFE range of codeswitches.

Housed in the traditional GEFE C002 body is a precision hybrid resistor network that can be cascaded (1 or more codeswitches) into decreasing output voltage decades, with each additional decade further dividing its input voltage by 10.

GEFE CV003 are 0.1% accurate to their input voltage. The hybrid resistors are 1% tolerance, 1 watt at 25°C and the temperature coefficient of the divider is less than 20PPM/°C. Each segment has a maximum non switching current of 0.5A.

The GEFE CV003 is front mounting. Each segment can be snapped together and simply inserted into the panel, where they are retained by GEFE's clip fixing. Front dimensions are 24mm x 7.62mm.

For further information contact Crusader Electronic Components, 81 Princes Highway, St Peters 2044.

SMD pi-filter

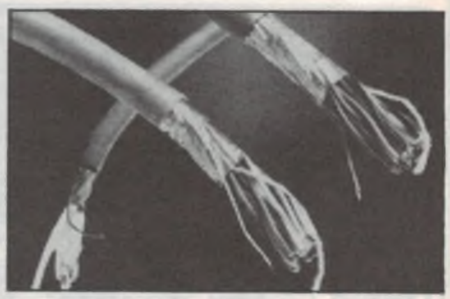
Designed for direct mounting to circuit boards, Oxley Surface Mounting Pi-Section Filters type SLT/P/1500/SMNI are leadless devices offering high insertion loss over a wide frequency range.

A feedthrough configuration provides low residual inductance and high self-resonant frequency (typically greater than 100MHz). Effective filtering is provided at 100MHz ((40dB), with over 20dB of insertion loss available at 1GHz.

A special low-Q ferrite material provides a "lossy" series impedance, essential for maintaining insertion loss over a wide range of source/load conditions.

High melting point solder (300°C MPT) is used for all internal joints, allowing vapour phase assembly by the user without component degradation.

For further details contact Tecnico Electronics, 11 Waltham Street, Artarmon 2064.



Low-C computer cable

Belden Electronics has announced its new 9680 Series of extended distance data cables. The cables combine 100% shield coverage and low capacitance (15.5pF/ft.) to allow extended distance data transmission in EIA RS-232 applications.

The 9680 Series consists of five cables with 3, 4, 6, 9, or 12-1/2 pairs. The 24

AWG stranded tinned copper conductors are insulated with a polypropylene foam. Each pair is covered with a Beldfoil shield to reduce crosstalk and improve signal integrity between the pairs. Additionally, the cables have a 24 AWG stranded tinned copper drain wire and a chrome PVC jacket.

For additional information please contact Belden Electronics, P.O. Box 322, Clayton 3168.

PCB terminals

Kingfisher International has announced a new range of general purpose PCB Terminals/Test Points, which have the useful feature of easy insertion onto the PCB with no special tools — and yet are self-retaining before soldering. They also provide a method of securely hooking test probes into a circuit, without the risk of a probe falling off and causing short circuits. The terminals are made in England by William Hughes.

The parts do not damage plated-through holes during insertion, and due to their spring design, can be used in poor tolerance holes which might otherwise cause jamming.

Alternative uses are as headers, and for raising hot components above the PCB surface. They are available in two sizes, with a ceramic insulating bead coded in six colours, designed for hole sizes 1.3 and 1mm.

Further information is available from Kingfisher International, 14 Excalibur Avenue, Glen Waverley 3150.

SMD fuses

Bussman has released what it claims is the world's first surface mounted fuse. The new SMD Tron is the first current-limiting fuse available for automatic placement and surface mounting. It is fully compatible with standard solder reflow methods — the high-temperature-resistant body surviving 60 second exposure to 420°F. The SMD Tron is in a standard JEDEC package, is totally sealed and withstands rigorous board washing.

This sub-miniature fuse offers substantial time delay with overloads, yet opens very quickly when subjected to heavy fault currents. Its current-limiting capability means extremely low let-through energy under fault conditions thus protecting PC board components.

It is available in 1 to 5 amp ratings and is rated at 300V DC. Packaging is 2500 fuses per reel.

For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon 2064.

Miniature crystals

Philips has introduced ranges of quartz crystals for automotive and consumer applications in the miniature RW-80 encapsulation, which has just one-fifth the volume of the RW-3 package it replaces.

The RW-80 package, just 9mm high, is hermetically sealed and resistance welded. All of the devices are assembled automatically, rather than with the traditional manual assembly still used for many competing crystals. The industrial versions are in a variety of RW-80 packages, including glass types with very stable ageing characteristics — demonstrated by a frequency change in a three month period, of just 0.5 PPM under test conditions.

The 9922 521 and 522 series of consumer and automotive crystals have fundamental frequencies between 8 to 20MHz: the series of industrial crystals have frequencies from 20 to 50MHz (3rd overtone) and 50 to 150MHz (5th overtone): 7th, 9th and 11th overtones are available on request with frequencies up to 250MHz.

For further information contact Philips Elcoma, 11 Waltham Street, Artarmon 2064.

Surface mounted switches

Eeco Inc. has released its 2400 series of Dip Switches in a surface mountable version. The Rocker Surface Mountable Switch offers gold contacts and low contact resistance over life. Gullwing configured leads allow easy mounting to surface pads, alleviating the need for drilling printed circuit boards. The unique rocker design is actuated with a downward force, eliminating the possibility of shearing the device from the solder pads.

The switches are available from 2 to 10 SPST switching positions and in either raised rocker or flush rocker versions. Permanent seal or process seal options are also available.

For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon 2064.

New Products Survey

Communications Equipment

432MHz transceiver

Icom Australia has announced the availability of a 70cm (432MHz) companion transceiver to its IC-275A two metre multi-mode transceiver.

The IC-475A is an SSB/CW/FM transceiver with a frequency range from 430-450MHz, built-in 240V AC 100% duty cycle power supply and provision for 13.8V DC mobile operation.

The IC-475A features Icom's direct digital synthesiser (DDS) frequency generation circuitry, for extremely fast (5ms) lock-on to a selected frequency, fast switching for advanced digital modes like Packet Radio and AMTOR, and high frequency stability.

Inside the IC-475A is the same HD64B180 ROP central microprocessor unit as is found in the IC-275A, providing 9 user-programmable memory channels to store frequency mode, duplex direction (plus or minus) and offset, and where used, sub-audible tone data. The microprocessor also provides remote control capability via a rear mounted RS-232C jack operating at 13200 baud, providing computer control of frequency and mode selection and memory channel data via an appropriate interface.

Under the covers also is a low noise, high gain, disk-type 3SK121 GaAs-FET receiver RF amplifier designed for UHF applications. This is supplemented by a quadruple-conversion superhet receiver design with a balanced mixer using a 2SC2026 UHF transistor with 2GHz frequency characteristics, for improved sensitivity and greater dynamic range.

Receive sensitivity is claimed at less than 0.1uV for 10dB S/N (SSB/CW); selectivity is claimed at 2.3kHz for –6dB (SSB/CW) and 15kHz for –6dB (FM). Squelch sensitivity is 0.14uV (FM) and 0.56uV (SSB). Although unstated in the specifications, the IC-475A receiver dynamic range is considered to be in excess of 105dB.

Transmitter power is continuously adjustable from 2.5 to 25 watts from the front panel. For higher power applications, the IC-475H provides continuously adjustable power up to a very hefty 100 watts. Spurious outputs are suppressed more than 60dB below carrier level, while carrier and unwanted sideband in SSB mode are suppressed by more than 40dB (1000Hz AF tone input test).

Further details are available from authorised Icom dealers.

Mobile fax

ACL Special Instruments has released the JRC JAX-110/JAX-120 High Speed Mobile Facsimile.

The equipment is made up of two separate units: the JAX-110 transmitter and the JAX-120 receiver. The extensive use of LSI's and HIC's has resulted in extremely compact facsimile equipment that requires only modest space in the interior of a vehicle.

Utilizing a special proprietary error correction technique, the JAX-110/120 enhances the apparent quality of a radio transmission channel by automatically correcting data errors that arise from a deteriorated signal-to-noise ratio and fading while a vehicle containing the equipment is moving. Synchronizing signals are continuously inserted at predetermined intervals even while a message is being transmitted and since the facsimile receiver can lock on the synchronizing signals at any time, it can start receiving the fax image during any part of the transmission.

The transmitter's built-in digital select-call capability makes it possible to communicate with specified stations only, allowing the transmission of confidential facsimile data.

For further details contact ACL Special Instruments, 27 Rosella Street, East Doncaster 3109.

UHF handheld transceiver

The Icom IC-U16, approved by the Federal Department of Communications for use on the UHF allocations between 450 and 490MHz, is a fully synthesised 16 channel portable transceiver with advanced keyboard entry and the ability to instantaneously program, or "clone", other ICV-U16 transceivers in the field, transferring frequency data, CTCSS selective calling data, transmit inhibit data (for receiver only channels), frequency offsets (for split frequency or repeater operation) and tones (for tone calling or tone access) by the simple connection of microphone jack to microphone jack with a mono-stereo connector cord.

With its rugged, all-metal chassis with stainless steel battery slide rails and a reinforced, die-cast aluminium back, as well as moisture and dust resistant seals, the IC-U16 is made to take the roughest treatment.

The IC-U16 delivers 2.5 watts of power, or double that output with the addition of an optional IC-CM7 battery pack. A special "power save" feature drops receive mode power consumption from around 160 milliamps to just 30 milliamps.

The Icom IC-U16 comes complete with BP8 long life battery pack, BC-18 SEC-approved 240V AC wall charger, flexible antenna, belt clip, earphone, handstrap, external speaker plug, external microphone plug, rainproof cap and DC power plug. Optional accessories include IC-HM9 speaker microphone, HS-10 headset, HS-10SA voice operated microphone unit, CM-60A desk multicharger and BC-36 desk charger.

Further details are available from authorised Icom dealers or Icom Australia, 7 Duke Street, Windsor 3181.

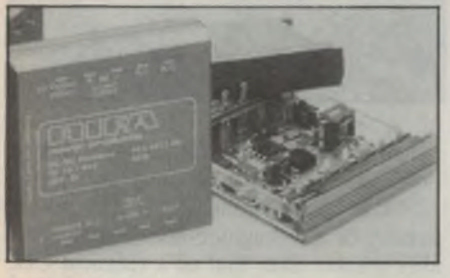
Four-speed 2400bps modem

ABE computers has announced its Maxwell 5 four-speed modem. The fully optioned modem has automatic speed select with speeds of 2400/2400, 1200/1200, 1200/75 and 300/300 baud and a price tag of $714 plus tax — around 30% below its nearest competitors. Retail price including tax is $845.

The Maxwell 5 has auto-dial, auto-answer, auto-speed selection, automatically switches between tone and pulse dialling, and is AT command set compatible.

Further details from ABE Computers, 24 Burwood Highway, Burwood 3125.

Power Supplies



Low profile 40W DC/DC converter

Rifa Power Products has introduced a 40W, 500V DC input to output isolated version of its PKA-series. The PKA 4411 PIL is a 39-64V/5V, 8A converter, ideally suited for Telecom use and has a predicted MTBF of 200 years at +45°C ambient temperature.

Claiming a temperature range of –45°C to +65°C, the converter is housed in a 3" x 3" standard anodized aluminium chassis. The 0.78"/19.8mm profile allows a 1.2"/30.48mm (6TE) board spacing in electronic shelves. A version with fast-on terminals for chassis mounting is also available (PKA 4411 CI).

To expand the temperature range to +85°C, a version with integrated heatsink, allowing 1.6"/40.64mm (8TE) board spacing with the same footprint will also be available. The height for this version, PKA 4411 PI, is 1.39"/34mm.

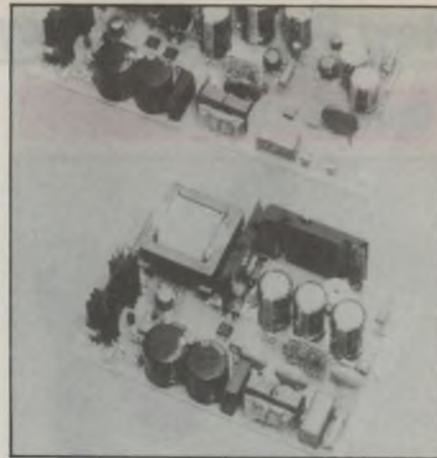
Further information from Rifa Power Products, PO Box 95, Preston 3072.

Compact switchers

Philips has introduced a new Series 190 range of 15 compact switched-mode power supplies, for built-in use by original equipment manufacturers. These units are based on a frameless card-mounted construction. They use self-oscillating flyback technology and surface mounted devices to combine compactness and performance with high reliability.

The range includes eight 40W and seven 60W models. All types can be loaded continuously at their nominal power output rating at an ambient temperature of 50°C. Features like potentiometer-adjustable output voltage and OVP are provided as standard.

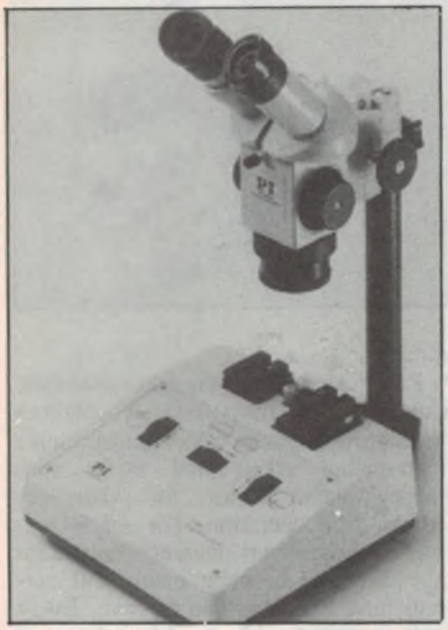
The main output of dual- and triple-output units is regulated on all models, while extra outputs are post-regulated or double-filter, depending on the model.



Power semiconductors and electrolytic capacitors are over-rated to obtain a prolonged lifetime. All models have high-quality epoxy-filled PCBs with through-plated holes for years of trouble-free operation. For safety reasons, the minimum clearance and creepage distances between mains and outputs have a safe margin of 8mm. Every unit is tested with an AC voltage of 4000V between primary and secondary.

For further information contact Philips Scientific & Industrial, 25-27 Paul Street North, North Ryde 2113.

Opto Electronics



Optical fibre joiners

The almost unlimited resolution of piezoelectric elements in the Physik Instruments F-200 optical fibre coupler unit provides for fibre coupling with minimal signal possible transfer losses. This is achieved by high position pre-adjustment in the factory, such that coarse adjustment of fibres is not necessary. Automatic or signal controlled x-y positioning is provided through analog inputs and, as an option, a driver unit for the z axis can be provided.

A double clamp holds the fibre stable and also facilitates changing fibres. The F-200 is easily operated using just three controls that optimise convenience and reduce fatigue. The combination of positioning elements and controls provide a good "feel" for movement in all three axes.

Further information is available from Warsash, PO Box 217, Double Bay 2028.

Blue light argon-ion laser

Siemens is offering an argon-ion laser tube featuring special mounting rings for ease of assembly. Currently the only development of its kind, the LGR7801 emits blue light with a wavelength of 488nm. The device is very suitable for film exposure in the reprographics industry (due to its high sensitivity), for laser-scan microscopy (increased contrast), particle counting and entertainment equipment.

The tubes and power supply modules are available as ready-to install components for OEMs. The fast-assembly rings (100mm in diameter, 15mm across) encircle the body of the tube and are designed to slot neatly into a circular bed in the OEM equipment. OEM option 1 offers regulated laser light from 2-5mW, and option 2, 2-15mW. With the second option, the tube comes already installed in a module housing.

End-users in research and development can obtain a blue-emitting laser module (LGK7900) with an output power of 2-25mW, which can be adjusted and kept constant via a regulator. This third option is protected against overheating by means of thermo-switches and forced-air cooling. The accompanying switched-mode power supply can be set to a number of rated line voltages (230, 115 and 100 volts).

Further information is available from Siemens, 544 Church Street, Richmond 3121.

25 watt CO_2 laser

For faster, more intensive legend inscription and marking, Siemens is now indenting a CO_2 laser with a continuous output of 25 watts (previously 5 watts). The dimensions of the LG8100 module remain unchanged from those of the earlier LG8000, at 321 x 110 x 600mm, a matching power supply unit is also available.

The optical resonator takes the form

of a waveguide in aluminium-oxide ceramic. Under high-frequency stimulation (by means of an integrated 125MHz pulse generator) the power density of a waveguide-laser is considerably greater than that of a classical CO_2 tube. Typical power per unit of length is 0.2-0.5W/cm.

The infrared light emitted by the LG8100 with a wavelength of 10.6um can be used to inscribe or mark glass, ceramics and plastics, and to cut paper, plastics, textiles, fabrics, etc. Plastic foils can be cut and bound quickly and permanently. Siemens' laser marketing group envisages uses in materials processing and in medicine — specifically in surgery.

Further information is available from Siemens, 544 Church Street, Richmond 3121.

Portable fibre splicing machine

The Fiberlign QFS-1001 mini fusion splicer is for use in application requiring joining and restoration of fibre optics cables, where light weight and portability are essential.

The unit is designed for both single mode and multimode fibres and is very easy to use in field applications. This low cost unit features precision micropositioners for pinpoint alignment of x and y axes. The z axis is aligned via a remote control keypad. An 80x microscope allows the splicer to view the position of optical fibres in the fusion area.

To further ensure the accuracy of fibre alignment, the QFS-1001 provides an integral LLD-200 Local Launch and Detect feature. When this is utilised, fibres can be optimised in 20 to 25 seconds.

The unit is capable of splicing fibre diameters of from 125 to 140 microns (core and cladding) and 250 — 900 microns coating. Splice loss is rated at NGT 0.1dB, with a typical performance of 0.05dB. The compact unit weighs only 9kg and measures 30cm x 23cm 18cm. Up to 200 splice operations can be performed on a single charge of the onboard rechargeable battery pack.

For more information contact Fanner-PLP, 150 Briens Road, Northmead 2152.

Production console

UK-based company Soundtracs has just released the "ERIC" production console.

Intended for the recording studio and video post-production markets, the ERIC console is 24 bus in a "split" configuration, available in three mainframe sizes: 32, 40 and 48 input. Priority of design has been placed on a high analog specification.

Crosstalk between channels or monitors is typically better than –74dB @ 20kHz, while mix noise with 56 inputs routed is better than –80dB (+4dBm) (measurements made using Audio Precision Test Equipment).

ERIC features solid balanced bussing with plug-in modules, designed for maximum performance and ease of servicing, located on a aerospace-type aluminium chassis. The monitor sections each have two line inputs for two 24-track tape machines. These may be used to select up to 24 individual tracks for the 48 tracks available.

For further information contact Amber Technology, Cnr Skyline Pl & Frenchs Forest Rd, Frenchs Forest 2086.

Personal PA for conferences

Philips has released a modular sound reinforcement system, suitable for discussion, conference and simultaneous interpretation — and it fits into a suitcase for convenient storage.

The suitcase option is part of the Philips CCS400 Congress System, which uses desk units each containing a microphone and loudspeaker for delegates at a discussion or conference. The basic "suitcase" contains a power supply unit, five delegate units, a chairman's unit and an extension cable.

CCS400 is suitable for small regular meetings such as local councils and associations, and for meetings in "live" rooms with poor acoustics.

For further information contact Philips Scientific & Industrial, 25-27 Paul Street North, North Ryde 2113.

Digital editor

"The Boss" is a new audio editor featuring a 16-bit master processing unit (MPU) with two disk drives, a 256K RAM (expandable to 1Mb) computer that can control all the equipment involved in the editing process. Because The Boss masters the art of machine management, the audio engineer is free to explore heights of creativity in sound editing.

A full-function keyboard that includes the familiar typewriter-style layout plus a calculator-style numeric keypad, allows single touch control over the entire production process.

With The Boss, the engineer can effectively manage up to 999 audio decisions simultaneously. At a single touch he can insert sound effects, command the VCR to fast-forward, recall the previous day's entire editing session, and perform countless other audio production tasks — all with one hand.

The full-colour monitor display was designed by audio engineers, for audio engineers. The screen is divided into several lists which describe equipment, editing script, even recording media.

For further information contact Amber Technology, Cnr Skyline Pl & Frenchs Forest Rd, Frenchs Forest 2086.

Soundcraft's Digitor

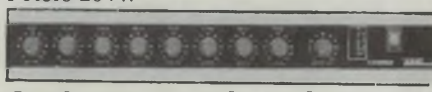
Priced at around $30,000 to $50,000 depending on memory size, the Soundcraft Digitor is a professional 16 bit 44.1/48kHz rate stereo audio editor that is not only remarkably powerful, but affordable too. Claimed additional benefits are more applications than the hard-disc based systems currently available.

Its maximum sized configuration means the analog in/out Digitor has the capacity to store and manipulate up to six minutes of audio. Unlike other tapeless audio recording systems, Digitor comes complete with monitor, processor, disc drive and dedicated keyboard.

Audio recorded live into Digitor or sampled from another recording can be edited, and sections may be removed, re-inserted, looped, played backwards or pitch shifted to further enhance artistic creativity. All "splices" may be effected via Digitor's on-screen waveform display — enabling smooth, fast, glitch-free transitions to be made.

Digital interfaces are said to make Digitor very suitable for mastering on DAT.

For further information contact Jands/JBL, 578 Princes Highway, St. Peters 2044.



8-channel mic mixer

Audio Telex Communications has announced a new public address microphone mixer with individual bass and treble equalisation per channel.

Manufactured under their "Techcraft" brand, the mixer features an LED level indicator, XLR Switchcraft microphone sockets and RCA phone line auxilliary input. Each channel will accept microphone or line level inputs. A small panel in the top of the mixer provides access for bass and treble adjustments per channel. These are preset and not accessible from the front.

Other features include high mic sensitivity public address applications, tape recorder record output and balanced 600-ohm output.

The TX8000 is one rack unit high (1-7/8"), finished in an attractive black matt with large easy to read knobs and controls.

Priced under $700 plus tax, the TX8000 is intended for quality public address applications or recording systems.

For more information contact Audio Telex Communications, 120-124 Beaconsfield Street, Auburn 2144.

New Products Survey

CAD Systems & OEM Computers

Drafting package

RCS Design is now able to supply the professional general drafting software package Qikdraw, home grown in South Australia.

Qikdraw has many beneficial features that set it apart from other products. These include completely on-screen menu driven; file names selected from screen menus; password protection; ability to "lock on" to parts of lines, circles etc; utility functions such as pan, zoom and recalling views can be nested within other commands and many other very sophisticated 2D and 3D capabilities.

Qikdraw offers the designer a realistic upgrade path. It runs on a variety of micro-computers and high powered workstations. RCS Design offers a low cost entry, at the level of the IBM XT/AT and compatibles such as the NEC APC IV. If more computing power is required, Qikdraw can step up to a more powerful graphics environment incorporating the APOLLO Domain, Sun or ICL Graphics workstations.

For further information contact RCS Design, 728 Heidelberg Road, Alphington 3078.

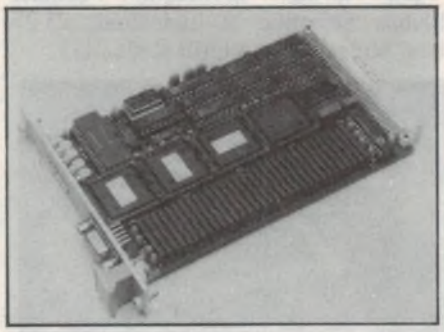
Graphics tablet

Hewlett-Packard Australia has introduced a low-priced, high-quality graphics tablet that provides easy interaction with leading personal computers and computer-aided design (CAD) workstations. The new tablet is designed for applications in mechanical or electronic design, architecture, engineering, construction, business graphics or desktop publishing.

The HP SketchPro table comes with a complete package of accessories that includes a lightweight stylus, four-button cursor, HP Vectra PC/IBM AT serial interface cable, IBM PC/XT adapter cable, Microsoft (R) Mouse driver files, CAD software packages.

HP SketchPro supports leading PC CAD software packages AutoCAD, VersaCAD and CADKEY, with operating modes of HP, Summagraphics Bit Pad Two and Hitachi HDG 1111B. Simple software-setup instructions are included with the HP tablet.

Further details from Hewlett Packard Australia, 31-41 Joseph Street, Blackburn 3130.



Fast graphics for VMEbus

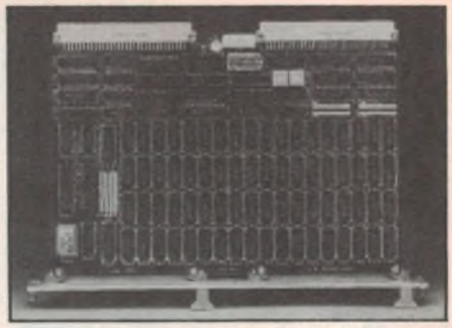
PEP Modular Computers offers its VGPM high performance graphics module designed on a single height board in a single height VME module.

This powerful controller logic combined with up to 1Mb of graphics memory provides a compact solution for all users of graphic boards on the VMEbus, particularly system designers in the industrial automation field who are seeking new levels of integrated solutions in graphic representation.

The ARCTC 63484 runs at 8MHz clock frequency to provide a typical drawing rate of 2 million pixels per second. The board is available for pixel frequencies up to 64MHz to utilise latest standard 49cm monitors with 1280x1024 pixel resolution on the market.

Due to the dual access at 64MHz of the onboard RAM, flickerless screens are no longer a problem. A bit-block transfer operation allows fast and flexible generation of characters and graphic objects for the user's convenience.

For further information contact The Dindima Group, 10 Argent Place, Ringwood 3134.



SCSI interface for VMEbus

The Compcontrol CC-74 VMEbus module functions as either an initiator or target in multiple host SCSI systems. It connects VMEbus computers to optical disks, hard disks, magnetic tapes and other intelligent peripherals, and may also interconnect computers.

The CC-74 handles arbitration, reselection, and generates parity bits with optional checking. Two of the four channels in the onboard 68450 DMA controller are dedicated to the SCSI interface, leaving the other two for the user's system application. The module's 23 address, 16 data and 6 address modifier lines permit it to address 16Mbytes across the VMEbus and transfer data between memory blocks with different address modifiers.

Data transfers can be unchained, array chained, or linked chained and data is moved from memory or between SCSI bus and memory. The module detects address and bus errors and generates error-interrupt vectors. It will also generate an interrupt at the software installed level when the SCSI bus must be serviced. The module takes up an address space of 512 bytes in the standard or short I/O memory map and has a "release when done" DTB requester with software programmable bus request level.

For further information contact Philips Scientific & Industrial, 25-27 Paul Street North, North Ryde 2113.

AutoSketch price cut

Autodesk Australia has dropped the price of its full function, precision drawing tool AutoSketch from $350 to $160 ex tax (recommended retail).

AutoSketch can be used by professionals and hobbyists alike as an entry-level CAD program to produce architectural drawings, assembly diagrams, flow diagrams, charts, office layouts, electrical and electronic schematics, or technical illustrations to name just a few applications.

The recommended retail price of

Autodesk's flagship product, AutoCAD (version2.6) has also been reduced, from $4890 to $4700. AutoSketch drawings can be exported to AutoCAD using the DXF file format. This provides a very cost-effective way to create preliminary designs which are then developed and expanded using AutoCAD.

AutoSketch is available from authorised AutoCAD Dealers and other outlets details of which can be obtained from Autodesk Australia, 9 Clifton Street, Richmond 3121.

AutoCAD 3D interface

Autodesk Australia has announced the availability of Cadetron's "The Engineer Works", a combination of a solid modelling package and several application modules.

The Engineer works is based on PADL-2, a solid modeller. PADL-2 has been used as the foundation for several leading manufacturers' mainframe and minicomputer-based solid modellers.

The Engineer Works solid modeller uses constructive solid geometry (CSG) to describe objects. With CSG, an engineer develops an object by combining simple concepts such as spheres, boxes, cones and tori with Boolean operations such as addition, subtraction, and intersection. Unlike other forms of three dimensional design, CSG can only develop valid physical objects, thus providing a built-in validity check usually absent in the design process. Cadetron converted PADL-2 to the C programming language, and added a contemporary user interface that uses multiple on-screen windows for the display of menus. This allows enhanced performance and different views of the same part or of multiple parts.

Once the three dimensional model has been developed another module of The Engineer Works allows it to be viewed in a realistic shaded rendering. Since the CSG model is a precise representation of a real object, it may be used to calculate mass properties such as weight, centre of gravity, volume and other properties of objects designed with it.

The Engineer Works operates on the IBM PC/AT or compatible computer under the Xenix operating system and requires six or more megabytes of memory for optimum performance. the package will encompass an interface to Autodesk's AutoCAD for purposes of detail drawing creation and output.

For further information contact Autodesk Australia, 9 Clifton Street, Richmond 3121.

SOME ADVICE FROM AN EXPERT:

Computers, CAD and productivity

This article arrived too late to be included in our September feature on CAD, but we decided to include it this month because it throws some valuable light on things that should be considered by anyone contemplating CAD. The author is a design engineer at Melbourne-based Earth Computer Systems.

by PHIL HEMPEL

It is not by accident that some companies have achieved great success with Computer Aided Drawing (CAD), while others would have been better off leaving the total system in its wrapping. The reason for this is generally quite obvious when the system, and the CAD management policy, operating within the companies achieving the different results are reviewed.

Similarly a lot has been written about the productivity gains that are achieved using CAD. Figures range from gains of 1.5 to 1 to 4 to 1. Some suppliers quote even higher gains by selecting particular types of drawings or parts of drawings that are ideally suited to CAD.

The highest gains are made with drawings that have a large repetitive symbol base, are non dimensional, non scalar and have an established data base. Drawings such as electrical single line diagrams, loop diagrams, flow sheets, circuits, etc. Gains of up to 7 to 1 can and are being achieved, in many offices where the correct CAD system has been installed, and managed correctly.

Productivity gains however need to be related to the total cost of a CAD system. Obviously if you install a CAD system that provides a productivity gain of 4 to 1, but costs more to evaluate, purchase, install, manage and provide consumables than the new found productivity gains can provide, then you are on a loser, as a finite payback period will never be achieved.

The type of drafting I am referring to here is production drawing produced in the general drawing office. This accounts for approximately 99% of drawings. The drawings *not* referred to here are those that are produced on CAD for reasons other than productivity. These are solid modelling drawings that are developed to produce results other than productivity.

Many large and expensive systems were purchased several years ago that had a projected payback period of four to five years (if they were lucky). These systems are now well and truly superseded.

For example a system installed four years ago, designed to run efficiently five terminals (all doing the same task at the same time) would have cost in excess of $750,000. This is for hardware, software and maintenance only. The management costs would come to at least $300,000, making a total of $1,050,000.

To justify this cost it was always necessary to work two shifts to get a return on investment. This worked for a time in America, but was unsuccessful in Australia. The additional cost of supervision, penalty rates and general falling off of production in the out-of-normal-hours shift, made working two shifts totally unworkable.

To achieve a payback period of even four years with this system, a productivity of at least 4 to 1 had to be achieved. This would be required to cover system availability, training and development (library symbols, programs, bills of materials, etc). Even if a four year payback was achieved at this time, return on investment would still not start to take place as this system would need upgrading both in hardware and software. A decision is often made at this stage to cut the losses and purchase more useful less expensive equipment. Equipment is available today, like the Earth personal computer, that outperforms most of these older systems for 1/20th of the cost.

A payback period today has to be less than one year to be able to take advantage of technology changes. It also must be based on an achievable productivity, and definitely one shift. If overtime is worked, then that is a bonus in regards to paying off the system.

In fact payback periods can be achieved today within three months for a single workstation system (terminal, software, plotter etc). The reason for a longer payback period with a single system is the cost of a plotter. This cost cannot be spread across a number of terminals and it cannot be used efficiently. One plotter can support five terminals with ease. With a large system an old PC can be used to drive the plotter, however with a single user he does not have that spare PC. Another problem is that while he is plotting, his sole PC is tied up and unavailable for producing drawings.

For a large system recently established using Earth terminals, with four terminals already installed, then the payback period for any additional terminal will be close to four weeks. This is based on 4 to 1 productivity; if a lower productivity of 2 to 1 is used (this is easily achieved), the payback period would go out to eight weeks for a four terminal system.

If companies are not achieving this then there is something very wrong with either their software, hardware, operator, supervision or management. Efficient CAD operators working on contract can, at the moment, command

Using a PC-based CAD system at Earth Computer Systems.

high hourly rates. This is because they have got their act together. They use good software, have it set up correctly and know how to drive the total system efficiently.

The following result was achieved at a large engineering design office in Melbourne. After having evaluated on site a large expensive CAD system for one year, working shifts and closely monitoring results, we decided to benchmark a PC-based CAD system on an XT. It proved so successful that we decided to stop using the much larger system, and buy a second PC. This time we went for an AT.

Having established solid management, training, development and installation procedures we found the PC-based system to offer a very good projected payback period. After four months we began testing an Earth ECS286 PC and realised its potential. We began to install these PC's at the rate of one per month, and on several occasions two per month. The current number of PC's now being used full time as CAD terminals is 26.

Another advantage PC-based CAD systems have over the larger systems is that as technology produces more advanced PC's, the out-dated ones can be used as plotter drivers and standard PC's to run database programs, spreadsheets and word processing. As a last resort, they can be sold off for far more than their written-off value.

The greatest problem CAD managers of the old larger systems now have is do they quit the large database of symbols established over the past four years, or do they attempt to transfer this database to a new PC-based system? If they decide to transfer the data, they are committed to using modified software from the same supplier. This also gives them problems as most times the intelligence associated with the symbols will not copy across, and they are stuck with revamped, but out-of-date software. With the advantages to be gained from going to current, efficient PC-based systems, it would be more economical to redraw the total database of symbols.

The benefits of staying with the old symbols are usually put forward by the company that sold the original system, to retain that client. In reality if a user had 1000 symbols, these could be typically redrawn during training sessions on the new system, in under five weeks on a single terminal. The difference in payback by using an efficient system would easily cover this cost. Just imagine the results if one was to put new racing wheels on a T-model Ford!

Many factors effect the productivity achieved when producing drawings by CAD on a personal computer (PC). These are mainly:

(a) The PC selected to run the CAD package on.
(b) The CAD package selected.
(c) Skill level of the operator.
(d) Command input method (i.e., digitizer, screen menu or keyboard).
(e) Level of program customisation and macros used.
(f) Types of drawings selected to be produced by CAD.
(g) Multiple use of data used and generated.

To evaluate the effect that the PC has, it needs to be established how much of an effect does the processing and disk access speed of the PC have on productivity. How is the higher cost of a high performance PC justified?

The average disk access speed varies from around 16ms on fast disks to in excess of 80ms on slower models. The processing speed varies with clock frequencies from 16MHz to 4.77MHz and also depends on the number of wait states. For example, a 16MHz Compaq is equal in performance to the 12.5MHz Earth machine.

The areas affected by disk speed when using CAD are:

- Loading software into RAM on start up.
- Setting up a new drawing or bringing up an existing drawing.
- Inserting library symbols that are stored on disk.
- Loading new commands as required.
- Paging to disk when complex graphics are being performed.
- Saving and filing drawings.

How each one of these effect productivity varies depending on the size and type of drawing being produced. For reference, with an average sized B1 drawing (140Kb) with a reasonable proportion of linework, blocks and text and using a popular CAD package like AutoCAD, the following results would be experienced.

All PCs can run CAD packages and it's possible to buy a PC for only a few thousand dollars to run a system capable of performing all the features provided by CAD. But what you would be getting is a toy and it would generally cost you far more money to produce a drawing on the system than it did manually.

How much faster need a PC run to ensure maximum productivity can be gained from the speed aspect of the system?

Response speed has two parts to it and both are important to overall drawing productivity. The first part is straight speed in the disk access and processing. This allows lines and text to be generated very quickly, blocks to be inserted without delay and editing performed rapidly (copy, menu, array, change, erase etc). These are the essential areas where speed is required to reduce the time to produce a drawing, and thereby increase productivity.

The second part is more important for operator acceptance. A system can be performing at a level acceptable within the bounds of required productivity, but due to the experience level of the operator, any type of delays (regular or irregular, short or long) can become a great annoyance.

Previously when a draftsperson produced a drawing manually, most of his time was spent actually preparing the drawing, getting the linework, text and sheet layout correct, and ensuring that the final drawing met the standard AS1100. A smaller portion of the time was spent thinking about the design.

Draftspeople on occasions have spent many hours ensuring all their lines meet perfectly, all the lettering is even and neat, and the line thickness is correct to highlight certain aspects of the drawing. They have ensured that all standards have been adhered to and they have added their own particular stylistic finish. The only problem — the design is wrong!

CAD can now perform all the time consuming drafting routines, in accordance with the standards, in an instant. This relieves the draftsperson to concentrate on the design. This aspect can cause problems when the machine response is inadequate.

Draftspeople who previously produced drawings during long concentration periods find with a slow machine, that their concentration, thought process and flow of ideas is constantly being disrupted by processor delays. This causes great annoyance and frustration to them, and they can be seen annoyingly tapping the desk. They are like jockeys on their mounts in the starting stalls, waiting for the gates to open.

The ideal speed for a PC to run is referred to as the "operator comfort speed" and the latest generation of PCs like the Earth 286 with a clock of 12.5MHz and no wait state fits within this "comfort speed".

As draftspeople become more experienced with CAD, and more systems are installed, the effect of PC speed in relation to operator comfort speed will become more important in relation to productivity.

The general areas where speed is most apparent is in the following areas:

Loading software
Set up of a new drawing
Load existing drawing
Insert library symbols
Load new commands
Paging to disk
Zooming
Panning
Regeneration
Redrawing
Text
Saving
Ending session
Editing
Copy
Move
Array
Erase
Etc.

Taking an average size B1 drawing (140Kb) with reasonable proportions of line work, blocks, text and editing commands and using a popular CAD package like AutoCAD, the table below shows the results that would be experienced. The costing figures are based on producing 85 "average" B1 size drawing per terminal per year.

Further information on the Earth 286 machine is available from Earth Computer Systems, 2.15 Brisbane Street, Eltham 3095.

Earth 286					
10MHz 20Mb Disk	10MHz 30Mb Disk	12.5MHz 30Mb Disk	IBM AT	NEC APC IV	COMPAQ 286
Wait Time (minutes) per DWG					
70	56	42	123	76	84
Wait Time (hours) for 85 DWGs					
99	79	60	174	107	119
Difference (hours)					
39	19	0	114	47	59
Labour costs plus burdens for wait time (one year)					
$1170	$570	0	$3420	$1410	$1770
Labour costs plus burdens for wait time (three years)					
$3,510	$1,710	0	$10,269	$4,230	$5,310

The above figures do not include all the intangible gains made with the speed increase such as performance associated with operator comfort speed.

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BASIC ELECTRONICS. This popular text has now been re-issued. *Basic Electronics* is almost certainly the mosty widely used reference manual on electronics fundamentals in Australia. Written as a basic text for the electronics enthusiast, it is also being used by radio clubs, secondary schools and colleges, and WIA youth radio clubs. It begins with the electron, introduces and explains components and circuit concepts and progresses through radio, audio techniques, servicing instruments, television, etc. If you've always wanted to know more about electronics, but have been scared off by the mysteries involved, let *Basic Electronics* explain them to you. Easily understood diagrams and text make this the perfect introduction to the growing and exciting world of electronics. We've even included five electronic projects for the beginner. **$4.50**

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Solid State Update

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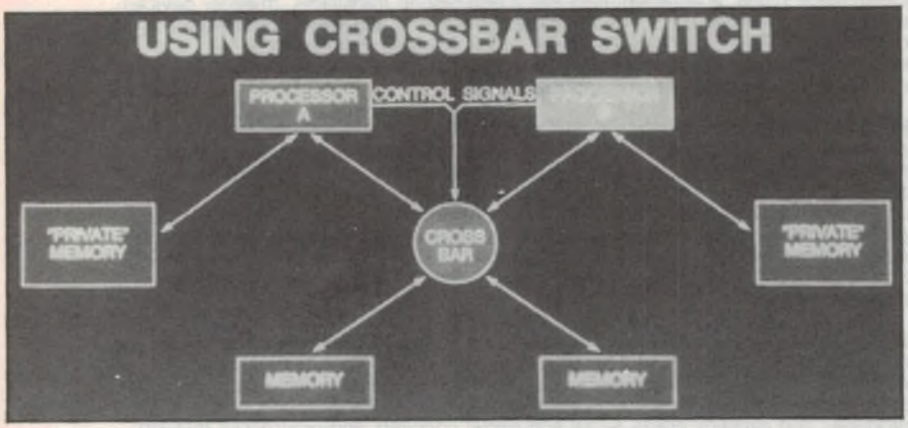


16-port digital crossbar switch

Texas Instruments has introduced a high speed 16-port digital crossbar switch. TI says its 74AS8840 digital crossbar switch eliminates bottlenecks, to speed data through complex bus architectures. It is capable of close-coupling a processor to memory, a processor to a processor, and a processor to input/output ports.

The universal 74AS8840 version of the switch can be used in any system where fast data transfer is critical. Examples include PABX's and computer interfaces with communication networks.

With 16 I/O ports, the flexible 74AS8840 is designed to provide simultaneous access from every port to every port. Sixty-four I/O pins are arranged in 16, separate, four-bit, bidirectional ports.

A single input can be broadcast to any combination of the 15 surrounding I/O ports, or even back to the sending port if operating off registered data, so that the 'AS8840 can switch from one to 16 nibbles of data from input to output in a single cycle. In addition, separate inputs can be broadcast to separate I/O ports simultaneously. This flexible design allows all I/O ports to read the same input or separate inputs at the same time. Port-to-port data transfer takes only 25 nanoseconds maximum regardless of the number of simultaneous broadcasts.

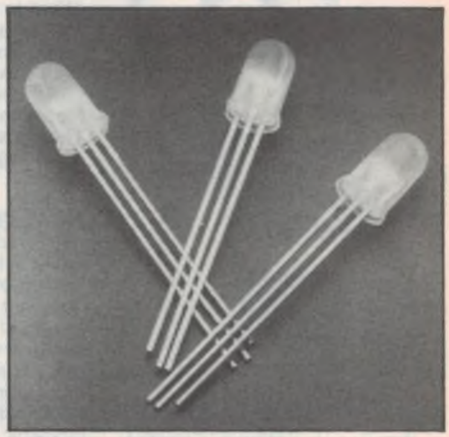
Further details are available from Texas Instruments Australia, 6 Talavera Road, North Ryde 2113.

Bicolour LED lamp

Hewlett-Packard has released a three-leaded bicolour LED lamp in the industry-standard T 1-3/4 package. The new HLMP-4000 is designed for applications where space is limited and two colours of indication are needed: telecommunications equipment, computers and small instrumentation that requires economy of board space and/or battery backup.

The HLMP-4000 has a high-efficiency red and a high-performance green chip on the centre lead of the three-leaded, T-1 3/4 lamp. Leads are spaced 0.05" from each other with the centre lead providing the common cathode.

For further details contact, VSI Electronics (Australia), 16 Dickson Avenue, Artarmon 2064.



High power GTOs, NPN transistors

Westcode Semiconductors, part of Westinghouse Brake & Signal, has announced a new series of gate turn-off thyristor devices for high power control and traction applications. The WG60 series has a nominal RMs on-state current rating of 500A and peak turn-off current of 600A, with a peak reverse gate power of 5kW. Repetitive peak off-state voltage ratings are 1200V for the WG6012 and 1600V for the WG6016 devices respectively. Both devices come in a cylindrical metal/ceramic package 51mm in diameter and 16mm high.

Also available from Westcode are a range of high current single diffused NPN power transistors, the WT4300/4400 series, with Vcbo ratings from 60V to 160V and collector current ratings from 150A to 250A continuous. The WT4300 series has a rated dissipation of 1040W at 25°C, with the WT4400 series rated at 830W.

The company also provides a range of high power transistor modules, for motor control and other high power switching applications. These feature 2500V AC isolation from the heatsink, high DC current gain and low saturation voltage.

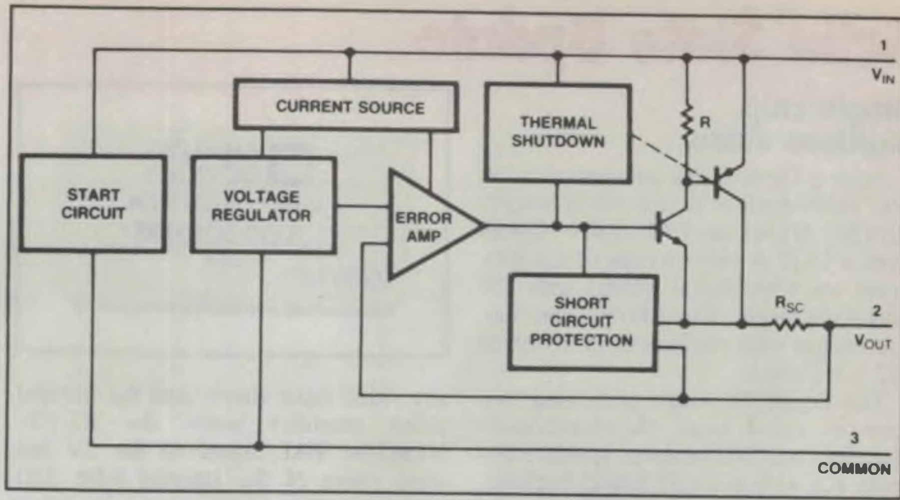
Further information is available from Westinghouse Systems, 80-86 Douglas Parade, Williamstown 3016.

5V/5A three terminal regulator

The 78HO5A positive three terminal fixed linear voltage regulator, manufactured by New Era Electronics, is capable of delivering a continuous load current in excess of 5 amperes at a nominal regulated output of 5 volts.

The 78HO5A has built-in protection features, such as output short circuit current limiting, thermal overload and safe operating area protection. If external conditions exceed the 78HO5A's capabilities, the device temporarily shuts down, protecting itself and the load circuit until the fault is removed.

This feature eliminates costly additional protection circuitry as well as overly conservative heatsinks typical of discrete high current voltage regulator designs. The 78HO5A is hermetically sealed in a TO-204 type packaging providing up to 50 watts of internal dissipation.



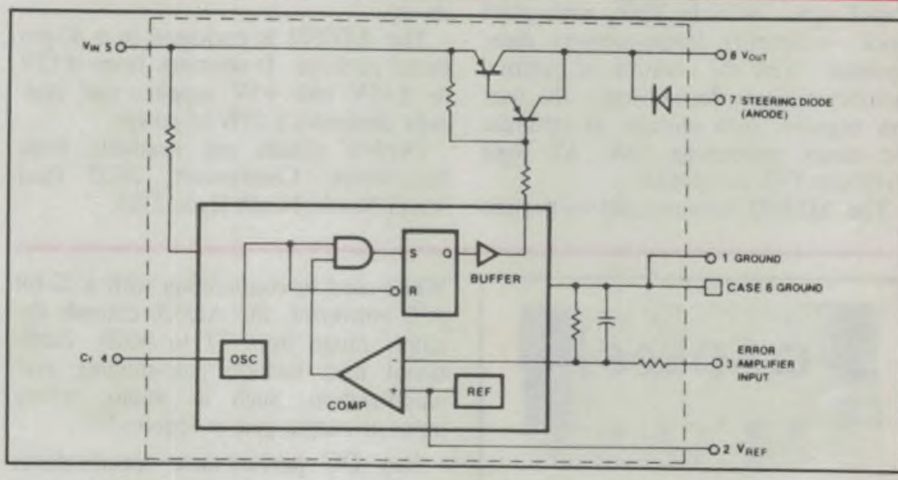
For further information contact George Brown Group outlets or the George Brown Group, Marketing Division, 456 Spencer Street, West Melbourne 3003.

5A switching regulator

The 1605A positive adjustable pulse width modulated voltage regulator building block, manufactured by New Era Electronics is designed for buck type switchers.

Capable of continuous load currents in excess of 5 amperes, the 1605A has an output range of 3 to 35 volts. Its control circuits provide true PWM output regulation in conjunction with a high current/high voltage switch and ultra fast soft recovery free wheeling diode.

Output voltage and switching frequency are adjustable for optimum circuit performance. Internal compensation insures stable operating over a wide range of circuit and ambient conditions. The device comes in an 9 pin metal TO-204 type package.



For further information contact George Brown Group outlets, or the George Brown Group, Marketing Division, 456 Spencer Street, West Melbourne 3003.

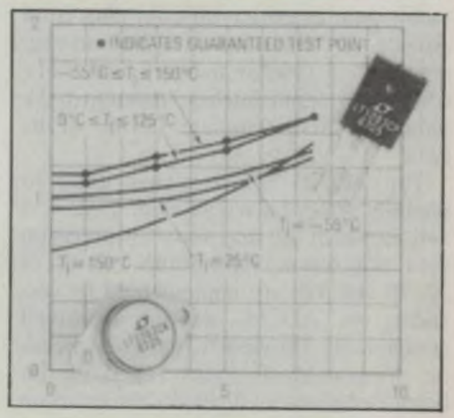
3-terminal regulator is rated at 7.5A

Linear Technology Corporation has introduced the LT1083, a 7.5 ampere low dropout adjustable positive voltage regulator. The LT1083 is pin-compatible with existing three-terminal regulators and is the lowest dropout regulator in its class. It is intended for power regulation in tight enclosures where it can reduce heatsink and fansizes. In some cases its use will eliminate the need for a cooling fan.

Typical applications for the LT1083 include high efficiency linear regulator designs, post regulators for switching power supplies, constant current regulators and battery chargers.

Dropout (Vin-Vout) is guaranteed at a maximum of 1.5V at maximum output current. On-chip trimming adjusts the reference voltage to 1%. Current limit is also trimmed, minimising the stress on both the regulator and power source circuitry under overload conditions. The LT1083 quiescent current flows into the load to increase efficiency, unlike PNP regulators, where up to 10% of the output current is wasted as quiescent current. The current limit is 7.5A minimum, with 9A typical. The input to output differential is 35V maximum.

At 25°C LT1083 typical line and load regulation are 0.015% and 0.1% respectively; thermal regulation is 0.01%/W maximum. The LT-1083 device has internal short-circuit and safe area protection and power dissipation is internally limited; it does not require protection diodes. It is available in TO-3 metal cans and TO-247 plastic packages.



Further details from Advanced Component Distributors, 55 Noreen Street, Chapel Hill 4069.

Solid State Update

Single chip digitises video

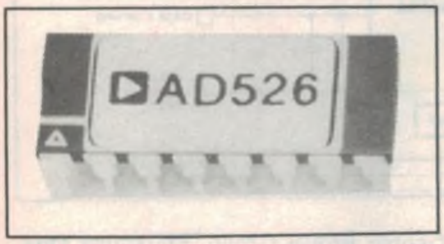
Analog Devices has announced a hybrid video digitiser device which accepts RS-170, NTSC or PAL video signals from a CCD or vidicon camera and produces an 8-bit digital output with 256 gray-scale levels. The AD9502 can digitise images with resolutions in excess of 512 x 512 pixels.

The design of image processing systems is eased since the functionally complete AD9502 replaces multiple discrete ICs with a single hybrid package, saving board space and reducing component cost. The digitiser contains a video amplifier, sample/hold, sync detector and separator, phase-locked pixel clock oscillator, and an 8-bit flash A/D converter. Three control outputs — horizontal sync, vertical sync, and pixel clock — simplify frame-memory management. With the addition of external memory address decode logic, the user can organise data storage to optimise the image processing task. All logic levels are TTL compatible.

The AD9502 automatically locks onto any video input signal, and the internal video amplifier scales the RS-170, NTSC or PAL signal to the 2V full scale range of the internal 8-bit A/D converter. In addition users can compensate for normal variations among cameras by adjusting the gain ±3dB, and offsetting the input amplifier by as much as 10 IRE units for variations in peak-to-peak signal amplitude and DC set-up.

The AD9502 is packaged in a 40-pin metal package. It operates from ±12V to ±15V and +5V supplies and typically dissipates 1.75W of power.

Further details are available from Parameters, Centrecourt, 25-27 Paul Street North, North Ryde 2113.



Digitally programmable gain amplifier chip

A new monolithic software programmable gain amplifier (SPGA) chip from Analog Devices features an on-chip amplifier, a resistor network and TTL-compatible input latches, making it the industry's first complete device of its kind.

The AD526 SPGA allows users to digitally select binary gains of 1, 2, 4, 8 and 16 which are necessary for precision data acquisition applications. Gains of 32, 64 and 128 are implemented by cascading two AD526s, with no additional components. Previously, designers needing programmable gains relied on in-house solutions or hybrid devices; both occupy more space and are more costly.

The AD526 provides the required precision for floating-point analog-to-digital (A/D) conversion, and the "gain code" simplifies setting the exponent. When used in conjunction with a 12-bit A/D converter, the AD526 extends dynamic range from 72 to 96dB. Additional uses include gain-ranging pre-amplification, such as audio, where input or output gain is required.

Key DC performance specifications include guaranteed maximum gain error of 0.01% for gains of 1, 2, and 4 and 0.02% for gains of 8 and 16; maximum nonlinearity is guaranteed at 0.01% of full-scale. The FET input stage yields a maximum 150pA input bias current. Settling time is guaranteed at 4us to 0.01% with a slew rate of 4V/us at low gains and 18V/us at high gains.

Fabricating all of the necessary functions on-chip improves more than just cost and size. The AD526 exhibits better stability over gains and temperature than discrete designs because the resistors are matched on-chip and vary proportionally. A monolithic device is also inherently more reliable than alternatives with a greater chip count.

The AD526 is available in a 16-pin 0.3" wide, side-brazed ceramic DIP and operates from a ±15V supply.

Further information is available from Parameters, at Centrecourt, 25-27 Paul Street North, North Ryde 2113.

Semi laser produces 27mW at 683nm

A semiconductor laser which produces continuous output of 27mW at a wavelength of 683nm has been developed at NEC's Opto Electronics Research Laboratories in Japan.

The new laser diode is an AlGaInP type using transverse mode control, and samples have oscillated continuously for up to 3000 hours. It is expected to be "a few years" before the lasers become commercially available; meanwhile, NEC is apparently working on a unit with 40-50mW output.

One megabit DRAM controller

A new dynamic memory controller chip from Advanced Micro Devices extends DRAM control to the 1 megabit level. AMD's Am29368 1 Megabit Dynamic Memory Controller (MC) optimises DRAM system timing, and supports scrubbing error detection and correction techniques in the control of 16K through 1 megabit dynamic RAMs. The Am29368 acts as the address controller between any processor and the dynamic memory array.

Scrubbing error detection and correction (EDC) techniques allow error detection and correction to be performed during the refresh cycle, with no system timing penalty. The Am29368, in conjunction with the Am2969 Memory Timing Controller and the Am2960A 16-Bit Error Detection and Correction Unit, provides a system solution for the timing and control of high-performance memory systems using EDC.

For memory systems not requiring EDC, the Am29368 can be paired with the Am2970 Memory Timing Controller. For highly accurate system timing, it can be used with AMD's Am2971 Programmable Event Generator, which allows precise timing of up to 12 independent system timing events down to 10ns increments.

The Am29368 has drivers and damping resistors on-chip, easing system design and avoiding interchip skews. The device's high-capacitance drivers on the outputs allow the Am29368 to drive four banks of 16-bit words, for a total of up to 88 DRAMS.

Further details are available from R & D Electronics, 4 Florence Street, Burwood 3125.

Unsung hero of the "flying doctor" service

Most Australians have heard of the Reverend John Flynn, honoured for his founding of the Royal Flying Doctor Service. But few people have heard of his colleague Alfred Traeger, inventor of the pedal-powered radio that made the service possible.

by JIM ROWE

Soon after John Flynn had been ordained as a minister of the Presbyterian Church in 1911, he was given the task of surveying the needs of people living on isolated stations in the vast stretches of the Australian inland. He reported that there was a very real need for medical and other support services, and as a result the Church set up the Australian Inland Mission (AIM), with Flynn as its first superintendent. By 1918 it had set up six nursing homes scattered around the inland, including one at Cloncurry (Qld) and another at Oodnadatta (SA). From these bases a team of "bush padres" toured the outback by road, providing both practical and spiritual help and also forming communications links with the cities.

Alfred Traeger (left), inventor of the pedal radio, pictured with Qantas founder Sir Hudson Fysh in front of an RFDS aircraft at Cloncurry in 1967.

Although the nursing homes and touring padres filled part of the need, Flynn realised that people living in isolated inland areas really needed much more. He dreamed of being able to provide a "mantle of safety" over the outback, by taking advantage of the then-new discoveries of aviation and radio. People living in the inland would be able to use radio to seek help, particularly in times of emergency, while aviation would be used to provide that help quickly.

At the time this seemed very far-fetched, because both technologies were in their infancies. But Flynn doggedly pursued his dream, and in 1921 sought advice from Hudson Fysh (later knighted) of QANTAS fame, regarding the most suitable kind of aircraft for a flying medical service.

It became apparent that the real problem was to provide the people of the outback with practical two-way radios. To be practical they would have to be cheap, and they would have to be self-powered because most outback stations had no way to generate electricity at the time.

On a trip to Adelaide in 1925, Flynn sought advice from Harry Kauper, a radio engineer working at the pioneering radio station 5CL. Kauper suggested that he talk to a young inventor called Alf Traeger, who was working at Hannan Brothers, a local electrical engineering firm.

Alfred Traeger had been born in 1895 at Glenlee, in Victoria, but grew up on a farm at Balaclava, near Adelaide. Of German descent, he had shown an interest in machinery and electricity from a very early age. At the age of 12 he had apparently rigged up a simple telephone system between various buildings at the farm, using all sorts of odds and ends.

A few years later he was able to attend the Adelaide School of Mines, and finally gained his qualification as an electrical engineer. Although shy he was very determined, and fascinated by the newly-emerging field of radio.

John Flynn followed Harry Kauper's advice, and called into Hannan Brothers to see if Alf Traeger had a generator which might be suitable for powering a radio transmitter. Traeger offered one of the existing models, which Flynn bought and took back to his then base at Alice Springs.

Alf Traeger thought little about the incident until about 12 months later, when Flynn contacted him with an invitation to join him at Alice Springs and work on the development of an outback radio network. Needless to say, he accepted immediately. He had no ties, and jumped at the idea of working in a pioneering new field.

Pedal radio inventor Alfred Traeger shown demonstrating one of his remote station sets in 1929. Note the morse key and pedal generator.

The stumbling block was still a low-cost generator to power the remote radio sets. Traeger's first attempt was a hand-powered generator, using a converted emery wheel, but this proved to be impractical. It was extremely difficult to turn the generator handle with one hand, while tapping out messages on a morse key with the other.

Then Traeger remembered reading of a system which the German army had used in World War I, with a pair of bicycle pedals hooked up to a small generator via gearing or chain sprockets. So he rigged up a similar system and found that a seated operator, pedalling slowly and comfortably, could produce about 20 watts — enough to power quite a practical set (even in those days). And the big advantage of pedal power was that it left both of the operator's hands free.

By careful design, Traeger was able to produce a practical pedal generator and radio set costing only 33 pounds. Although nominally the equivalent of $66, in those days it was still quite expensive, as the average weekly wage was only 5 pounds. So 33 pounds then was the equivalent of around $3000 in today's money!

But it worked, and they were finally able to proceed with Flynn's dream of an outback radio network and flying medical service.

John Flynn chose the Queensland town of Cloncurry as the base for the new service, because it had a well equipped aerodrome and was also linked to the expanding telegraph and telephone networks. It also boasted a 40-bed hospital with a resident medical officer and nursing staff.

While Flynn's colleague Dr George Simpson was discussing the proposed service with Cloncurry authorities in 1927, word was received from Mount Isa that a miner had been seriously injured. The mining company chartered a De Havilland single engined DH50 aircraft from QANTAS, and Dr Simpson flew to Mount Isa to tend to the injured man on the flight back to Cloncurry hospital. It was a dramatic demonstration of the viability of a flying medical service, and the authorities were understandably impressed.

Shortly after, on September 9, 1927, the AIM was able to set up the Australian Aerial Medical Service based in Cloncurry, with Dr K. St.Vincent Welch as its first "flying doctor". A DH50 aircraft chartered from QANTAS was modified to carry a stretcher, and became the service's first official air ambulance. It was flown by Arthur Affleck, a top QANTAS pilot. The first official call and flight was from Julia Creek, about 85 miles east of Cloncurry, on May 15, 1928.

Alf Traeger and his assistant Harry Kinzbrunner installed a 200 watt base station transmitter and receiver in the vestry of the Cloncurry Presbyterian Church. Given the official callsign "VJI", it was powered by a motor-generator set in a nearby shed, and operated initially on a wavelength of 88 metres (3.4MHz). Later this was changed to 146.3 metres (2.05MHz).

They initially installed some 10 pedal-powered sets on outlying stations. The sets had a single valve transmitter with 10 watts input, and a two-valve regenerative receiver. Each set took about 2 weeks to install, as they had to teach the station owners how to transmit and receive in morse code.

Within about a year, the system was changed from telegraphy to radio telephone. By the end of 1928, Traeger's pedal radio network was being used not just for medical emergency calls, but for almost every kind of communication — from keeping in touch with the "neighbours" to sending telegrams and listen-

Trying out the first VJI base station in 1927, outside the Cloncurry Presbyterian Church. Alf Traeger is seated with headphones, Rev John Flynn standing behind him with the hat.

ing to news broadcasts from capital city radio stations. Radio had arrived in the bush, and people embraced it with open arms; for a time, Traeger and Kinzbrunner simply couldn't keep up with the demand for pedal radios.

They also made a portable pedal-powered set that could be transported by car or even camel, for the AIM's ground-based bush padres.

Never one to rest on his laurels, Alfred Traeger continued to work for the service for many years. In 1939 he developed an improved two-way radio set for remote stations, powered from batteries by means of a vibrator converter.

In 1941 the official name of the service was changed to the Flying Doctor Service, by which many people had known it. The "Royal" prefix was granted in 1955, four years after the Rev. John Flynn's death in Sydney on May 5, 1951 at the age of 71.

Flynn was always very grateful for Alf Traeger's role in helping to make his dream of a flying doctor service a reality. He is quoted as saying "I must express my deep gratitude to Alf Traeger.

He worked without ceasing, and remained cheerful under the most trying runs of bad luck . . . " Alfred Traeger himself died in Adelaide in 1980, at the age of 85. His son Michael continues the family involvement with radio and electronics.

Bush padre Rev Kingsley Partridge sending a telegram to Cloncurry from outback central Australia in 1934, using Traeger's 8XP portable pedal set.

To commemorate the work of John Flynn, Alfred Traeger and the other RFDS pioneers, the Flynn of the Inland Fund and Cloncurry District Bicentennial Council are building a permanent memorial in Cloncurry. To be known as John Flynn Place, it will contain a museum, outdoor theatre, art gallery and cultural centre.

In the museum will be housed a half-scale replica of the historic DH50 aircraft used to inaugurate the RFDS.

The cultural centre will be named in honour of Alfred Traeger, while the outdoor theatre will be named after Dr Alan Vickers, the longest serving doctor to work from the RFDS base at Cloncurry. The art gallery will have the name of the Very Reverend Fred Mackay, one of Flynn's original offsiders and the man who succeeded him for 22 years as head of the Inland Mission. Rev Mackay is still sprightly at over 80, and is very enthusiastic about the project.

"To know that at last the whole nation will know of the work of these men is one of the most exciting happenings of my life", he said recently. "Flynn and his co-workers spent sweat and blood pioneering the service from Cloncurry. It's a place where I got my baptism of John Flynn's fire."

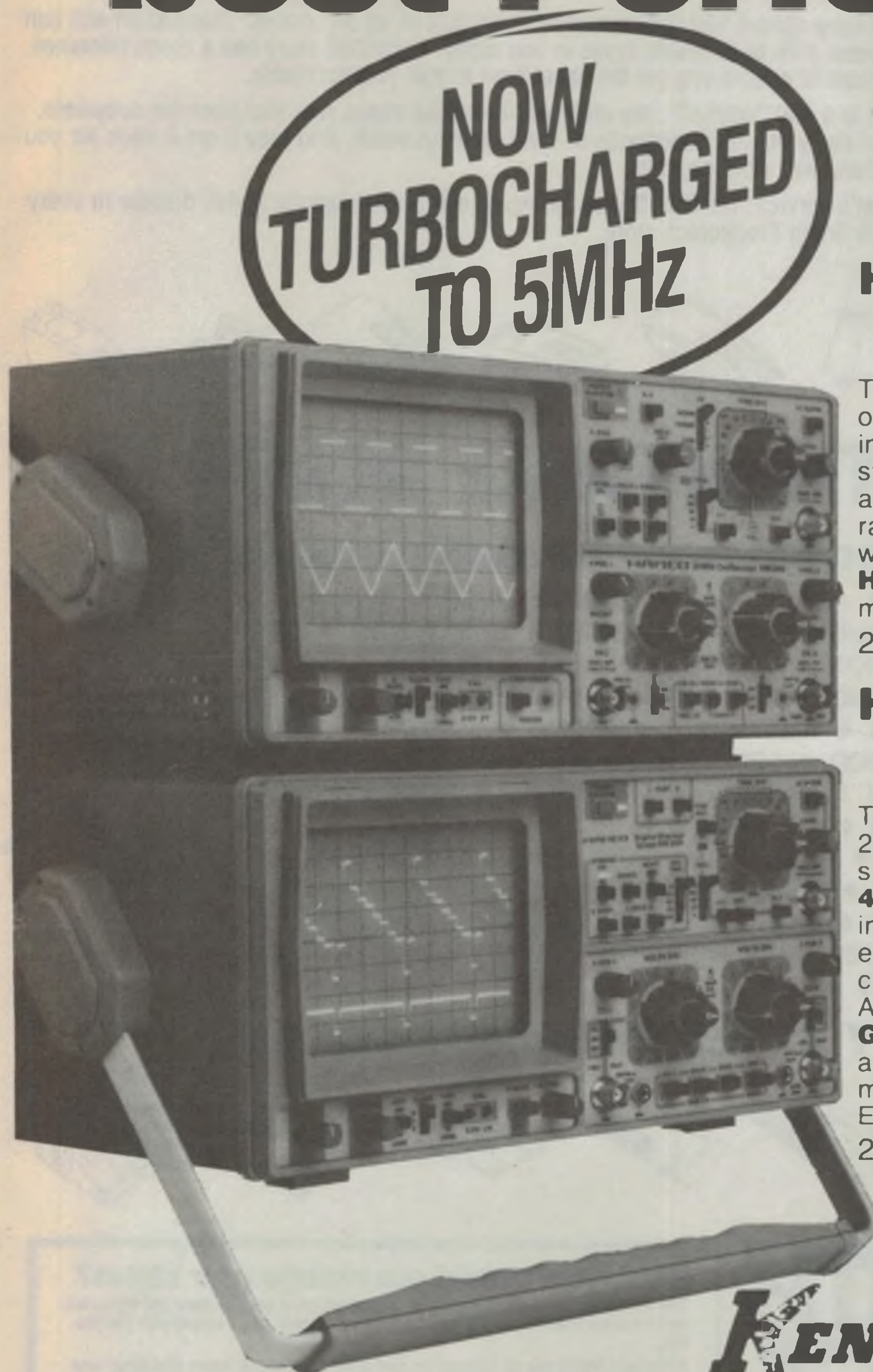
The $1.75 million memorial complex is currently taking shape and looks set to become a major attraction in the central western district of Queensland. It is due to open on April 27, 1988, to coincide with the CSR Hinkler Air Race's stopover in Cloncurry.

The Flynn of the Inland Fund would still welcome donations from any individuals or companies, to assist with the memorial. Donations of $3000 or more will entitle the giver to a plaque at the Flynn Place centre, while donations of $1000 or more will earn foundation membership of the project. Further information is available from Mr Greg Beavis, Fund Secretary at 61 Gregory Street, Cloncurry 4824, or by phoning (077) 42 1757.

The Fund is operating on one of John Flynn's maxims: "If you start an idea, nothing can stop it." Like his earlier dream of a mantle of safety over the inland, the memorial to Flynn, Traeger and their colleagues looks certain to become an enduring reality.

My thanks to Greg Beavis, Angie Testa and the Australian Bicentennial Authority for their help in preparing this story.

Two of our best Performers



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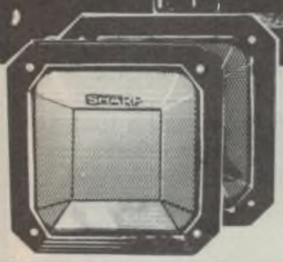

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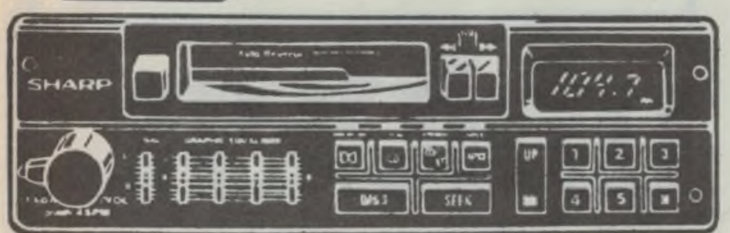

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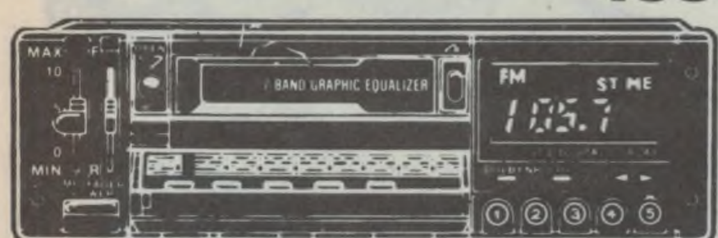

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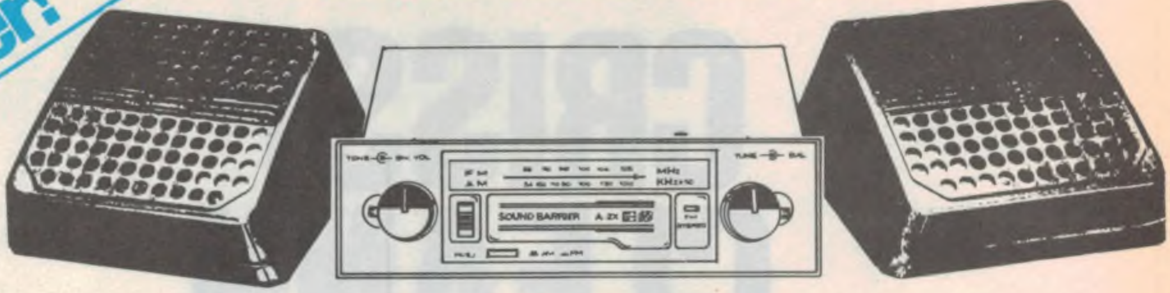

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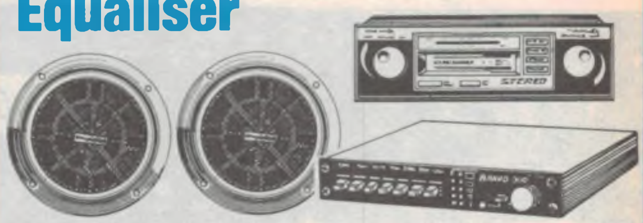

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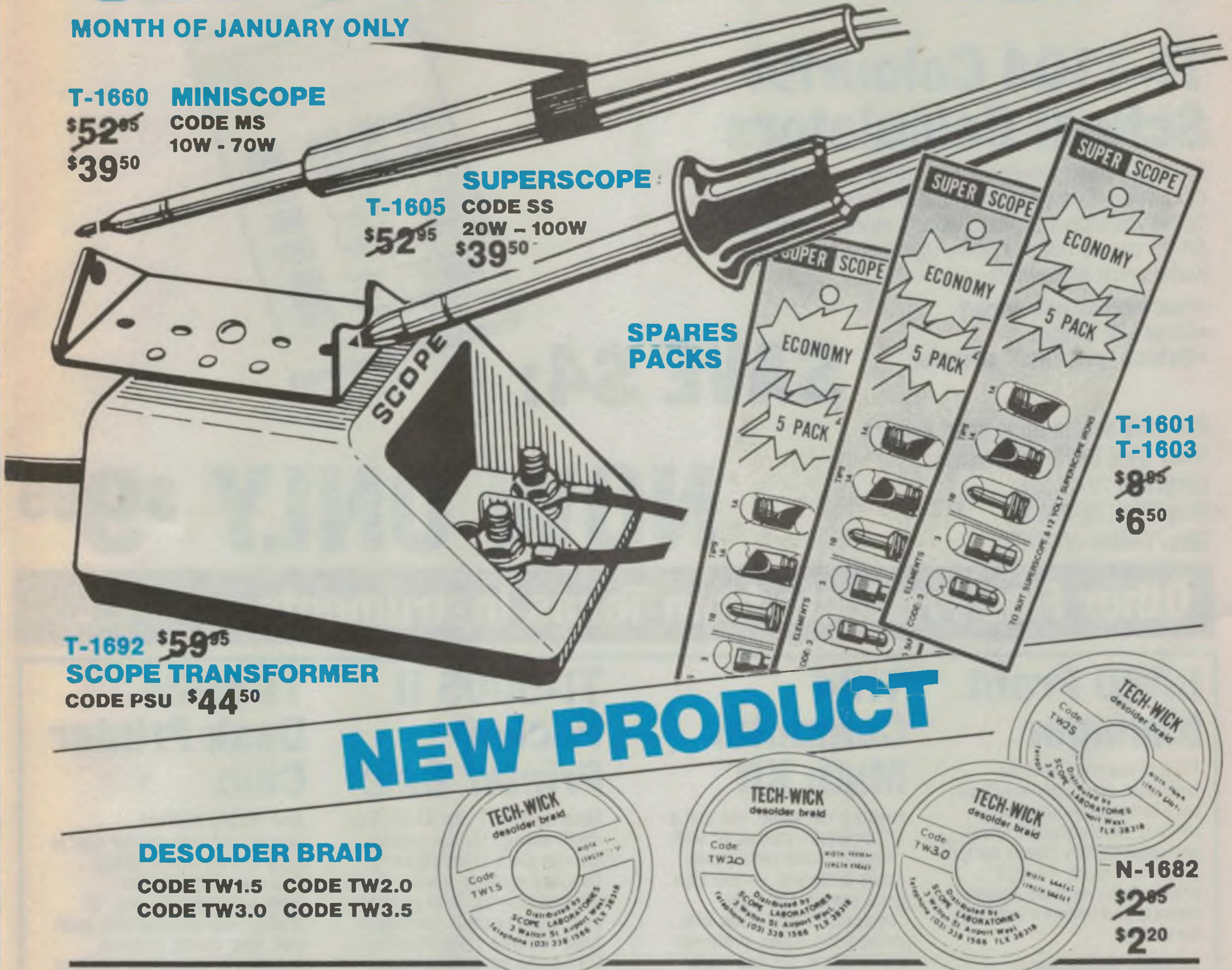

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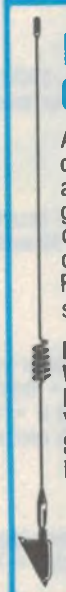

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Just the thing for working on the car, or camping, or...! Built to last with super long cable, cigarette lighter plug and alligator clips for easy connection. At this price it's better value than a torch. Cat A-7210

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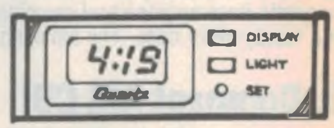


Bargain Car Clock

No clock in the old heap? Or perhaps it just doesn't work? Car clocks always seem to be the first thing to go. This digital car clock is easy to fit, suits most modern cars and has a light for night viewing. Cat A-7464

$7.95

SAVE $5!

100 watt Halogen Driving Lights

If you do any night driving you'll appreciate a good set of driving lights. Kit comes with two lights, wire, switch and all mounting hardware. In matt black finish they look great on most cars.
Round Cat A-7207
Rectangular Cat A-7208

Special $29.95 pr.

DICK SMITH ELECTRONICS PTY LTD

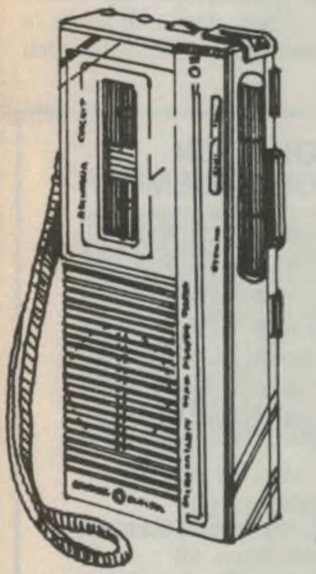
SMALLER THAN

BEN HUR

M.H.G.E. and DSE give you bigger savings and better value on all those little things that make life easy!

Save $40

GE Microcassette Recorder



Pocket sized and perfect for students, executives, journalists, etc. With 2 speeds to save tape, recharging capability, battery LED indicator, mic/ear sockets and top mounted mic so you can leave it in your pocket while you're recording. Cat A-4037

NOW ONLY

$99

New Desk Top Recorder

Slim-line Cassette Recorder from GE. Features built in microphone, auto level control, pause control, auto stop and more! A real work tool at a great price. Comes with AC Adaptor. Cat A-4028

$69.95

With AC Adaptor!

New Voice Activate Microcassette

Hands free recording! Just start talking and the cassette starts recording. Beautifully designed from GE. Features 2 speeds, review/preview, built-in mic, 3-way power option, recharge capability... the lot! Cat A-4039

$159

Low Cost Portable Stereo

Check it out — take it anywhere! Walkie-style Stereo Cassette with great sounding, lightweight headphones and removable belt clip. Who said you had to pay the earth? Cat A-4046

ONLY

$39.95

AM/FM Stereo Headphones

One piece, cordless and nothing to carry on your belt! Amazing sound from these GE Stereo Radio Headphones. They're lightweight, compact and designed for easy operation. Once you hear them, you'll want to own them! Cat A-4303

$79.95

Microtape Twin Packs

Value plus! Pack of two quality Microcassette Tapes. Each 60 minutes long so you'll have it when you need it. Fits ALL microcassette recorders. Cat C-3073

ONLY

$13.95

DICK SMITH ELECTRONICS
PTY LTD

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.

Wireless Weekly 3d

January 1938

March to Nationhood: The Anniversary Celebrations Committee has arranged for Amalgamated Wireless to place 70 loudspeakers along the route of the March to Nationhood on January 26. These will enable spectators to hear a description of the historic landing at Farm Cove, and of other incidents of interest in the course of the procession.

Valve and Circuit Tester: The Paton Electrical Instrument Company has just released a new meter which should appeal to all radio dealers and service men. It consists of a complete valve and circuit tester, which is not only a meter with wide applications, covering resistance measurements to 10 megohms, volts to 1000, both AC and DC current in four ranges to 250mA, but is also equipped to test valves, electrolytic condensers, and also paper and mica condensers.

RADIO, TELEVISION and HOBBIES

January 1963

Alumina Film: A new ceramic material — cast alumina film — has properties which make it suitable for a wide range of applications, including the manufacture of capacitors for the electronics industry, in which it replaces mica. Its advantages are high insulation resistance and good power factor.

This film can be supplied in sheets down to 0.005in thick. The sheets can be bonded together to form laminates of exceptional strength with high resistance to mechanical or thermal shock. Furthermore, complex shapes can readily be stamped out during manufacture.

Ultrasonic Welding: An ultrasonic spot-welder in prototype form has been tested with aluminium sheet one-hundredth of an inch thick and has achieved speeds of 20 feet of seam-welding per minute with the comparatively small input of 60 watts.

To carry out this work, pressure on the vibrating welding stub was 10lb, the transducer produced a frequency of 20 kilocycles and the amplitude of vibration was 0.0004 inch.

The vibration breaks up films on the surfaces to be joined and then heats the metals in contact by friction till they seize together.

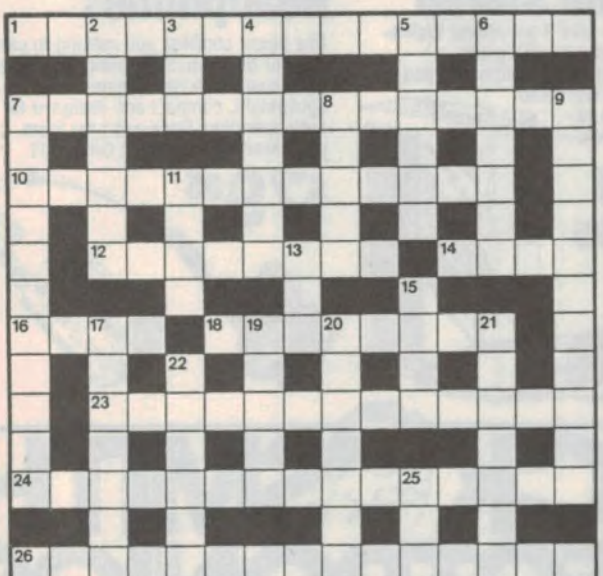
Music Analgesia: Doctors are investigating the playing of music as a means of easing childbirth.

Details were given to the recent International Congress of Psychosomatic Medicine and Childbirth by two Italian obstetricians of how they used music to help the women committed to their care.

JANUARY CROSSWORD

ACROSS

1. Modern system of centralised car-door control. (8,7)
7. Accurate device for measuring mass. (8,7)
10. Each of these would provide a range of temperature settings. (8,5)
12. Cutting short the time taken for tuning? (8)
14. Check data on VDU. (4)
16. Exclamation associated with mild shock. (4)
18. It conducts copper for burglar alarm in the States! (5,3)
23. Process of recording output of an electrometer. (13)
24. Said of particles pulled to positive poles. (15)
26. Let's face it, they reduce skin friction. (8,7)



DOWN

2. Boiling point of an electric jug? (7)
3. If its fuse blows, blast! (1,1,1)
4. This is elementary for the most dense. (7)
5. Made telephonic contact. (6)
6. Said of charged particles. (7)
7. Expire by admittance of massive shock. (11)
8. State of fused fuse. (5)
9. Conducting liquid. (11)
11. Wire left for future connection. (4)
13. International Standards Organisation. (3)
15. Australian Council for Educational Research. (1,1,1,1)
17. Lead, as in phase difference. (7)
19. Relation between transformer windings, etc.(5)
20. Speakers of the lower class? (7)
21. Record label literally allowing lots of replays. (7)
22. Musical group of six. (6)
25. Electronics manufacturers (actually seen in faraway Hawaii and Ottawa)! (1,1,1)

SOLUTION FOR DECEMBER

Professional Standard Electronic Components from the real professionals – Westinghouse

Melbourne: (03) 397 1033, Sydney: (02) 525 2222, Brisbane: (07) 275 3188, Adelaide: (08) 212 3161, Perth: (09) 447 8844.

RFI Suppression Filters

Electronic equipment which draws power from mains must be protected from mains-born interference at frequencies up to 300MHz as well as preventing high frequency interference being fed back into mains as defined in international regulations. **Wide range available.**

RFI Suppression Chokes

Current compensated chokes are used for suppression of high interference levels such as from ultrasonic generators, rectifiers, switched mains equipment etc. **Wide range available.**

NSG 432 Line Interference simulators

The aim of these compact devices is the simple and low cost simulation of static discharge NSG432.

High Voltage Testers

The equipment NSG509/510 permit the test of insulation (hipot) on systems and equipment with a variable leakage current according to international standards. Both comply with worldwide safety standards.

Pulse Transformers

Igniting thyristors and triacs;driving bipolar transistors, preferred in the main power transistors in switching applications; line coupling transformers in high speed data transmission.

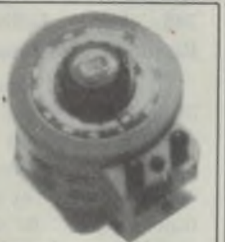
Wide range available.

Low Profile Transformers

These low-profile transformers are specifically designed to be mounted directly on printed circuit boards and, because of their minimal height, are ideal for use in compact electronic circuits and equipment. **Ask for details.**

Variable Auto Transformers

'Dimmerstat'. Input: nominally 240V; output; 0-270V; Current range: 3/4A-28A single phase 2A-200A 3 phase



Hockey Puck Transistors

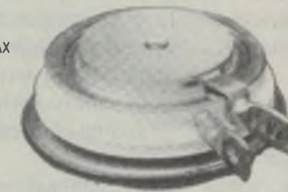
One of a large range of Westcode power transistors.

Up to 300A I_C (PEAK) and V_{CEV} of 1400V.

Gate Turn-Off Devices – 'G.T.O.s'

Available up to 1600 V_{DRM} and MAX I_T (RMS) of 500A.

Ask our engineering dept for details



Fast Recovery and Rectifier Diodes

Part of a large range of Westcode rectifier diodes. From 17A to 4310A. Maximum VRRM of 4400V – DO4, DO5 style up to large capsule assemblies.

High Power Thyristors

From Westcode – phase control thyristors, fast turn off thyristors and high frequency up to many thousands of ampere.

High Power Transistor Modules

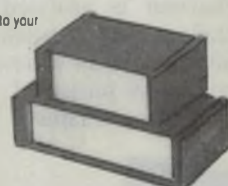
Westcode transistor modules for use in motor controls and high power switching, and consist of insulated type Darlington Transistors. Electrodes are fully isolated from heat sink. Single ended electrode construction simplifies mounting. Devices with current capability up to 400A and voltage rating up to 1400V available.

Computer and Video Protector

The unit incorporates a potted line filter (single stage or two stage with earth line choke) and a metal oxide varistor supplying clean output voltage to an integral three pin 10A socket for equipment connection. The computer and video protectors are available in 1, 3, 6 and 10A.

Instrument Cases

Series 100 and 75. Gives fully professional appearance to your finished product. Very strong, rigid and lightweight. Durable anodised finish – no painting required. Max. width of the housings is 2000 mm.



Bridge Rectifiers

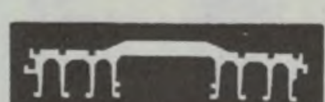
A full range of encapsulated single phase bridge rectifiers is also available with ratings up to 1000V PIV and 100A.

Vista VX PCB Inspection Equipment

The ultimate inspection equipment and a worthy successor to our proven Vista and Vista 5. Vista VX is a superb screen image offering variable magnification and direct access to the workpiece.

Heat Sinks and Mounting Hardware

A full range of aluminium extruded heatsinks and suitable mounting clamps are also available. The range includes bar-clamps, box-clamps, special insulators and heat transfer compound.



HAWKER SIDDELEY

Westinghouse BRAKE & SIGNAL COMPANY

SYSTEMS

WS39

80-86 Douglas Parade., Williamstown, Victoria.
Postal Address: (P.O. Box 267, Williamstown, Vic. 3016)
Ph: (03) 397 1033, Tlx: 37477 Wessys, Fax: (03) 397 1861

Books & Literature

DX listening guide

BETTER RADIO/TV RECEPTION, by Ashok Nallawalla, Arthur Cushen and Bryan Clark. Published by Ashley Publishing, 1986. Soft covers, 281 x 209mm, 125 pages. ISBN 0 9588532 0 7. Recommended retail price $19.95.

An introductory and reference book for the person who wants to go into radio and TV reception more deeply, perhaps with a view to taking up short-wave listening or "DX-ing" as a hobby. The authors are all well-known and experienced short-wave listeners, while Ash Nullawalla is also a radio amateur and co-author of a series of books on personal computing. Long-time readers of *EA* may recall that Arthur Cushen wrote a short-wave listening column in the magazine for many years.

In this book they've produced a very practical and helpful compendium of information, not off-puttingly technical but at the same time with enough "meat" to give the more serious reader a sound understanding and enable them to get the best reception.

It begins with a general overview of radio transmission and reception, propagation basics and a glossary of radio jargon. Following chapters then deal with the various broadcasting bands and their characteristics; receivers; antennas; advanced topics such as test instruments; the main international broadcasters; and the hobby of radio DX-ing. A set of appendices at the rear give sample reception reports, useful addresses and details of the authors.

The text is well written, and easy to follow. There are not perhaps as many illustrations as one might like, but nevertheless quite a few. The book appears to have been produced using a desktop publishing system, and the text is set in full-width single column format.

My impression overall is that it will be found both interesting and of considerable value — not only by the budding short-wave listener, but also by people such as migrants simply wanting a guide to setting up a receiver for reliable reception of broadcasts from the "old country".

The review copy came direct from the publisher, but copies are apparently available from Emtronics (all branches), Jaycar Electronics (Sydney), McGills and the Technical Book Shop (Melbourne). It is also available by mail order from High-Tech Media, PO Box 35, Drysdale 3222. New Zealand readers can also obtain it directly from Arthur Cushen, at 212 Earn Street, Invercargill 9501, for NZ$25 postpaid. (J.R.)

CMOS user guide

CMOS CIRCUITS MANUAL, by R.M. Marston. Published by William Heinemann, 1987. Soft covers, 217 x 139mm, 190 pages. ISBN 0 434 91212 3. Recommended retail price $35.00.

A useful reference and ideas book on CMOS integrated circuits and their use, written for the technician, student or hobbyist.

It begins with a discussion of the basic operation and characteristics of CMOS transistors and inverters, and general aspects such as electrostatic protection and design rules. Then the 4007UB device is examined, as the simplest readily available CMOS device. Its behaviour is analysed in considerable detail, as both a switch and a linear amplifier, and then various practical circuit applications presented.

Following chapters then discuss inverter, gate and logic circuits; bilateral switches and selectors; clock generators; pulse generators; clocked flip-flops; up and up/down counters; down counters and decoders; and finally miscellaneous circuits.

The text is written in a clear, down to earth style and is well supported by illustrations. There isn't a great deal of maths, but nonetheless the subject is presented in a thorough and comprehensive manner. The emphasis is largely on nominally "digital" devices, but with a reasonable amount of information on linear applications.

In short, a useful reference book on CMOS integrated circuits and their application.

The review copy came from the Australian office of the publisher, but copies should be available from all major and technical bookstores by the time you read this. (J.R.)

Electrostatic speakers

ELECTROSTATIC LOUDSPEAKER DESIGN AND CONSTRUCTION, by Ronald Wagner. Published by Tab Books, 1987. Soft covers, 234 x 188mm, 248 pages. ISBN 0 8306 2832 0. Recommended retail price $24.95.

Electrostatic loudspeakers have been around for a great many years, but have never become as widely used as the familiar electromagnetic variety. This isn't because they give poorer reproduction — quite the contrary, in fact. The problem us that for a given amount of sound, they have to be very much larger (at least in area). And in this era of small living rooms and "bookshelf" hi-fi systems, this puts them at something of a disadvantage.

There's another problem nowadays, as well: electrostatics are very high impedance devices, and need very large drive voltages (like *thousands* of volts). In the days of valve amplifiers this wasn't too much of a problem, but with modern solid state amplifiers it can be fairly messy.

For those who are prepared to persevere, however, the results can be very impressive indeed. A pair of sizeable electrostatic loudspeakers properly driven can produce absolutely *electrifying* sound (sorry for the pun!). Warm, smooth bass and almost breathtakingly transparent treble — it almost has to be heard to be believed.

And the good thing about electrostatic speakers is that unlike the electromagnetic variety, they *can* be made by hobbyists, using relatively simple tools and easy to obtain materials.

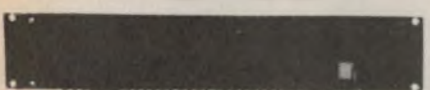
Continued on page 175

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,500 sold!

For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.



POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER

- 1% Metal Film resistors

SPECIAL, ONLY $399
SAVE $50

... developed by ... ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms (per channel)
POWER AMPLIFIER: 100W RMS into 8 ohms (+ 55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0 - 0.4 dB 2.8Hz to 65KHz +0 - 3 dB. NOTE: These figures are determined solely by passive filters
INPUT SENSITIVITY: 1 V RMS for 100W ouput
HUM: 100 dB below full output (flat)
NOISE: 116 dB below full output (flat, 20KHz bandwidth)
2nd HARMONIC DISTORTION: <0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + - 56V SUPPLY rated at 4A continues <0.0003% for all frequencies less than 10KHz and all powers below clipping
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above)
INTERMODULATION DISTORTION: 0.003% at 100W (50Hz and 7KHz mixed 4:1)
STABILITY: Unconditional

Cat. K44771 .... **$449**
Assembled and tested $599
packing and post $10

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER

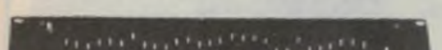
- 1% Metal Film ...

SPECIAL, ONLY $359
SAVE $40

... believe that dollar for ... commercial unit available that sounds as ...

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input: 15Hz - 130KHz, +0, -1dB
Low-Level input-conforms to RIAA equalisation + - 0.2dB
DISTORTION: 1KHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V) -92dB flat -100dB A-weighted. MM input: master full, with respect to full output (1.2V) at 5mV input 50ohms source resistance connected -86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal -71dB flat -75dB A-weighted

Cat. K44791 .... **$399**
Assembled and tested $699
packing and postage $10



THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands ...

SPECIAL, ONLY $209
SAVE $30

Cat. K44590 .... 1 unit **$239**
.... 2 units **$429**
packing and postage $10

SERIES 4000 SPEAKERS

8 Speakers .... only $549
8 Speakers with Crossovers ... $795
Speaker Cabinet Kit (complete) $395
(Please specify cabinet to suit 7" or 8" mid range woofer)
Crossover Kits $295
Complete kit of parts (speakers, crossovers, screws, innerband boxes.) $1,095
Assembled, tested and ready to hook up to your system ... $1,295
(Approximately 4 weeks delivery)

Errors and Ommissions Excepted

30 V/1 A FULLY PROTECTED POWER SUPPLY

The last power supply we did was the phenomenally popular ETI 131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both volatage and current metering is provided. (ETI Dec. 83) ETI 162

Cat. K41620 .... Normally $73.50
SPECIAL, $63.50

KITS

ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes. (ETI May 83) ETI 164

Cat. K41640 .... **$11.95**

BIPOLAR PROM PROGRAMMER KIT

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188/288, 82S23 & 82S123 etc. (ETI June 83) ETI 688

Cat. K46880 .... **$69.95**

SERIES 4000 STEREO PREAMP

This high performance project is designed to complement ETI's 60 watt low distortion amplifier module and forms part of a complete stereo system, the "Series 4000" project. (ETI 471) (Top Projects Vol. 6)

Cat. K44710 .... **$59.95**

GENERAL PURPOSE PREAMPLIFIER

A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders or microphones by changing a few components. (ETI445) (ETI July '76)

Cat. K44490 .... **$9.95**

OP AMP TESTER

The Op Amp Tester which could save you hours in agonising whether that old op amp thats been sitting in the draw for the last year. (ETI April 85, ETI 183)

Cat. K41830 .... Normally $26.50
SPECIAL, $21.50

150W MOSFET POWER AMPLIFIER

Here's a high power, general purpose 150W Mosfet Power Amp Module! Suitable for guitar and P.A. applications and employing rugged reliable Mosfets in the output stage. (ETI 499) (ETI March 82)

Cat. K44990 .... **$97.50**
(Heatsink not included)
plus transformer $49.50

1W AUDIO AMPLIFIER

A low-cost general-purpose 1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov. 84)

Cat. **$9.95**

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system. (EA Oct. 84) 84MS10

Cat. K84100 .... Normally $26.95
SPECIAL, $16.95

PLAYMASTER 300 WATT AMPLIFIER

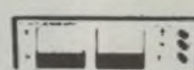
This module will deliver up to 200 watts into an 8 ohm load and up to 300 watts into a 4 ohm load. Comprehensive protection is included and a printer circuit board brings it all together in a rugged easy-to-build module. It can be built in either fully-complemetary or quasi-complementary versions, so output transistor shortages should be no problem at all. (80PA6) (EA July 80)

Cat. K80060 .... Normally $109
SPECIAL, ONLY $99
(Heatsink not included)

ELECTRIC FENCE CONTROLLER

Restore discipline to the farm or allotment with this new electric fence controller. It features higher output power and lower current drain than the previous design for use in rural areas. (EA Dec. 85. 85ef11)

Cat. K85110 .... Normally $49.95
SPECIAL, $45.95



50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design. (Ea May,June 83) 83PS5

Cat. K83050 .... **$199**

50 W AMPLIFIER MODULE (ETI 480)

Cat. K44880 .... Normally $31.80
SPECIAL, $24.95
(Heatsink optional extra)

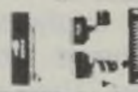
100 W AMPLIFIER MODULE (ETI 480)

Cat. K44801 .... Normally $34.80
SPECIAL, $26.95
(Heatsink optional extra)

LOW BATTERY VOLTAGE INDICATOR

Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure, and makes a handy beginner's project. (ETI 280, March 85)

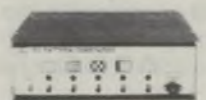
Cat. K42800 .... **$9.95**



MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an RS232 connector or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel Centronics interface printers. Save money by building this interface. (ETI Jan. 84) ETI 675

Cat. K46750 .... Normally $49.50
SPECIAL, $29.50



CRYSTAL CONTROLLED TV PATTERN GENERATOR

Anyone wishing to obtain the maximum performance from a colour TV reciever needs a pattern generator. Why not build this superb unit which provides five separate patterns: dot, crosshatch, checker board, grey scale and white raster? **Note:** The RIE kit includes a large ABS type case! (80pg6, EA June 80)

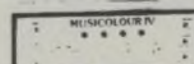
Cat. K80033 .... **$99.95**

MAIL ORDER HOTLINE
008 335757 (TOLL FREE)
LOCAL: 543 7877

RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr. 83)

Cat. K47330 .... **$19.95**



MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto coupled switching for increased safety. (EA Aug. 81) 81MC8

Cat. K81080 .... **$114.95**

MULTI SECTOR ALARM STATION

Protect your home and possessions from burglars with this up to the minute burglar alarm system. It's easy to build, costs less than equivalent commercial units, and features eight seperate inputs, individual sector control, battery back up and self-test facility.

Specifications
- Eight sectors with LED status indication
- Two delayed entry sectors
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds, exit delay variable between 5 and 45 seconds, alarm time variable between 1 and 15 minutes
- Resistive loop sensing: suits both normally open and normally closed alarm sensors
- Battery back-up with in-built charger circuit
- Built-in siren driver

The RIE kit includes a superb printed and prepunched metal case and inside metal work, plus a gell battery! Unbeatable VALUE!

K85901 without battery backup ~~$134~~
SPECIAL, $115
K85900 complete kit ~~$159~~
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Principles of Logic Analysis — 2

In this second of our short series of articles on the basic principles of logic analysis, we first look at the conventional measuring instruments which can be used in logic circuits, and their suitability. Then we look at logic analysers, and the way they work.

by WOLFGANG SCHUBERT

To begin this month, let us first consider the various measuring instruments which can be used in logic circuits and their suitability for the various measuring problems.

Voltmeter

In the digital field, a voltmeter can only be used for the measurement of supply voltages and static signals because the response of the voltmeter is far too slow to register brief changes in signals.

Oscilloscope

In addition to the measurements possible with a voltmeter, an oscilloscope can be used to analyse repetitive processes. Level errors can be detected using an oscilloscope. A multibeam oscilloscope can be used to provide quantitative information on the timing relationship of signals.

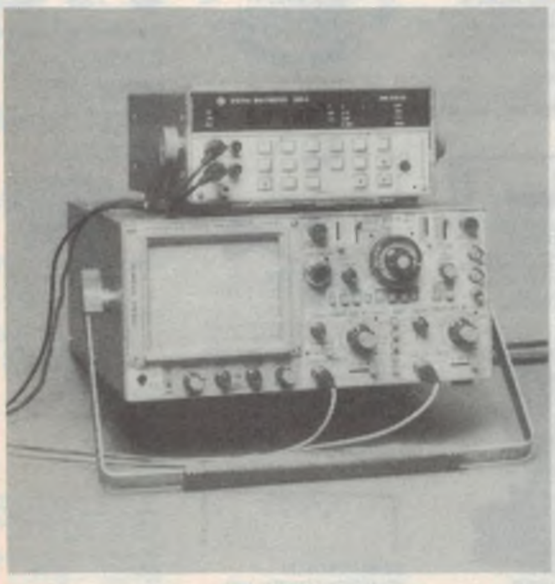
Before an oscilloscope can be used successfully with such types of measurements, it is necessary for the examined processes to be periodic since a stationary oscillogram cannot otherwise be obtained. The use of storage oscilloscopes to analyse single events is usually difficult because the oscilloscope triggering must be set "blind" in the case of single or seldom events and the measurement may have to be repeated very often before a meaningful oscillogram is obtained.

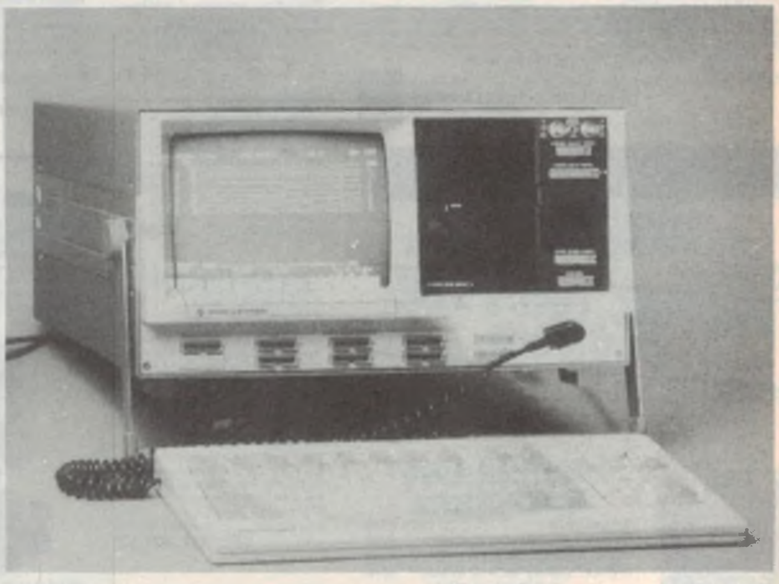
Development system with in-circuit emulator

The in-circuit emulator of a development system replaces the CPU in a microprocessor circuit and enables the CPU program to be executed step-by-step, with a view to gaining an insight into the internal processor registers as well as the external memories and peripherals connected to it.

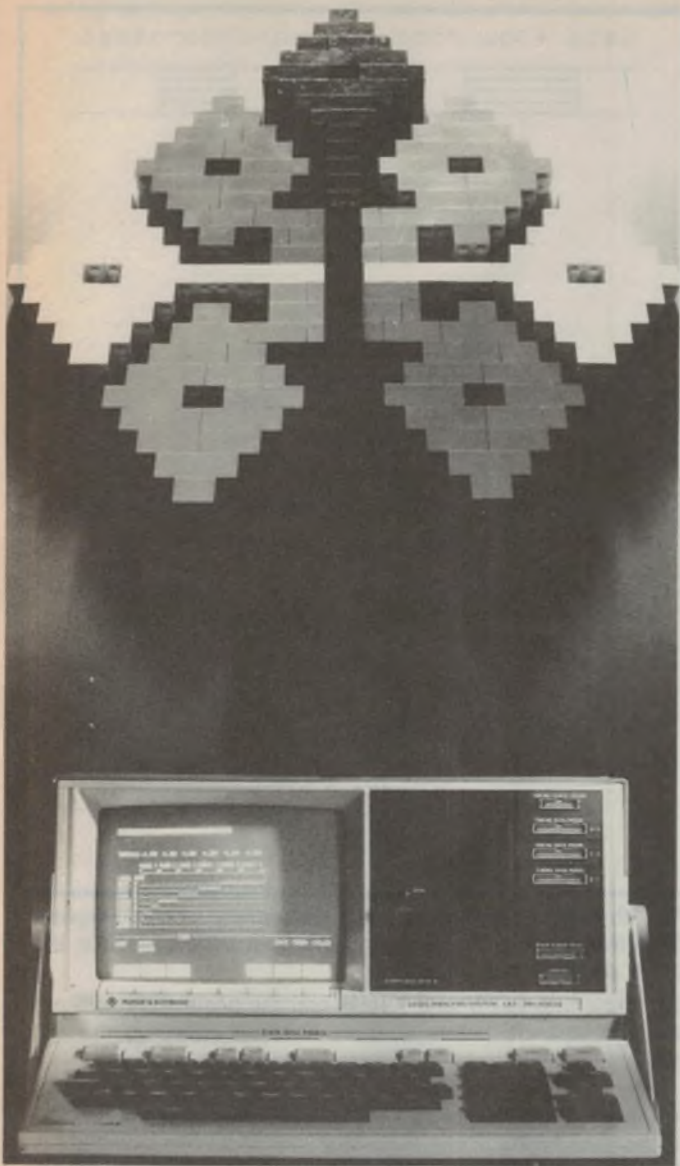
Many users believe that they do not require a logic analyser if they use an in-circuit emulator for test purposes. This is not correct, for several reasons:

- This means for filtering out relevant sections of the program using an in-circuit emulator are very limited compared to the possibilities offered by a logic analyser.





Conventional test instruments like a voltmeter or oscilloscope (left) are of limited use in checking logic circuits. A logic analyser like that at right is much more suitable.



The LAS logic analyser system from Rohde & Schwarz, capable of both state and timing analysis as required.

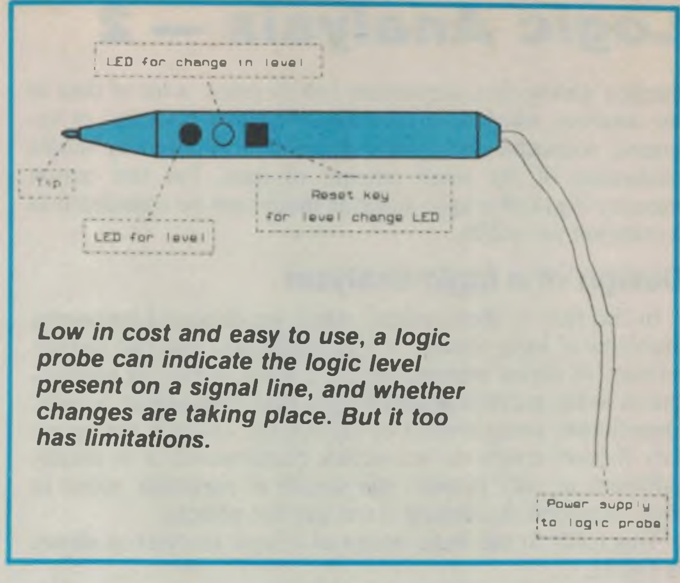
- Many in-circuit emulators do not operate in real-time. Errors which only occur at the full operating speed cannot be detected by them.
- The in-circuit emulator replaces the microprocessor and therefore only "sees" events which can be detected by the processor. Faults in the peripheral units connected to the circuit cannot be detected.

It is often only possible to detect the *effects* of hardware malfunctions, but not the causes.

Example: Because of a fault in the address decoding for the memory modules of a microprocessor circuit, all write events of the microprocessor are simply lost instead of entering the addressed RAM location. The in-circuit emulator can no longer read the supposedly written cell; the fact that it was not even physically addressed remains undetected.

Logic probe

The logic probe is a very useful instrument for answering elementary questions in logic circuits: what is the level of a signal line and has this line changed its level at some time? But it is obviously not suitable for more detailed measurements.



Low in cost and easy to use, a logic probe can indicate the logic level present on a signal line, and whether changes are taking place. But it too has limitations.

Of the measuring problems mentioned in the previous article, the following cannot be solved satisfactorily using the previously mentioned instruments:

- Simultaneous monitoring of a large number of test points.
- Analysis of discontinuous events
- Analysis of single events

These tasks, and many more, can be solved using a logic analyser. The principle and mode of operation of logic analysers will now be explained.

Objective: data reduction

Each digital system can be considered as a data source which continuously outputs data during operation. These data are usually present at the same time as a clock: such circuits are referred to as synchronous circuits.

In order to obtain information on whether a system is functioning correctly, the data can be tested to see whether they correspond with the values expected for intact systems. This method of direct comparison between a good circuit and a circuit of the same type is often used with automatic test setups but can no longer be considered if no "good" circuit is available as a reference or if more information is required than simply Go/Nogo.

A different method is used in logic analysis. The required result can be considered as a bit which is then zero if the circuit does not function, and one if it functions correctly. The function of the logic analyser then becomes a data reduction function: the data flow, which can be of any width and basically of unlimited duration, output by the device under test is to be reduced according to criteria set by the user to generate the "bit" which provides information if the circuit is operating correctly or not.

This data reduction takes place in two steps: during the data acquisition stage, parts of the unlimited data flow are filtered out and stored if they are relevant to the information concerning correct functioning.

There are two possibilities for data evaluation:

- The stored data are displayed in such a manner that the user themselves can easily generate the Go/NoGo bit. This could be referred to as "user-based postprocessing".
- The stored data are processed in the logic analyser by intelligent evaluation programs and the information concerning correct functioning appears directly on the monitor.

Two procedures to generate the "bit" are conceivable, because data reduction takes place in two steps: a limited re-

Logic Analysis — 2

duction during data acquisition and therefore a lot of data in the analyser which may then be difficult to evaluate, or extensive reduction during data acquisition followed by simple evaluation of the small amount of data. For this reason *memory depth* of a logic analyser should not be considered as a criterion for quality.

Design of a logic analyser

In the first of these articles when we discussed measuring problems of logic circuits, it was emphasised that two characteristics of digital systems permit a lower degree of sophistication in the measuring instruments than with analog circuits. Quantitative measurement of the voltage values is not necessary if level errors do not occur. Furthermore, it is usually sufficient to only monitor the signals at particular points in time, provided that timing errors are not present.

This leads to the basic design of a logic analyser as shown in Fig.11.

A logic analyser consists of a memory, a sequence controller, a clock generator, a computer, a display (screen) connected to the computer and external data and clock probes via which the device-under-test is connected. The probes are comparators programmed to the thresholds of the logic family to be analysed and therefore only output the information HIGH or LOW.

Data are applied from the data probes, to the memory if a clock signal occurs and if the sequence controller requests this. The clock may come from the device-under-test itself (external clock) or from the clock generator in the logic analyser (internal clock).

The sequence controller is a circuit programmed by the computer prior to recording according to inputs made by the user. It monitors the input data and requests the memory to accept data. At the end of recording, the data collected in the memory are evaluated by the computer and displayed.

Differences between logic analysers and oscilloscopes

Fig.12 shows, using an analog signal sequence for illustration, how the simplifications of the actual signal sequence during storage in the logic analyser, namely the division of the levels into LOW and HIGH and the acquisition of these levels at discrete points in time, have an effect on the display.

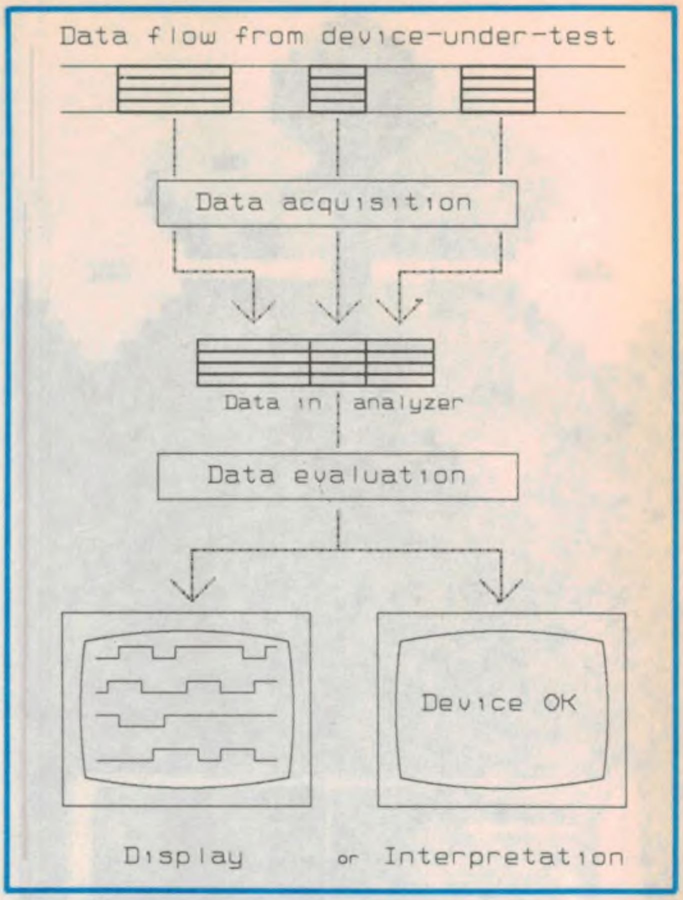


Fig.10: Logic analysis consists essentially of two stages of data reduction; one during the acquisition of data, the other during its evaluation.

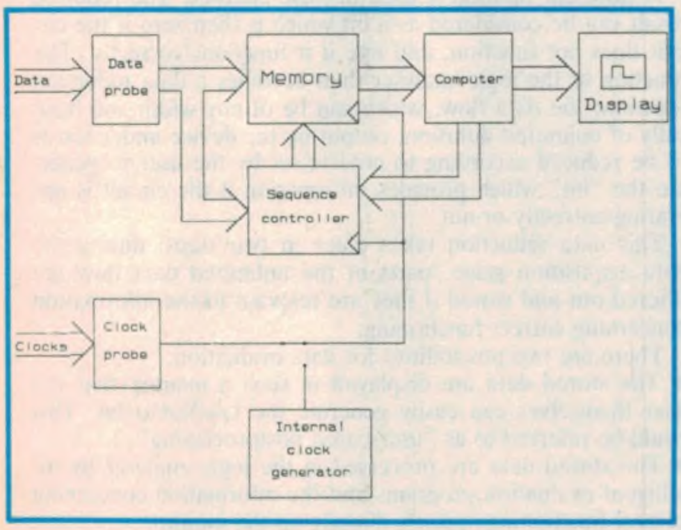


Fig.11: The basic design of a logic analyser. Data is strobed into a memory, analysed and displayed.

The top curve shows the actual analog signal and how it would be displayed on an oscilloscope. This signal is applied to the data probe of the logic analyser. If the set threshold is 0 Volt, the level-discrete signal shown in the centre results at the input to the logic analyser memory.

This signal is only applied to the memory when a clock occurs. The result is a level-discrete and time-discrete signal present in the memory as a sequence of "0" and "1".

Conversion of this sequence into a timing display results in the bottom curve: the integral between the signal edges can no longer be reconstructed and may therefore be incorrect by up to one period of the clock.

Logic analyser families

It is easy to see that the timing accuracy of the signal reconstructed during evaluation from the stored data is improved if the clock frequency used for sampling is increased. The time interval between two signals can only be determined sufficiently accurately if sampling takes place several times within the interval.

The tendency in logic analysers is therefore towards higher and higher sampling frequencies. However, such high frequencies result in problems in the implementation of the memory and the sequence controller which then have to be designed using fast, expensive technologies such as ECL (emitter coupled logic) which also have high current drain. The costs also increase with the number of channels measured.

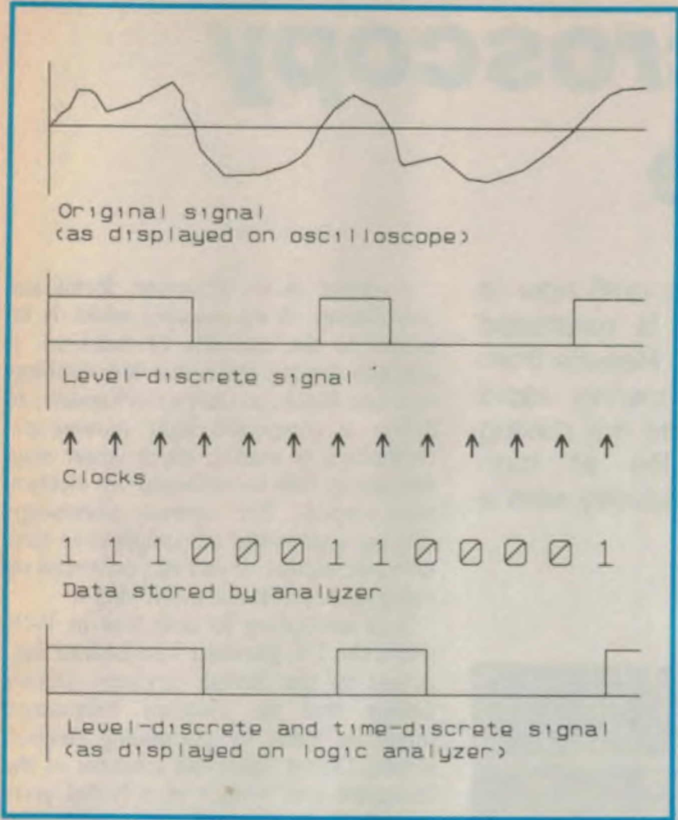


Fig.12: A logic analyser does not store or display an analog facsimile of the original signal, but a simplified logic level-discrete and time-discrete version.

Characteristics of the analyzer families

	Timing analyzer	State analyzer
Number of data channels	few (≤ 24)	many (≥24)
Highest sampling frequency	large (≥ 100MHz)	small (≤ 20 MHz)
Memory size	large (≥ 1 kbit)	small (≤ 1 kbit)

These factors have resulted in two families of logic analysers:

State analysers with a large number of channels, a low limiting frequency and a larger trigger intelligence are usually operated using an external clock obtained from the device-under-test. They are primarily used to determine state errors.

Timing analysers on the other hand have a higher limiting frequency and — for economical reasons — a lower trigger intelligence and a smaller number of channels. If the sampling rate is high enough, they can be used to trace timing errors and to measure delay times between signals.

Example: The 100MHz analyser LAS-B1 in the Logic Analysis System LAS from Rohde & Schwarz.

Table 2 shows a summary of the basic characteristics of the two families of logic analysers.

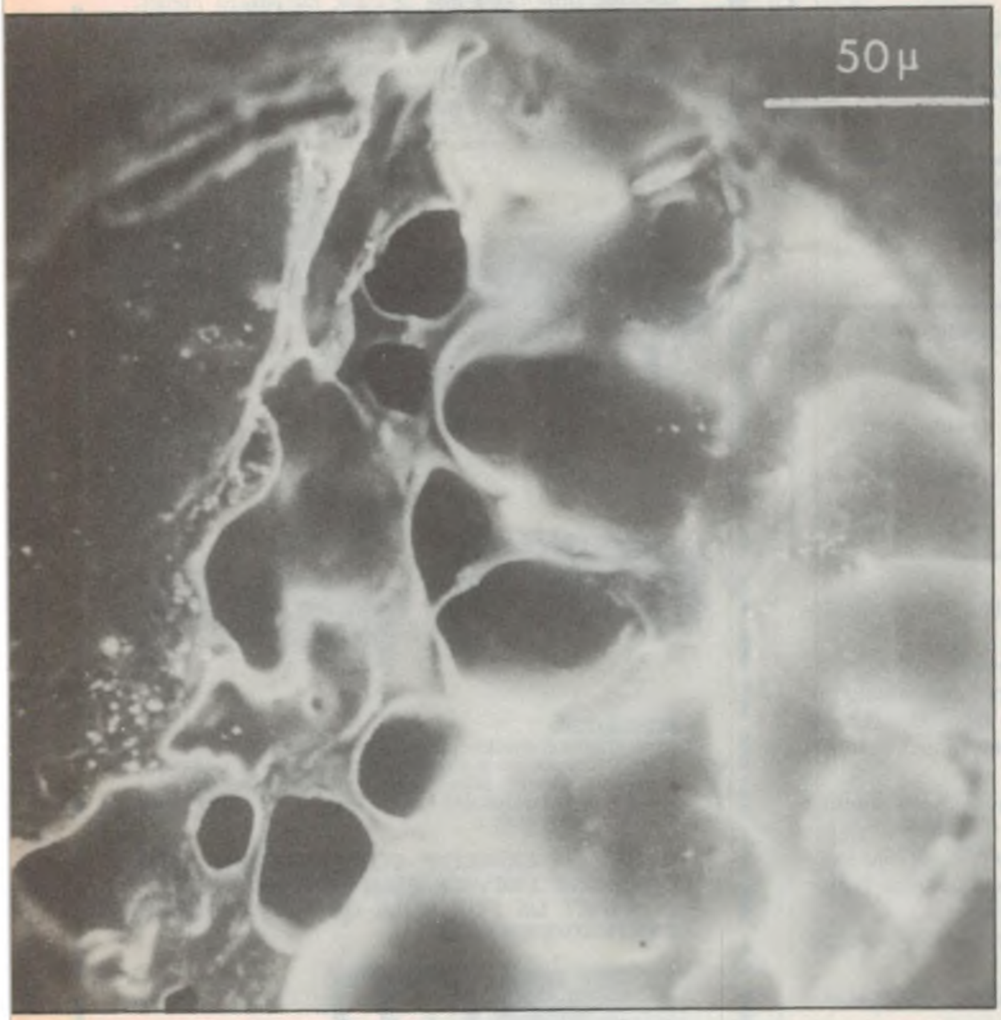
In the next article we will look at the way logic analysers are used in practice.

(Published by courtesy Rohde & Schwarz of Munich, West Germany, and Rohde & Schwarz Australia, 13 Wentworth Avenue, Darlinghurst NSW 2010).

Electron microscopy comes to life

One important limitation of electron microscopes until now is that the conditions under which the specimen is examined have made it impracticable to view living matter. Results from a technique now under development are showing rapid progress in microscopy of biological materials and are paving the way to observing the dynamics of life at high magnifications. Incidentally, it will also provide industry with a powerful tool for inspection and fault finding.

by Dr JITU SHAH
H.H. Wills Physics Laboratory, University of Bristol



Scanning electron microscopy inherently suffers from the disadvantages that living specimens cannot be placed in the vacuum necessary for transmission of the electron beam, and the beam burns anything placed under it. A technique developed at Bristol University now permits electron micrographs such as this to be obtained. It shows a cross-section of a hydrated leaf with full retention of tissue fluid, indicated by intact domed surfaces of cells.

A desire to see structure, forms and morphology at microscopic scales is inherent to the curiosity of mankind. It was the driving force that led Anthony van Lee Hoek, a Dutch clockmaker, to devise a compound light microscope. Nowadays, of course, much larger magnifications can be obtained by electron microscopes. Yet optical microscopy still has a powerful advantage over electron microscopy: it can be performed on living matter without destroying it.

It is interesting to note that in 1926, when the US physicist Leo Szilard suggested to the British engineer Dennis Gabor that an electron microscope might be made by assembling electron lenses, Gabor (later the inventor of the hologram and winner of a Nobel prize in physics) rejected the idea and pointed out that living specimens cannot be placed in a vacuum, which is essential for electron beam optics, and that energy in the focused electron beam would burn and destroy anything placed under it.

In the event, the first such microscope was built by the German scientists Max Knoll and Ernst Ruska in 1931. Advances since then in many branches of materials science, biology and medicine can be attributed to the use of electron microscopy. This has been duly acknowledged by the fact that Ernst Ruska shared a 1986 Nobel prize in physics, so it is appropriate now to review how far electron microscopy for biological and other difficult materials has progressed.

With a modern, commercially available *transmission* electron microscope (the type developed by Ruska) we can visualise features and structures of only a few nanometres (10^{-9} metres). However, such an instrument requires the specimen to be thin, because an image is obtained by passing electrons through it. This means that surface features of a thick, three-dimensional object cannot be examined very well.

Additionally, because the specimens have to be very thin, it is extremely laborious to obtain three-dimensional information.

These disadvantages are overcome by the *scanning* electron microscope, a type of instrument first built by the German physicist Manfred von Ardenne in 1938.

Depth of focus

The first commercial scanning electron microscope was made available in 1965 by Cambridge Instruments, a British firm near Cambridge. In this kind of microscope an extremely small, focused spot of electrons is made to fall on the surface of a specimen and scan across it in a "raster", just as in an ordinary television tube.

The electrons interact with the specimen and release secondary electrons from near the surface. (Some of the primary, incident electrons are absorbed within the specimen, while some are bounced back out of the surface; more about this back-scattering later). Emitted secondary electrons yield information about the surface topography.

In a conventional scanning electron microscope these secondary electrons are collected, point by point, and used to build a picture.

Deeper surface features of thick specimens can be imaged in a scanning electron microscope because the depth of focus is much greater than that in an optical microscope, so the technique gives a much more vivid impression of three-dimensionality. It displays morphological and topological features at much higher magnifications than in an optical microscope.

Because the instrument is relatively easy to use and can be combined with other analytical techniques, it has become enormously popular. Magnifications available with modern instruments are only slightly less than those possible in a transmission electron microscope.

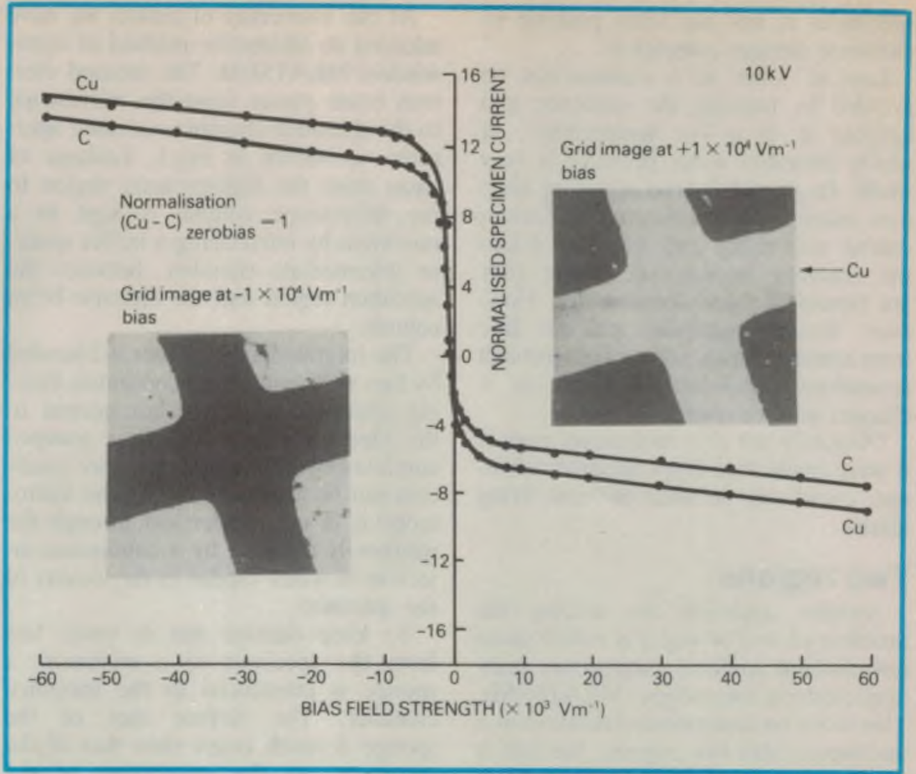


Fig.2: Variation of "normalised" specimen current with field bias strength for 10kV accelerated primary electrons. Normalisation is on the basis that the difference between the specimen current from copper and carbon at zero field strength is unity.

When it comes to viewing living matter, scanning electron microscopy has the same serious drawbacks as those pointed out by Dennis Gabor. Therefore we must be able to keep specimens in a microscope in a fully hydrated state, without loss of water. That is to say, they must be kept as near as possible to a living state.

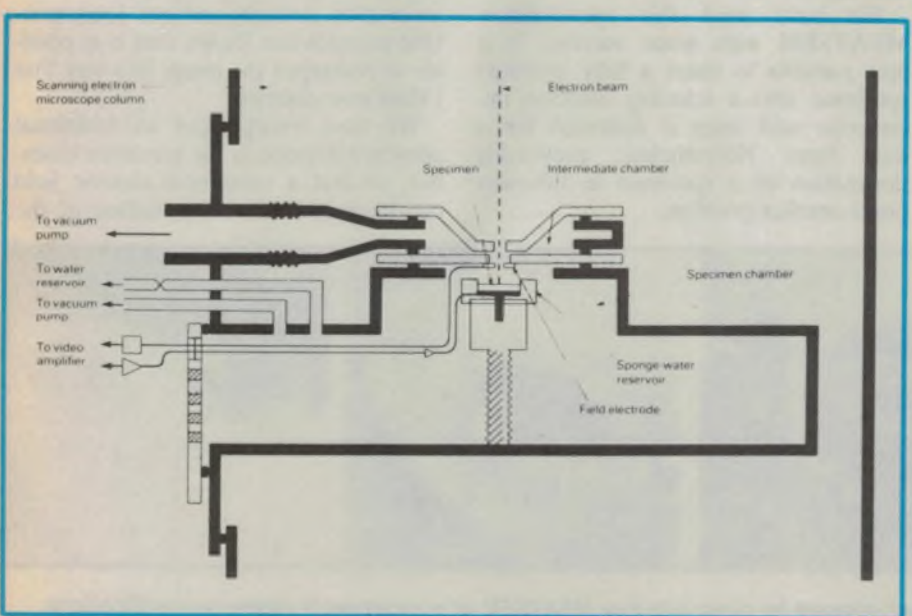


Fig.1: Schematic diagram of the apparatus used for MEATSEM.

In any electron microscope, a well-focused beam of high-energy electrons, necessary for imaging, has to be produced and kept in a high vacuum. It cannot travel long distances in a high-pressure gaseous environment without being scattered by gas atoms or molecules and losing its energy, and a badly scattered beam cannot render high resolution. This is an obstacle to electron microscopy of biological material in its natural, hydrated state.

For these reasons specimens are, conventionally, deliberately dried out and made stable for viewing by using procedures such as chemical fixation, dehydration and fluid replacement. Additionally, for scanning electron microscopy, dehydrated specimens, which are generally poorly conducting, are coated with a thin conducting layer of gold or of an alloy of gold and palladium to avoid a build-up of charge, for detailed features on charged surfaces cannot be imaged well.

But these techniques cause a drastic change in interfacial tension forces, which in turn causes delicate biological structures to become distorted and even to collapse. In spite of the development of special techniques for preparing specimens it has not been possible to eliminate damage completely.

Loss of water in a vacuum can be avoided by freezing the specimen and keeping it at a low temperature, at which saturated water pressure is very small. In so-called cryo scanning electron microscopy, specimens are frozen, coated with metal and transferred into the scanning microscope, where they are viewed at a low temperature. However, frozen specimens are not free from damage which takes place through anomalous expansion of water as it changes into ice crystals.

Obviously the cryo technique, even if it were made free from specimen damage, could not be used to view living matter.

Two regions

Another approach for solving the problem of loss of water is called moist environment ambient temperature scanning electron microscopy (MEATSEM). This relies on compartmentalisation of a microscope into two regions: the first is a high-vacuum region for electron beam production and electron lens optics; the second is a high-pressure region at room temperature, to surround the specimen and prevent it from losing fluid and gaseous constituents. (If a specimen is kept at saturated vapour pressure of water or 100 percent humidity it will remain wet, just like clothes hanging on a washing line on a humid day.)

Complete compartmentalisation can be achieved by using a window that is transparent to electrons but at the same time tough enough to maintain a high difference of pressure between the two compartments. This approach has the drawback that window materials scatter the electron beam badly. To keep scattering down to feasible levels the window has to be extremely thin, which means it is extremely fragile. Reliable windows with an acceptable loss of resolution are difficult to make.

At the University of Bristol we have adopted an alternative method of open-window MEATSEM. The focused electron beam passes from the microscope to the specimen chamber *via* small apertures, as shown in Fig.1. Leakage of gases from the high-pressure region to the microscope column is kept to a minimum by introducing a buffer space, or intermediate chamber, between the specimen region and the electron beam column.

The intermediate chamber is bounded by two walls containing concentric limiting apertures in the planes normal to the electron beam, and it is pumped continuously so that the pressure gradients can be maintained while the microscope is in use. Water lost through the window is replaced by a continuous injection of water vapour in the vicinity of the specimen.

To keep damage due to water loss from the specimen to a minimum, a sponge is introduced to the specimen chamber. The surface area of the sponge is much larger than that of the specimen, so the proportion of the water lost from the specimen to the total loss of water is very small.

Scattering of the electron beam in this arrangement depends largely upon the pressure in the specimen compartment and how far the electron beam travels through the high pressure to reach the specimen. Pressure in the specimen chamber is kept at the saturated water vapour pressure, at near to room temperature. With careful design of the apparatus the scattering of the primary beam can be kept down to give reasonable resolution.

We have used this open-window MEATSEM with some success: it is now possible to insert a fully hydrated specimen into a scanning electron microscope and keep it hydrated for a long time. Nevertheless, preventing desiccation of a specimen in this way poses another problem.

Additional electrons

Forming an image under these conditions presents formidable difficulties. The conventional technique of constructing an image by secondary emitted electrons does not work, because secondary electrons, primary electrons and back-scattered electrons ionise water or gas molecules close to the specimen and produce additional electrons. These electrons, which do not carry any information about the specimen surface, have a similar energy range to that of the secondary electrons emitted from the specimen, so they cannot be separated easily from the secondary electrons released from the specimen surface. Without such separation, there is a severe deterioration of the secondary emitted image.

Back-scattered electrons (deflected primary electrons from beneath the specimen) also carry image information. Because they are scattered from a larger volume of specimen, the resolution achievable by their use is not as good as that obtainable by using secondary electrons. Further deterioration in the resolution is also likely because the low-energy of back-scattered electrons means that they cannot be separated easily from spurious electrons.

Interaction of the primary electron beam with the specimen creates a charge which, in turn, generates a minute current in the specimen. The point-to-point variation of this current with scanning of the beam can be made use of for image generation. With a wet specimen the current can be collected without any metal coating. A specimen-current image is also susceptible to deterioration through ambient ionisation. Our research has shown that it is possible to resharpen the image in a way that I shall now describe.

We have incorporated an additional annular electrode in the specimen chamber, so that a substantial electric field can be produced at the surface of the

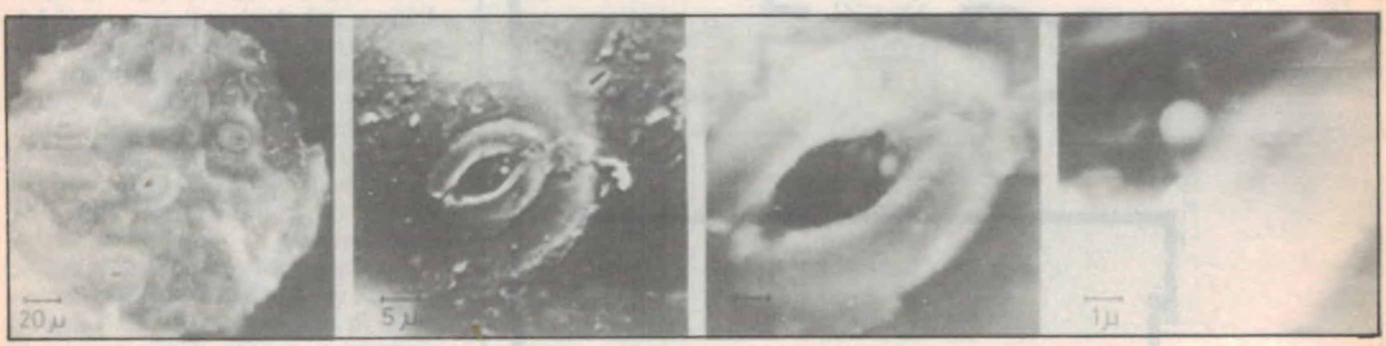


Fig.3: Stomata, or breathing pores of a leaf, viewed by open-window MEATSEM at successively higher magnifications. These eventually reveal a tubular structure with a slit within a stoma.

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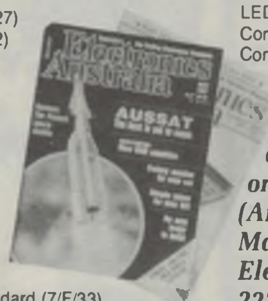

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specimen. The field has a considerable effect on the specimen current, shown in Fig.2.

The images are of copper grid bars on a carbon surface, and the curves represent variations of specimen current with the strength of electric field from copper and carbon.

It is thought that the electric field helps to conduct the excess charged carriers, produced by the interaction of primary, back-scattered and secondary electrons, through the gases, which enhances the contrast in the specimen-current image.

Application of the field changes the magnitude of the specimen current rapidly at first and then more slowly as one or other plateau in the curve is reached. The image quality and contrast is re-established with the magnitude of the field applied. It is also possible to invert the image contrast by changing the direction of the imposed field.

The curves shown for copper and carbon indicate that the contributions to the current by both the back-scattered electrons and the secondary emitted electrons are recovered to a great extent in the plateau regions. So, once the specimen current reaches a plateau, the contrast, sharpness and resolution of the specimen-current image of an object under high pressure are substantially recovered. The image is comparable in quality to the conventional, secondary emissive image of a similar object in a high vacuum.

A series of pictures in Fig.3 shows recovered images of stomata of a fully hydrated leaf, at roughly 16°C, at various magnifications.

Stomata are breathing pores of a leaf, which automatically close and open to regulate exchange of water vapour between the leaf and the air. They are therefore suitable specimens to study by MEATSEM on a fully hydrated leaf.

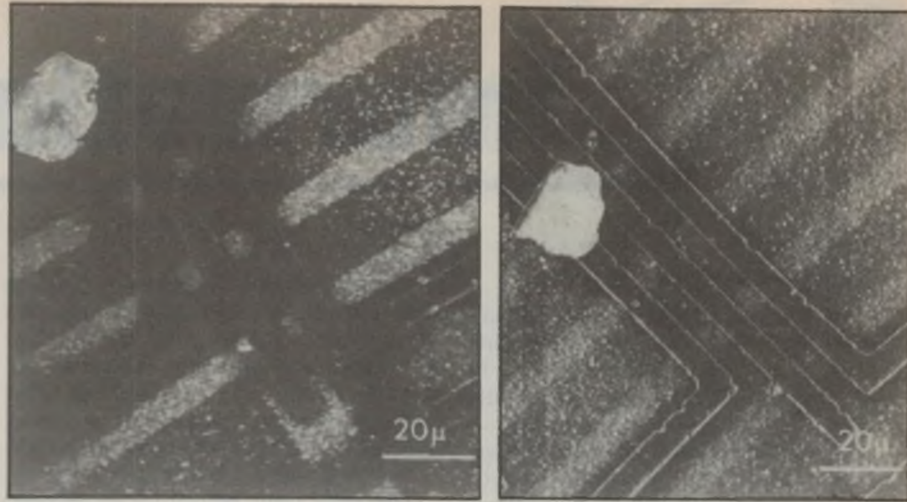
The larger picture is a cross-sectional view of the same hydrated leaf, showing cells in between the cutical (outer) layers of the leaf. There are two distinct layers: one layer contains holes; in the other, denser layer the cells have intact upper domed surfaces indicating preservation of tissue fluid.

Fully hydrated internal tissue cells of animals can be imaged, too. The resolution obtained so far is limited by factors not directly related to the principle of the technique, while difficulties stem from the fact that the current from a typical uncoated "wet" biological specimen is smaller.

Results indicate that we may well see rapid progress in scanning electron microscopy of hydrated biological materials. In turn this will open up means of realistically assessing deterioration from other causes, such as radiation damage due to incident electron and heat produced by the interaction of electrons with a living specimen.

Optimistically, we may expect other advances such as low-voltage scanning electron microscopy combined with MEATSEM , which may well enable us to view live matter *without* inevitably killing the specimen. This will not only fulfil a long standing dream of mankind but also provide a tool for observing the dynamics of life at high magnification.

MEATSEM has led to a solution of another long-standing problem in scanning electron microscopy. I have already mentioned that insulating, semiconducting and poorly conducting materials are difficult to image, unless coated in a scanning electron beam instrument because of charge build-up on the surface of the specimen. It alters the trajectories of primary and secondary (emitted) electrons and the process of emission of secondary electrons; this grossly distorts the image and is also accompanied by loss of details and resolution. Charging can also bring about electric breakdown of the material, which is particularly serious in examining semiconductor chips containing circuits and active electronic devices.



Left: View of part of a circuit on a semiconductor wafer, showing charging effects; "spread" in the darker area is due to charging. Right: A view of the same circuit after charge neutralisation.

With certain modifications of the open-window MEATSEM, a charge neutralisation mechanism can be employed to reduce or eliminate charge build-up on a surface. The final illustration shows before-and-after images of a circuit on a semiconductor wafer. The improvement was achieved by charge neutralisation.

Potentially, the technique is a powerful tool for inspection and fault detection, and promises to have other industrial uses. Cambridge Instruments, who built the first scanning electron microscope, may well be the first company to make the MEATSEM and its associated techniques available commercially.

Radio *Continued from page 80*

or a metal water pipe which travels underground at some point. The soil should be reasonably conductive, otherwise it will be difficult to obtain a good connection. However, if this is not the case, there is probably not much that you can do about it anyway.

A few notes with regard to operation of a regenerative radio are perhaps in order here, as this type of receiver is something of an oddity these days. Begin with the regeneration control set about mid-range, and adjust the tuning control until the desired station can be heard. If the radio squeals, back off the regeneration until it stops. Conversely, if you don't hear anything at all, or if it is very weak, advance the regeneration control until *just before* the onset of oscillation.

Best performance is achieved when the radio is just on the verge of (but not quite) oscillating. If the volume is too loud, do not back-off the regeneration, as this will reduce the selectivity and introduce interference from other stations. Use the volume control instead. The oscillation may not always be audible, but instead may manifest itself as severe distortion of the audio output.

Have fun with your new radio!

Information centre

8-channel remote control

I want to build the 8-channel remote control unit, as described in your June 1987 issue. I have since found that all the parts used in this unit are readily available and relatively inexpensive — except that is, for four IC's: the Plessey SL486, SL490, ML923, ML928. I have tried various distributors, all without success. Would you please tell me where they can be obtained. Also the 6.8uF electrolytic capacitor, used or the preamplifier board.

I am also a user of the UHF 28 aerial described in the magazine about two years ago, and find its performance very good. I have found that at least two capital city TV stations broadcast on UHF Band 5, as well as VHF. I think it would be great if you could modify/design an antenna for UHF Band 5, because there is a lot less interference on UHF when compared with VHF. There are over 40 country stations broadcasting on UHF Band 5, as well. (T.B.W., Ballarat, Vic)

• ***The Plessey ICs are available from Jaycar Electronics' kit department. If a 6.8uF capacitor is not available for the preamplifier circuit, there should be enough space on the PCB to wire two 3.3uF capacitors in parallel for a 6.6uF result — near enough.***

Although we have not tried it, there is no theoretical reason why you cannot physically scale your UHF antenna to receive the Band 5 TV stations. Just reduce the element length and spacing in the inverse ratio of the frequencies.

Video Fader

When using the Video Fader built from a Jaycar kit in conjunction with a Canon VM-E1 video camera and Philips video cassette recorder VR901, the following occurs. The picture has shakes, and horizontal ripples, as the fader is turned to fade-out. The picture loses colour and tears, followed by black horizontal lines over the entire screen. The horizontal lines fade out as the fader control is turned to full fade-out.

The same happens in reverse as the fader control is turned to fade-in. Adjustment by trimpot VR2 makes no improvement to the irregularity. (A.C., Bossley Part, NSW)

• ***The Jaycar kit department advises that Jaycar occasionally supply the kit with a 74LS00 (IC2) rather than the 7400 we specified. However the former may not be able to sink enough output current. As a result the sync pulses can get distorted, which results in a shaking picture.***

The best cure would be to replace the 74LS00 by a 7400. However if the 7400 is difficult to get, IC1 and IC3, 74123, may be replaced by 74LS123 type ICs. This would reduce the loading on IC2.

Super bass filter

I refer to your article in the February 1980 issue, about the "Super Bass Filter" that is used in the sub woofer design of July –August 1982. Can you tell me if the roll-off point (upper end) can be varied, over the range 400 — 100Hz, by the addition of a suitable pot?

• ***The filter concerned is a third-order filter. This means that in order to make the roll-off variable, you would have to vary three resistors or three capacitors. This is not really feasible using available components.***

You could move up the roll-off point by decreasing the values of capacitors in switch position 4. Half the given values would double the roll-off frequency, etc. This is quite a rough way of calculating but it will serve the purpose.

VZ-300 expansion problem

From your "Circuit & Design Ideas" in the May issue I decided to make the "16K memory add-on for the VZ-300 computer". I thought it worth taking a chance on, and at the worst I might not be able to make it work. For it to kill my computer was more than I bargained for.

Your Notes & Errata in the August issue say this might happen if the circuit is constructed in the way shown. I have changed the internal RAM chips (4116) but the fault of garbage displayed did not change. I realise that it is not your usual policy but I would be very grateful if you could comment, from advice you may have received, as to which chip or chips in the circuit are likely to have been damaged by the addition of this expansion. I hope you can help. (W.E.P., Christchurch NZ)

• ***We haven't had any further advice, but from your description that the unit now displays "garbage", it sounds as if either the 6847 video display controller chip (U15) or the 6116 video RAM (U7) may have been damaged somehow. Or perhaps the 74LS245 bus buffer U14, if there was a bus conflict. A remote possibility is that the Z80A CPU itself has been damaged. Sorry, but it's hard to offer more help than these suggestions.***

CD compressor

Referring to the CD Compressor project described in the May 1986 issue, I require the NE572 Stereo Compandor IC. Could you please advise where I should be able to get this crucial part. (D.P., Devonport, Tas.)

• ***The NE572 Stereo Compandor IC is currently still available from Jaycar Electronics, with stores in Sydney, Melbourne and Brisbane.***

Multi-sector burglar alarm

I have recently constructed the Multi-Sector Burglar Alarm, described in the January and February 1985 issues, and I am experiencing difficulty in getting this project running. I have thoroughly checked all wiring and construction details.

I find that with a 47k loop attached to all inputs, inputs 2, 4, 6 and 8 will only trigger the alarm when short-circuited and then only after the alarm has been allowed to remain in the on state for at least 60 seconds.

The LEDs for inputs 1, 3, 5 and 7 remain on, even when this loop is attached. I found that when I make and break the loop to inputs 1 and 3, the LEDs flash at the time of making and breaking contact. The LEDs inputs 5 and 7 are not effected in this manner, but remain on at all times. (N.A.S., Morphett Vale, SA)

• ***The problem is almost certain to be concentrated around the input stages. The most likely thing to***

assume is that the XOR gates IC1 and IC2 are faulty. There has been an errata on this project, which mentioned that the XOR gates should be 4030B's which are buffered CMOS gates.

Industrial remote control

I wish to build a radio control to switch industrial equipment on and off. It must have a range of two or three kilometres and send coded signals to minimise false triggerings from noise or nearby transmitters. A digitally modulated radio signal springs immediately to mind. Could you please advise on this topic. References to any past projects would be handy, as would a good, basic and practical text on radio transmitters and receivers. Just as a guide to cost, Hobbyco can provide a transmitter with a one kilometre range at 29MHz for $20.

Can the shortwave receiver project in an earlier magazine this year be modified to receive transmissions at the 100MHz range? (F.B., Kensington NSW)

• ***While the system of which you speak is certainly technically feasible, considering the range required (2-3km), a licence would almost certainly be required from the Department of Transport and Communications (DOTC). Unfortunately, we have not published a design for a device suitable for this application, and do not know of any other design which would meet your needs.***

With regard to the short-wave receiver published in January 1987, we doubt very much that it could be modified to receive signals in the 100MHz range. The frequencies of which you speak are approximately six times higher than those for which the receiver was designed. Also, the receiver can only resolve amplitude modulated (AM) transmissions, which means that it would of no use if the transmissions involved were, say, FM or SSB.

Subwoofer amp

I have a query about the 100W Subwoofer Power Amplifier of July 1982. The article claims that the resulting subwoofer signal has a maximum possible bandwidth (at the –3dB points) of 7Hz to 96Hz, and that this frequency can be moved up or down in frequency by scaling the capacitor values.

However after reading the article several times I cannot find any clear pointers. As my stereo has speakers rated from 100Hz to 16,000Hz and I wish to have the subwoofer signal to overlap by about 50Hz with the normal stereo signal. I would appreciate any help, information or clues you can give me. (S.S., Norman Park Qld)

• ***To extend the response of the sub-woofer up to 150Hz, all that is required is to scale the capacitor values in the input filter down by a factor of 2/3. That is, the 0.082uF becomes 0.056uF, 0.068uF becomes 0.047uF, and the 0.0068uF becomes 0.0047uF.***

Note, however, that if the frequency responses of the two systems overlap by too large an amount, a peak in response may become obvious, especially if either or both systems have a peak which falls within this overlap.

Lamp saver project

Having purchased a kit recently for your Lamp Saver of June 1986, and built it up, I have come across one problem. The 10k 1/2W resistor R1 gets extremely hot within seconds, and one resistor has burnt out so far (it went o/c). Even a 1W resistor gets too hot to touch. All components appear to check out, and the zener diode is a 400mW type.

The load was 300W initially, but the overheating of R1 also occurs with a 60W load. No other component gets hot. The soft starting section appears to work, as there is a slight delay after switch-on till the lamp lights up.

I don't have any test equipment except for an analog multimeter, 100k/V DC and 10k/V AC.

Your assistance in this matter will be appreciated. (A.V., Fern Tree Gully Vic)

• ***The problem you describe with the project is due to the Triac not fully conducting after the soft start period. You may notice that the lamps do not actually run at full brilliance during this period. When the circuit is operating normally, R1 is effectively shorted out by the Triac, and dissipates little power.***

The first step in tracking down the source of the problem is to remove Q1 to eliminate the soft start circuit. If this cures the problem, replace Q1 or perhaps the 1uF capacitor.

If the problem is still evident, the Triac gate control circuitry should be checked for correct component values. If all else fails, try replacing the 0.22uF capacitor or try another Silicon Bilateral Switch.

Notes & Errata

PLAYMASTER SERIES 200 MOSFET AMPLIFIER (Jan/March/-May 1985 File: 1/SA/69/70/71): Some units exhibit instability at maximum volume and treble boost settings. Investigations by the R&D department of Dick Smith Electronics suggest that this is due to excessive bandwidth, well above the 70kHz figure specified, and presumably due to exceptionally "hot" transistors.

In all cases observed to date, all traces of instability can be removed by lowering the corner frequency of the power amp input R-C filter to define the bandwidth at the specified 70kHz. the components concerned are between the balance control pot(s) and the base of input transistor(s) Q6. The 2.2k series resistor should be increased to 4.7k, and the 330pF shunt capacitor increased to 560pF.

VOLTAGE & CONTINUITY CHECKER (November 1987, File: 7/M/70): On the overlay diagram, IC3 is shown reversed. Pin 1 of IC3 should connect to R31. On the circuit diagram. the pin numbers of IC3c and IC3b are shown exchanged. IC3c should have pins 12, 13 and 14, while IC3b has pins 1, 2 and 3.

Books *Continued from page 162*

Mind you, they aren't something you can slap together in an evening. Truth is they're a rather long, fiddly and tedious project — but if you're patient and painstaking, the results can be worth it.

This new book by Ronald Wagner provides pretty well all the information you'd need to build your own electrostatics. In fact it brings together a great deal of design information, not just on electrostatics but on loudspeakers in general. There's reference to the standard analyses of speaker behaviour by our own Neville Thiele and Richard Small, as well as reprints (by permission) of classic papers on electrostatics.

The text is a little rough and hard to follow in places, and there are a surprisingly large number of typos and misspellings. Still, considering the moderate price and the amount of useful information given, I guess that's fairly minor.

In short, it would make a very useful reference book for the loudspeaker enthusiast, as well as an invaluable guide for those who'd like to try their hand at making electrostatics.

The review copy came from Dick Smith Electronics, and you'll find it in DSE's stores as catalog item number B-1253. (J.R.)

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