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Electronics Australia '90

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE – ESTABLISHED IN 1922

Large screen video displays

Large video screens are now found in many hotels, clubs, convention centres and offices. As the technology improves, they may become more common in our homes. Here's a rundown on how the latest systems work. *(See page 12)*

Sony's mighty midget

EA Editor Jim Rowe was able to try out an advance sample of Sony's tiny new CCD-TR55 video 8 camcorder, released in Australia this month. It left him asking "Please, Mr Sony, don't make them any smaller than this!". *See page 42.*

On the cover

A montage of today's electronics technology. Top left, Hewlett-Packard's new E2373A DMM; top right, Sony's tiny new CCD-TR55 camcorder; bottom right, Micro Networks' MN5820 20MHz flash A/D converter (Priority Electronics); bottom left, Analog Devices' PC-based instrumentation and analysis package (Priority Electronics); and centre, a high density surface-mount PCB designed using CADStar (RCS CADCentres).

Features

Entertainment Electronics

Projects and Technical

Volume 52, No.1
January 1990

ANNUAL DIGEST

News and Comment

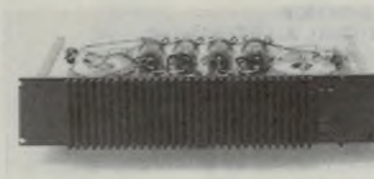
Departments

GREAT PROJECTS TO BUILD:

VK Powermate 25

Here it is at last – the husky 13.8V/25A power supply we've been telling you about. You can build it for hundreds of dollars less than a comparable commercial supply. See page 84.

High quality 140W/channel amp



In the second article describing his great new Playmaster 'Pro Series One' MOSFET amplifier, Rob Evans tells you how to put it all together. See page 98.

'Master control' power switch

Ever wished that you could turn off your TV with the VCR's remote control unit? You can, using this low cost master-slave switching unit. It has lots of other applications, too. See page 152.

Simple FM receiver for 6m

Another project to encourage home construction of ham radio gear. Build this low-cost FM receiver for 50-54MHz, expand it later for the other VHF/UHF bands. See page 110.

MANAGING EDITOR
Jamieson Rowe, B.A., B.Sc., SMIREE, VK2ZLO
TECHNICAL EDITOR
Peter Phillips, B.Ed., Dip.Ed., ECC
PRODUCTION CO-ORDINATOR
Milli Godden
EDITORIAL STAFF
Rob Evans, CET (RMIT)
Dewald de Lange, B.Eng.
READER SERVICES
Allison Brown
ADVERTISING MANAGER
Selwyn Sayers
CONTRIBUTORS
Neville Williams, FIREE, VK2XV
Ian Pogson, VK2AZN
Ron Cooper
Jim Lawler, MTETIA
Bryan Maher, M.E., B.Sc.
Ken Pohlmann, M.S., B.S.
DRAFTING
Karen Rowlands
GRAPHICS DESIGNER
Brian Jones
ART PRODUCTION
Alana Horak, Larry Leach, Ray Eirth, Ron Farrell
PRODUCTION
Tracy Douglas
ADVERTISING PRODUCTION
Brett Baker, Inga Tettmann
CIRCULATION MANAGER
Michael Prior
PUBLISHER
Michael Hannan
HEAD OFFICE, EDITORIAL & ADVERTISING
180 Bourke Road, Alexandria, NSW 2015
P.O. Box 227, Waterloo 2017.
Phone: (02) 693 6620
Fax number: (02) 693 6613
Representative: Brett Annesley
For reader services see back of magazine.
INTERSTATE ADVERTISING OFFICES
Melbourne: 221a Bay Street, Port Melbourne, Vic 3207. Phone: (03) 646 3111
Fax No: (03) 646 5494, Nikki Roche
Brisbane: 26 Chermside Street, Newstead, Qld 4006. Phone: (07) 854 1119
Fax No: (07) 252 3692, Bernie Summers
Adelaide: 98 Jervois Street, Torrensville, SA 5031. Phone: (08) 352 8666
Fax No: (08) 352 6033, Mike Mullins
Perth: 118 Forrest Street, Cottesloe, WA 6011. Phone: (09) 385 3332, Fax (09) 385 3700. Estelle de San Miguel
New Zealand: 63-73 View Road, Auckland, New Zealand. Phone: (09) 443 0954.
Fax No: (09) 443 1326, Gordon Marr
United Kingdom: John Fairfax & Sons (Aust) Ltd, 12 Norwich Street, London, EC4A 1BH. Phone: (01) 353 9321, Fax: (09) 593 0348
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LETTERS TO THE EDITOR

Amiga projects

I am writing about the lack of computer projects for the Commodore Amiga range of computers, particularly the very successful Amiga 500. Most of your projects have been for IBM PCs. Although the Amiga can run IBM software, the Amiga 500 cannot be made IBM hardware compatible. I think a lot of people are just waiting for Amiga projects.

I am particularly interested in an Amiga version of the 'Frame Grabber' that was in your August 1989 issue. Also a Genlock project would be useful to allow the Amiga to be used with a home video camera to create special effects.

An audio A/D converter project for the Amiga would also be very useful, as the Amiga has an inbuilt D to A for sound output. This could allow the Amiga to sample and edit sounds. A memory expander project may also be a worthwhile idea.

I hope you will give thought to some of the above projects and keep in mind the Amiga when designing new computer projects.

P. Sinclair,
Christchurch, NZ

Comment: We'll see what can be done Mr. Sinclair. Are there any readers out there with Amiga projects they've developed?

Isolating capacitor

I would like to bring to the attention of your readers a matter of safety regarding an 'AC Capacitor' advertised in the Altronics catalogue on page 60. The 2uF 440-volt AC capacitor is quoted as "As used in mains isolation applications..."

This caught my eyesight straight away, as I remember putting 0.47uF capacitors across the 240V switch contacts of a turntable once, and the turntable was quite happy to continue running due to the low reactance (ac resistance) of the capacitor at 50Hz.

A 2uF capacitor has a reactance of 1591 ohms at 50 hertz, which means that 150 milliamps can flow through a circuit with this capacitor in series. I believe that current above 30mA at 240-volts can kill a human, so that makes a 2uF capacitor totally unsuitable and downright deadly for mains isolation purposes. It may be suitable for suppression purposes, if it can handle the continuous 150mA.

A copy of this letter has also been sent to Altronics, perhaps a sticker could be produced to stick over the current advertisement. I'm sure some hobbyists' lives could be at stake if some sort of broadly distributed correction is not made.

Perhaps the magazine could print a range of applications for such a capacitor, and print the formula for reactance and current flow.

Mervyn Jack,
Cobram, Vic.

Comment: Thanks for the note, Mervyn. We suspect that this was an oversight, and Altronics will correct it as soon as possible.

Low incentive

Your editorial in the June issue points to a decline in the numbers seeking careers in science and engineering, and relates this to a lack of support from government and society for such endeavours.

While there is some validity in tying the decline to negative perceptions of these disciplines from their relationship to environmental problems and the like, there is a far more fundamental reason – cold, hard economics.

School leavers have little incentive to seek a career in science or engineering as professionals, let alone as technicians when far greater rewards are available in other areas such as commerce and the law, with far less onerous entry requirements. Just by way of example, a recent advertisement in a national newspaper listed the average income of a group of professionals in the financial services industry as being of the order of $70,000. Which engineers or scientists could ever hope to attain such incomes?

This relates to the supply side of the problem. On the demand-side, relatively few scientists, engineers and technicians are required by industry because the community's financial resources, rather than being committed to production, are committed to the takeover industry. Far larger profits are to be made by borrowing to take over established firms than by investing the same money to produce more, better and different goods.

The Government encourages these-takeover merchants to shift the cost of their borrowings to the taxpayer and in the case of overseas borrowings, to the community at large, via exchange rate effects. Politicians of both colours also lend respectability to the 'entrepreneurs' who behave so antisocially, by gracing their family functions and publicly lionising them.

It is good to see your magazine begin debate on these issues. Perhaps if those of us with technical interests are prepared to stand up and be counted, we can start a bandwagon which will enable the trend to be reversed. Otherwise, Australia's future will be bleak indeed.

Bob Hinds,
Wulguru, Qld.

Comment: You've summarised the situation very well Bob. But how do we change hearts and minds?

Takayanagi tribute

I refer to your April 1988 article on Kenjiro Takayanagi, the Japanese TV pioneer. I offer some anecdotes which hopefully will be of interest to you and the magazine.

My relationship to this wonderful man came through his son-in-law, the late Jwyia Ishibachi – Shihan, whose daughter Penelope married my late good friend, Professor John F.Nakoa – Shihan, PhD, D.Litt.

Takayanagi's most prized possession and favourite of the families was the 'Stop Gap' mechanical spinning disc transmitter and the 'photographs' were likened to Rotgenology (x-rays) and the work done by the Russian Armenian Jew Kirlian, whose fame is based on the fact that he had had little or no formal academic training of a scientific nature but the gift of his touch and living photography.

Takayanagi however was an academic recluse of high tertiary fame and ability. Son-in-law Ishibachi (1910-75) was a classical martial artist with a love for music (he was a trained baritone), who taught at the Inter-Zen-Kyshido-Karate-Kan in Nara, Japan and the University at Meji. He remembered well being a voluntary guinea pig and being 'zapped' more than once by his father-in-law's inventions! When Ishibachi was in his early twenties he went with his future father-in-law to the United States and

continued on page 167

EDITORIAL VIEWPOINT

The dawn of another exciting electronics decade

Well, here we are again at the start of another decade, and one in which we're likely to see even more rapid developments in electronics than we've seen – and tried to keep up with – in the last.

Even though we seem to be going through a slower period right at present, my guess is that big things will ultimately take place in electronics during the 1990's. Satellite communications look set to undergo much more rapid expansion, and the same could well happen in opto-electronics and photonics.

We may not see full high-definition TV this century, perhaps, but we may well get something almost as good: enhanced compatible television, similar to the 'Clear Vision' system currently creating so much interest in Japan. And inevitably we're going to see personal computers become cheaper, smaller, more powerful and even more pervasive.

I'm sure we'll also see microprocessors making greater inroads into things like test equipment – although many test instruments seem to have become 'microprocessorised' already.

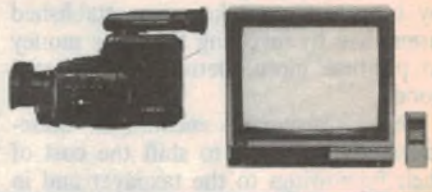
Just how much of an active part Australia's electronics industry will take in these developments remains to be seen, of course. There are lots of opportunities, although based on past performance it doesn't seem likely that local firms will pick up and run with more than a small proportion. The old 'She'll be right' attitude of apathy is still far too strong, I suspect.

Whatever happens, though, and wherever it happens you can expect to find *Electronics Australia* bringing you the details. It's very much a part of our mission to keep our readers up to date with developments both here and overseas, and we'll be striving to do this even more effectively in the coming decade.

For a start, you should find plenty of informative reading inside this Annual Digest Issue. There are articles for the consumer, for the professional and for the hobbyist – including the start of a new series introducing electronics for the beginner. So read and enjoy, with our compliments.

Jim Rowe

What's New In
HOME ELECTRONICS



What happened in 1989, and what to expect in 1990

In each year's Annual Digest issue, we review what has happened in home electronics during the previous year, and try to predict what might happen during the coming year. Here's our attempt for this year:

In many ways 1989 did turn out to be a rather quiet year in terms of home electronics, as we predicted. A year of consolidation and steady – if in some cases quite rapid – growth in existing market areas, rather than dramatic changes and the arrival of revolutionary new products. And it turns out that most of the new products that hadn't quite 'made it' to market by this time last year still haven't.

A good example of this is DAT (digital audio tape) recorders, which still haven't been released on consumer markets outside Japan. In a practical sense this is exactly the situation as existed last January: but as it happens, this doesn't mean that DAT has died.

In fact quite a lot of negotiation has been going on the during the past 12 months, between the hardware and software sides of the audio industry, to thrash out an acceptable solution to the copyright conflict which has been responsible for the DAT stalemate. And only a couple of months ago, a solution was agreed upon – in the form of the Serial Copy Management System (SCMS), details of which were given in *EA* last month.

So despite the stall of more than 12 months, DAT now looks likely to move ahead. We may well see the first SCMS-fitted DAT machines in Australia by the middle of the year, with more likely to arrive soon after. They won't be cheap, of course (probably around $2000 – $3000), but the quality of reproduction is virtually indistinguishable from CD's – and the new SCMS machines should allow direct digital dubbing from CDs, although only for one generation of dubbing.

Another new product that still didn't take off in 1989 was CD-video, or 'CD-V'. There have certainly been a few CD-V players available, but the promised release of loads of software doesn't seem to have happened, and understandably there hasn't been much interest by consumers.

It's perhaps still possible that the software may eventuate, and CD-V will spring to life. However as time passes, this is looking less and less likely. It may well be that our prediction of this time last year was right, and CD-V is a dead duck – like videodisc before it. In any case most consumers seem to be quite happy with video on magnetic tape, it seems.

Talking about video and tape, the VHS system seems to have held its own in the home playback and time-shift segment of the market, while Video-8 has continued to grow in the home movie/camcorder area. Hard sales figures are notoriously elusive in this area, but it looks as if the 8mm format now dominates with VHS-C trailing.

On the other hand, the new enhanced video formats (S-VHS, ED-Beta and Hi-8, or high band Video 8) still haven't really taken off. Market growth seems to have been very slow indeed, with only a trickle of new machines, very low-key advertising and almost no pre-recorded software to boost buyer motivation. Again this was exactly as we

New digital message machine

To meet an increasing need for a reliable and durable audio message recorder player, Audio Telex has introduced the TR900 Digital Message Player. This is suited for offices, factories, fun parks, art galleries, museums or any location which requires a continuous message to be replayed.

Previously, the most common method of producing a continuous audio message was by means of an audio tape and recorder. These are prone to quality deterioration, jamming, interference and of course, they wear out! The TR900 uses a solid state microchip, so it doesn't wear out. There are no moving parts and it will play indefinitely.

TR900 provides four channels of natural speech recording and playback, for repetitive message applications without

predicted last January – sorry about the gloating, but we're not usually so good!

One problem with the enhanced video formats may be that to get their full benefit, you really need to use a matching high resolution video monitor with separate luminance and chrominance inputs. So changing over doesn't just involve replacing one's present VCR, but the existing colour TV as well; this will involve quite a cost hurdle, for most consumers.

Together with the apparent shortage of pre-recorded video software in the enhanced formats, this is probably the reason behind the market's continuing 'ho hum' attitude – despite the obvious technical advantages. And presumably because there are so few machines in the marketplace, the software vendors still haven't committed themselves yet. So we have a classical 'chicken and egg' situation, suggesting that S-VHS and the other enhanced formats will probably again grow only slowly in 1990.

What about high definition TV (HDTV)? Good question. This continues to be in the 'coming soon' category, so we were also fairly right about this in last year's predictions.

The Europeans have pushed ahead developing their EUREKA-95 standard, which uses 1250 lines, 50Hz field rate and 2:1 interleaved scanning and retains some compatibility with the existing PAL and SECAM systems. Similarly the USA is gradually evolving a system which will be compatible with its existing 525 line/60Hz NTSC system, despite its apparent initial interest in the 1125 line/60Hz/2:1 system developed by NHK in Japan.

Meanwhile in Japan itself, the real pioneer of HDTV, NHK began in June to broadcast 1 hour of non-compatible HDTV programmes daily to DBS and cable subscribers. However the set makers are hedging their bets, and starting to produce receivers for the other systems – as well as for transition-phase systems such as the Extended-Definition TV (EDTV) or 'clear vision' system. This is essentially an enhanced and compatible version of NTSC, using digital processing in the receiver to cancel ghosting and double the effective field scan rate.

In Australia, all we've had over the last few years has been a few demonstrations of the various HDTV systems – the last being the EUREKA system which was displayed in Sydney in November. They've all been very impressive, but which one we'll finally see is anyone's guess.

Generally speaking the viewing public doesn't seem to be impatient for the arrival of HDTV. In fact most people in Australia seem to be quite happy with our existing 625 line/50Hz PAL system – including the existing broadcasters, currently beset with economic problems. So our guess is that you shouldn't expect to see much real action on the HDTV front in 1990, either.

When it comes to TV receivers themselves, superficially these have again changed only slowly during the last 12 months. Our prediction again proved fairly accurate, with the main changes being in the area of assembly simplification and greater reliability, via greater use of LSI chips, and the provision of additional features such as picture freeze and 'picture in a picture' using digital technology.

Small-screen personal portables using active-matrix LCD screens have become more readily available, although public acceptance hasn't been wildly enthusiastic. High-end consoles with relatively large screens have been rather more successful, although these are still not as popular in Australia as they seem to be in the USA and Europe.

Our prediction is that both of these areas will grow only slowly again in 1990.

In the radio market, AM stereo still hasn't really taken off, with few receivers available and most consumers still either unaware of its existence, or uninterested. As yet there is no decision as to whether Australia will adopt the Radio Data System (RDS) which has begun to take off in Europe, and so it seems unlikely that we'll see any action here in 1990.

The real action seems more likely to take place in the area of communications, with fax machines now really booming and starting to move into the home as well as the office. We may also see the start of true cellular mobile and portable phones, later in the year.

So again 1990 seems likely to us to be a relatively quiet year in terms of consumer electronics – more of the same, in fact. The main event might be the long-awaited appearance of DAT machines, at last, with everything else undergoing gradual evolution rather and revolution.

At least that's the way we see it. But we could easily be wrong – so keep reading these pages!

---

the maintenance required with tape based systems. Each channel is 10 seconds long and channels can be used separately or linked together to provide 40 seconds of continuous message. An optional circuit change will increase each channel up to 30 seconds for a total of two minutes.

Recording of a message is achieved by simply plugging in a microphone or other programme source. One popular application for TR900 is to intersperse messages with music for 'music on hold,' for PAXB's, shopping centres, supermarkets or any point of sale applications.

TR900 costs about the same as a good quality tape recorder, but requires no maintenance and will last at least 10 times longer. For further information contact Audio Telex Communications, on Sydney (02) 647 1411.

Economy CD players from Sony

Sony has just released the CDP-270 (430mm full size) and the CDP-M27 (355mm midi size) compact disc players, with features and benefits you would not find in players under $400 previously.

The new players are designed to fit harmoniously into virtually any home stereo system. They use a four times oversampling digital filter with dual D/A converters, to deliver the full range of dynamic CD sound. However, perhaps their most outstanding feature is the custom edit feature allowing the user to time edit, programme edit and time fade track selection for transfer to tape. This enables editing versatility and maximum tape utilisation, previously found only with more expensive models.

The CDP-270 and CDP-M27 are available through the Sony dealer network, with the CDP-270 having a suggested retail price of $349 and the CDP-M27 at $319.

Home Electronics

'Chrome Maxima II' tape from BASF

Those who predicted CDs would mean the end of audio cassettes may need to think again, with the latest audio tape released by BASF. The company's new Chrome Maxima II is being promoted as 99.9% noise free.

In fact BASF has launched a bold advertising campaign, which includes 70mm cinema advertising, challenging listeners to tell the difference between the same music on BASF Chrome Maxima II and a CD.

BASF Australia's Division Manager – Consumer Products, Jim Hall, said the campaign had been a huge success in United States when it was launched at the Consumer Electronics Show in January and later in Europe.

"Listening tests have shown most people can't tell the difference between the new Chrome tape and CD," said Mr Hall.

At the US launch in Las Vegas, BASF tested audio buffs with 10 sample pieces of music each 12 seconds long. They had to tell which was Chrome Maxima II and which was CD. Of 529 candidates, only 11 got more than nine correct and two of them admitted they guessed right. Two sound engineers and three specialist journalists were among those with a good ear.

"With the phenomenal success of CDs, consumer demand for sound quality has increased enormously. This also applies to blank and pre-recorded cassettes, so as tape manufacturers we have had to improve our products accordingly," Mr Hall said.

Mr Hall explained that the new tape has two ultra-coercive chrome dioxide layers, homogeneous matched particles, improved pigments in the upper layer and a smoother tape surface. It offered a dynamic range of 66dB without a noise reduction system, and up to 79dB with Dolby C.

Technics multi-CD player uses turntable

Technic's new SL-PC10 CD turntable is both fully featured and economically priced.

The SL-PC10 can be loaded with up to five discs for continuous play. The advantage of a CD turntable over a multi-stackable CD is that the top-loading, flat design allows the user to change individual discs during play, so as not to interrupt the music.

The player features 20-step random access programming so you can play tracks in any order, or just let each disc play one after the other for up to six hours continuous music.

A quadruple oversampling digital filter and one digital-analog converter (DAC) per channel ensure top quality sound reproduction.

The SL-PC10 can also play CD singles without the need for an adaptor ring and is remote compatible via the Technics SA-R177 AM/FM stereo receiver.

Super VHS video tape released by BASF

BASF has released a new range of video tape specially formulated for the Super VHS standard. Super VHS provides distinctly improved picture sharpness with its 5MHz resolution, compared with the VHS standard of 3MHz.

BASF Australia's Divisonal Manager – Consumer Products, Jim Hall, said extremely fine particles of magnetic pigment were needed for Super VHS recording. High performance binders had also been used in the new tape to ensure the highest possible reliability and to optimise tape running, especially in camcorders, he said.

The cassette housing is designed to automatically switch the recorder to S-VHS mode. Normal casettes recorded in Super VHS mode would have greater picture noise, but Super VHS tapes

used in normal VHS recorders would provide outstanding picture quality.

BASF has released the Super VHS tape in SE180 and SEC30 for the Super VHS-C system.

New Sharp VCRs offer easier control

Sharp Corporation estimates that by the end of 1989, over 70% of all Australian homes had a video recorder, with more and more consumers interested in models offering greater sophistication.

Sharp has released a number of new models to meet these expectations.

Among the new range is the latest Sharp 'Chatterbox' model, the VC-T310X, which has a 'talking' command control.

This is truly a TV 'mate' for those who are still a little overwhelmed by high technology. They can now operate the video by following the machine's easy, step-by-step guidelines – given in a feminine voice.

Video buyers may also choose the sister model VCT-510X, which in addition to the talking command control has a four-head long play facility which allows a single 4-hour tape the ability to record for up to 8 hours.

Additionally, the Sharp 'Chatterbox' has variable speed slow motion and noiseless still frame functions, all operated from the remote control.

Another new model in the Sharp video range is the VC-A615X, with a 63-function 'Command Control' remote unit.

No longer will you have to bend down on hands and knees to program the video. Now you just instruct it from the comfort of your armchair to tape your favourite show.

The long play facility again allows you to record up to 8 hours on a standard 4 hour tape.

New stereo FM/AM tuner from Akai

Akai has introduced a 16 station programmable FM/AM stereo tuner, the AT-52.

As a follow-on to the existing 'Reference Master Series' quartz synthesized tuner (AT-93), the AT-52 is a quartz synthesized stereo FM/AM tuner offering selectable IF bandwidth for better FM reception, a 5-way tuning system for greater tuning convenience, and FM mute system.

The tuner employes high voltage twin-variable capacitor diodes and all tuning stages use high performance dual-gate MOSFETs in both RF and mixer stages. Akai also uses a proprietary advanced linear IF filter for increased stereo separation and reduced signal distortion.

The tuned station frequency is displayed on a large LCD (Liquid Crystal Display(, together with a 5-segment signal strength meter indicating station strength.

Memory tuning offers the facility for storing up to 16 pre-set frequencies via 'memory buttons'.

New VHS-C tapes from TDK

Timed to coincide with the recent overseas unveiling of tabletop VCR decks that are able to play both VHS and VHS-C tapes without the use of an adaptor, TDK (Australia) has introduced two new VHS-C video tape formulations.

Known as 'Super Avilyn Technology Plus,' the two improved grades comprise new E–HG (Extra-High Grade) and new HD-XPRO (High definition–Excellent Grade). The 'new' prefix indicates the latest formulation upgrade.

TDK says that the magnetic material of the tapes (Super Avilyn) has been made finer. However, making magnetic particles finer creates other problems such as agglomeration (or bunching up). To overcome this problem TDK have developed Particle Surface Control Technology, which results in a high density coating of evenly distributed particles in the magnetic layer. They have also paid special attention to particle orientation, allowing the full potential from the magnetic layer to be realised.

The tapes also use a TDC (three dimensional compound) binder that is specifically designed to individually bind the ultra fine magnetic particles together as well as bond the magnetic layer firmly to the base film.

The new E-HG offers a TPQI of 263 and is designed for home filming and library building in both LP and EP play modes. It is designed for both indoor and outdoor applications, is available in EC-30 playing time and has an RRP of $18.30.

The new HD-XPRO has a TPQI of 283 and is designed for mastering, editing masters, and professional film applications.

It is available in EC-30 playing time and has an RRP of $27.50.

LARGE SCREEN VIDEO DISPLAYS

Although still not as common in Australian domestic loungerooms as they are in the USA, large video screens are now found in many hotels, clubs, convention centres and sporting venues. And as the technology improves, they'll no doubt find their way into our homes as well...

by DEREK J. POWELL

The first video projectors began appearing in Australia just on a decade ago. They were blurred, dull and decidedly ungainly, but they spurred an appetite for really BIG video pictures that continues to grow.

Wherever people gather, it seems that there is a demand for large screen video. In education, medicine, conventions, business meetings and even at pubs and sporting events video is becoming indispensable.

Specialist cinemas are turning to video projection, to cut costs. Australia is now seeing live satellite broadcasts of special sporting events, and at large rock concerts where performers are too far away to be clearly seen, 'Video PA' is becoming commonplace – to zoom close-up shots of the musicians onto a giant screen.

Large screen video is even now finding its way into homes. The wall-sized TV has long been a domestic dream, and manufacturers report that projection systems are finding steady demand among high end video buffs in Japan and the USA.

Current technology

So how is large screen reproduction of video accomplished? There are three basic techniques for displaying video pictures to an audience: direct view picture tubes (or increasingly LCD displays); giant 'light bulb' display systems as are seen at the sporting grounds; and video projectors. We'll look at the alternatives in turn.

The first question must be: "Why not simply use a bigger picture tube?" Great strides have been made in picture tube technology over the past three years, with most manufacturers now able to offer models with screen sizes in the 65 – 95cm range.

However various factors, particularly glass strength and weight, still limit the practical size of a picture tube. Large colour LCD displays are still some way off, although all the industry pundits are predicting that this is the way we will be watching TV beyond the year 2000 (or maybe 2010).

For large outdoor venues, 'Scoreboard' video displays such as the Mitsubishi 'Diamond Vision' are the only alternative, but as they use enough power for a small city and require a minimum viewing distance of about 50 metres, their application is obviously limited. (See *EA* January 1987 for a description of the system at the Sydney Cricket Ground.)

An interesting crossover between the first two categories is the 'Videowall'. Four, nine, 16 or more monitors are stacked closely together and special digital processing splits and expands the signal, so that one large picture can be spread across all the screens.

A Videowall can do more than just show one large picture however, and with its capability for special effects, it is best considered as an entertainment art form in its own right.

This leaves projection onto a screen surface as the most practical way to produce large video pictures, so it is on this branch of display technology that we will concentrate.

The vast majority of video projectors in use today employ high brightness cathode ray tubes (CRT's), coupled to a lens system which projects the image onto a screen.

The systems we saw in the early 1980's (often disparagingly called 'Pub Projectors') used a one piece design, with a mirror to provide a longer projection path to the integral screen. The screen, usually 120 to 150 centimetres diagonal, was parabolic in shape – often with an aluminium foil screen surface to provide high optical gain.

This was necessary because of the comparatively poor light output from early projection tubes. The acceptable viewing angle of these screens was quite narrow and the audience was restricted to a small area on either side of the centre line.

Other types emerged which used rear projection screen surfaces. The appearance of these units was more like a conventional television set.

The projection tubes were mounted at the bottom, and reflected from an internal mirror onto the rear of the projection screen. The screen was usually around 120cm (48") diagonal. These types are still available from several manufacturers, but are rapidly being overtaken by large direct-view CRT sets, which produce crisper and brighter images.

In late 1982 the first of the present generation of CRT projectors appeared in Australia. These were much smaller and used a separate curved or flat screen. Similar units are available from a number of manufacturers including Sony, Panasonic, Barco, Electrohome and others. Most sell for between eight and twelve thousand dollars.

Most current projectors feature switching between composite video and RGB inputs, although very few provide an inbuilt TV tuner. To enhance their flexibility with input sources, many provide decoders to handle NTSC and SECAM video signals as well as the Australian PAL system.

'Data Projectors' are a special class of video projector designed to accept RGB signals from a wide range of computers. Their design is different in a number of critical areas.

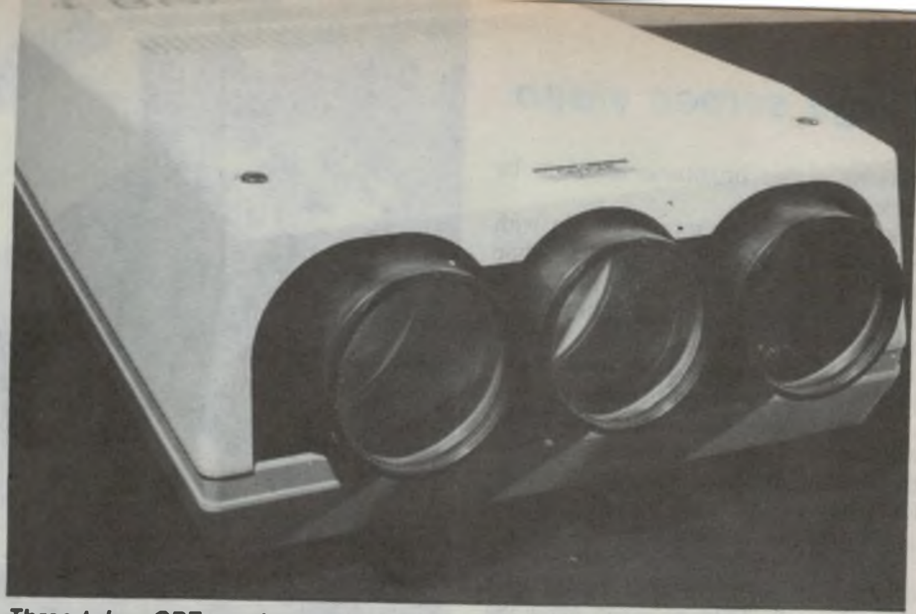
Firstly, their deflection circuits can handle horizontal line rates far above the 15.625kHz of standard video signals. Indeed most Data Projectors these days can scan to the 35kHz horizontal rate required by the IBM PS2 and Apple MacIntosh II computers.

The latest generation of projectors are able to double even that figure. In addition, the lenses and wideband video amplifiers found in Data Projectors offer resolution several times that of standard video projectors.

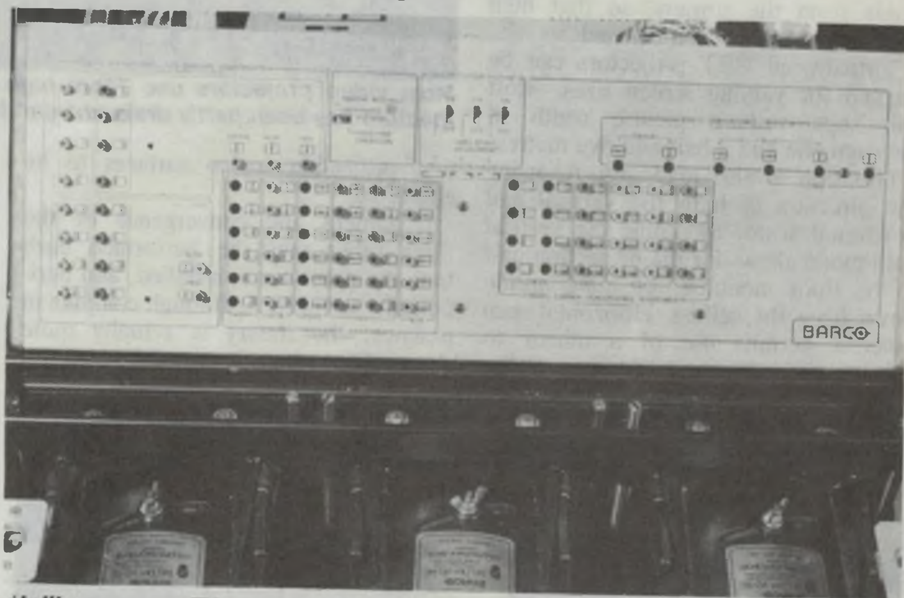
The 'business end' of the projector consists of three high brightness CRT's, coupled to three projection lenses. Each tube handles one colour – red, green or blue, and each has its own yoke and deflection circuitry. Standard tube size is 14cm (5.5"), though tubes of up to 23cm (9") have been used for increased brightness and sharpness.

The projection tubes themselves operate at extremely high brightness, with accelerating potentials of up to 50kV. As around 80% of the energy produced in the tube is converted to heat, the tubes have to be liquid cooled.

A mixture of ethylene glycol and water is sandwiched between a glass coverplate and the CRT faceplate. Convection currents in the liquid radiate the heat more effectively than the glass envelope. This reduces the thermal stress on the faceplate and lowers the operating temperature of the phosphor,



Three-tube CRT projectors are currently the most flexible devices for presenting video pictures to a large audience.



Unlike modern TV receivers and monitors, video projectors generally require complex alignment to produce well converged pictures.

The projection tubes and matching lenses from a Barco video projector. The tube on the left has been partly drained of its cooling fluid.

allowing higher brightness levels to be achieved.

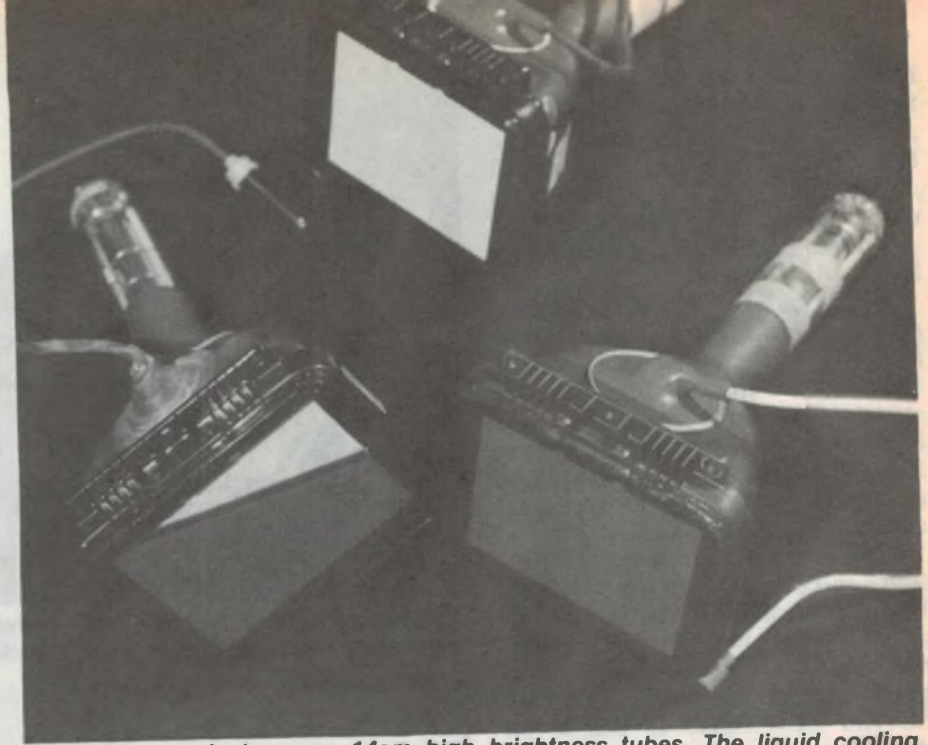
Some early projectors made do with two tubes (green and magenta), while there have also been more recent attempts to improve the brightness by using four and even six tubes. (Alignment and convergence of these monsters is not for the faint hearted!)

The projection lenses are quite large, with up to six high precision elements. Because of the need for minimal light loss, they are designed to be super fast – with an effective aperture of f/1.0.

Current state-of-the-art lenses use a combination of aspherical plastic and glass elements. Extra elements allow the centre of the picture to be focused separately from the corners, so that high gain curved screens can be used.

Virtually all CRT projectors can be aligned for varying screen sizes. Most will cope with a picture width of between one and a half and five metres.

Provision is also made for reversing the direction of both the vertical and horizontal scans. Switching the vertical scan mode allows for the projection unit to be floor mounted, or hung upside down from the ceiling. Horizontal scan reversal permits use of a mirror to shorten the projection distance, or for rear projection screen surfaces to be employed.

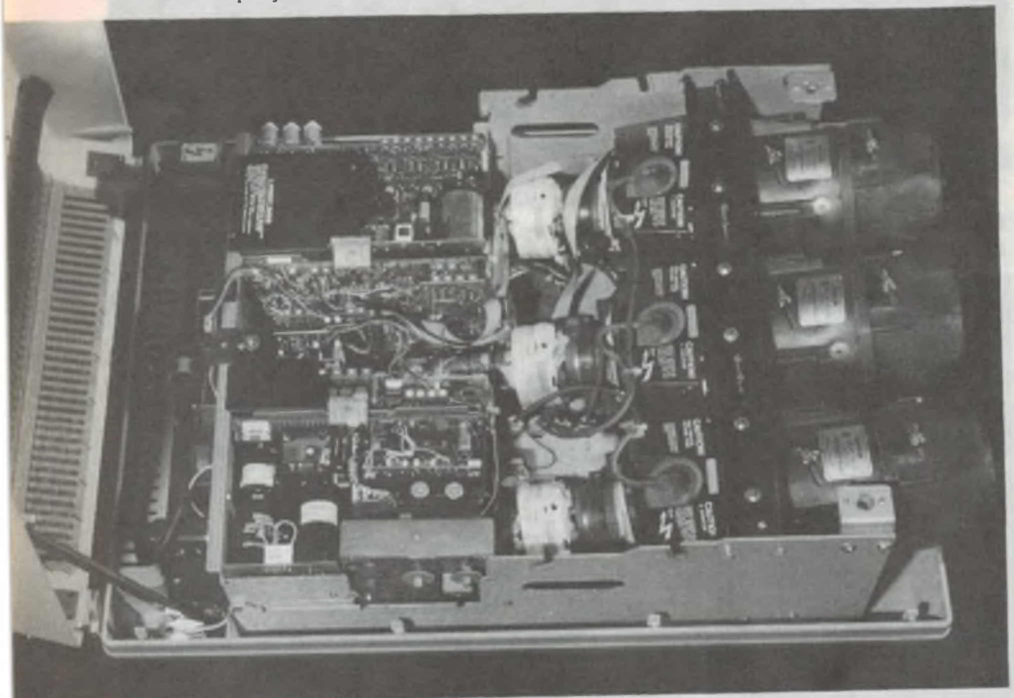


Most video projectors use 14cm high brightness tubes. The liquid cooling medium has been partly drained from the tube on the left.

Alignment and convergence of the three tubes must be performed each time the projector is installed, and periodically 'tweaked'. Although complex in practice, the theory is actually quite straightforward.

With only the green tube switched on, the lens is focused and the overall geometry of the green raster adjusted. An inbuilt crosshatch generator simplifies this procedure. Then the red and blue tubes are focused and aligned with their respective convergence controls, so that the three scans overlay exactly. Some 50 or more controls may be involved in the convergence procedure.

The final result, in a darkened room, is extremely good and a single projector on a three or four metre wide screen can cater for audiences of several hundred. However, like a cine projector, the picture is quickly washed out by strong ambient light and it cannot cope with uncontrolled daylight at all.



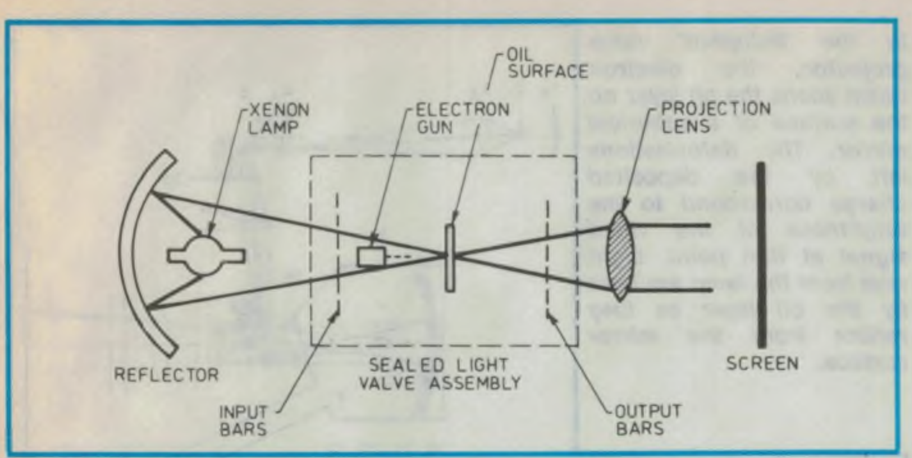
Internal layout of a typical three-CRT video projector. On the right are the projection lenses mounted in front of the red, green and blue projection CRT's. The yokes can clearly be seen just to the right of the main circuit boards, which are stacked vertically on a mother board at the bottom. The convergence adjustment panel, which normally sits above the yokes, has been removed for clarity.

Light valve projectors

In the quest for larger, brighter and sharper pictures other methods must be used. The most developed of these involve devices called 'light valves'. In a light valve projector the electronic raster does not scan a phosphor coated tube to produce a glowing picture. Instead the raster is used to modulate the output of a separate light source.

The light valve arrangement used in the 'Talaria' projector from GE consists of a Xenon arc light source with a Schlieren optical system.

This is how it works. Light from the arc lamp is projected through a grating (the input bars) onto a transparent control plane. On the control plane is a film of special oil, which deforms when scanned by a beam of electrons.



The Schlieren optical system forms the basis for several 'light valve' video projection systems. Instead of producing a glowing trace on a phosphor, the electron beam deposits a charge on a thin layer of oil. The charge deforms the normally smooth surface of the oil so that it acts as a diffraction grating. Light from the lamp, which passes through the pattern of input bars is normally blocked from the screen by the precisely matched pattern of the output bars. However where the oil layer is disturbed, the light rays are bent so that they miss the output bars and are projected onto the screen.

When light strikes an unmodulated surface, it is simply transmitted through and blocked by a precisely aligned set of output bars which match the input grating.

The fluid control layer is addressed by a beam of electrons which is velocity modulated by the input video signal. The thickness of the control layer varies according to the charge deposited on the surface of the oil by the electron beam.

Light striking a deformed area of the control surface is refracted and diffracted by an amount proportional to the depth of the deformation and passes between the output bars, then through a lens to the screen.

Unlike CRT projectors the overall brightness of the system is determined by the power of the projection arc lamp and the electron beam raster is merely the controlling element.

Colour is produced by splitting the white light from the lamp into green and magenta via dichroic filters. The input slots let the green and magenta light through to the fluid control surface. The electron beam is modulated so that it forms three grooves (deformations) in the oil layer, one for each primary colour.

Each groove acts as a diffraction grating, producing a spectrum of colour from which the desired colour is selected by the pattern of the output bars. As there is only one electron beam and light source, there are no convergence adjustments.

Light valve projectors of this type are currently significantly brighter than CRT types. They can produce pictures up to 10 metres wide, and feature interchangeable lenses for flexible positioning relative to the screen. Light valve projectors are expensive, however – typically an order of magnitude more than CRT types.

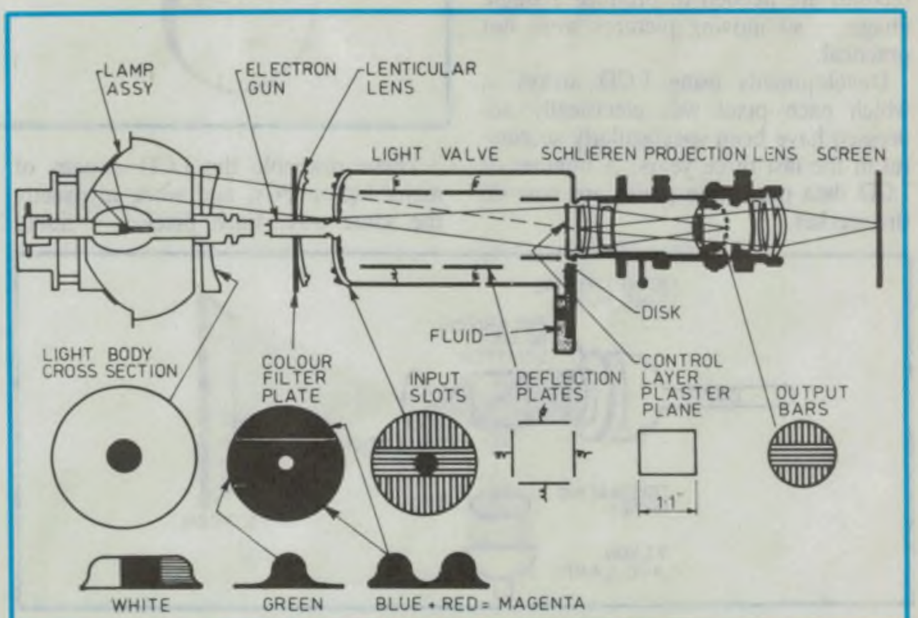
An interesting variation on the light valve just described, is employed in the Eidophor projectors manufactured by the Gretag company of Switzerland. Here the control layer is formed on the surface of a concave mirror and there is only one set of bars in the light path.

The light from the arc lamp is directed through a condenser lens onto a set of mirrored bars, tilted at a 45° angle. The light is then reflected onto the viscous liquid on the spherical mirror. When the control layer is unmodulated, the light is reflected back down the same path to the mirror bars and returns to the lamp house.

When the control layer is deformed by the scanning electron beam, the reflected light is deflected, and instead of following the path back to the light source, it bypasses the mirror bars and passes through the projection lens to the screen.

The depth of the deformation in the control layer, which is proportional to the modulation of the electron beam, determines the degree of deflection of the incident light and hence the proportion of light which appears on the screen, versus that reflected back to the source by the mirror bars.

Two different principles can be employed for colour operation. In the field sequential mode, the field rate is tripled and the electron beam is fed by sequential fields of red, green and blue information. A mechanical colour filter wheel is interposed between the light



The Schlieren optical system forms the heart of the General Electric 'Talaria' video projector. The electron beam 'etches' a pattern of grooves in the deformable fluid control layer. The depth of the groove is proportional to the picture brightness at that point. Light from the xenon arc lamp is bent as it passes through the grooves, so that it passes through the output bars to form an image on the screen.

Large screen video

source and mirrors, synchronised to provide red, green or blue light during the appropriate scanning periods.

In the simultaneous colour version there are three light valve units with individual control layers, electron guns and mirror bar systems for the R, G and B channels. The light from the lamp is split by dichroic mirrors into the three primary colours for the individual channels.

The top of the line Eidophor systems produce superb pictures up to 17 metres wide, but are extremely expensive. They are also quite hefty. The projector with its electronics racks and power supplies weighs around a tonne, and consumes 16.5kW of power.

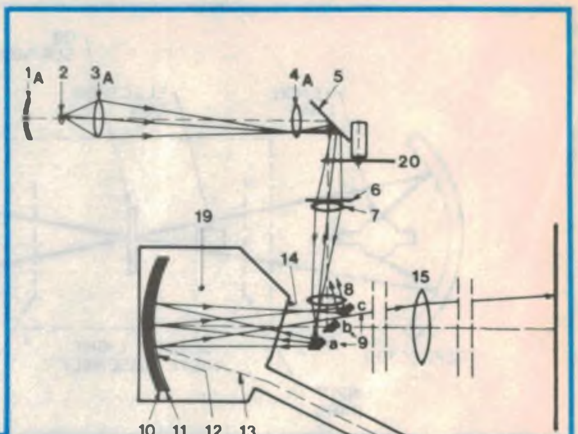
Using LCDs

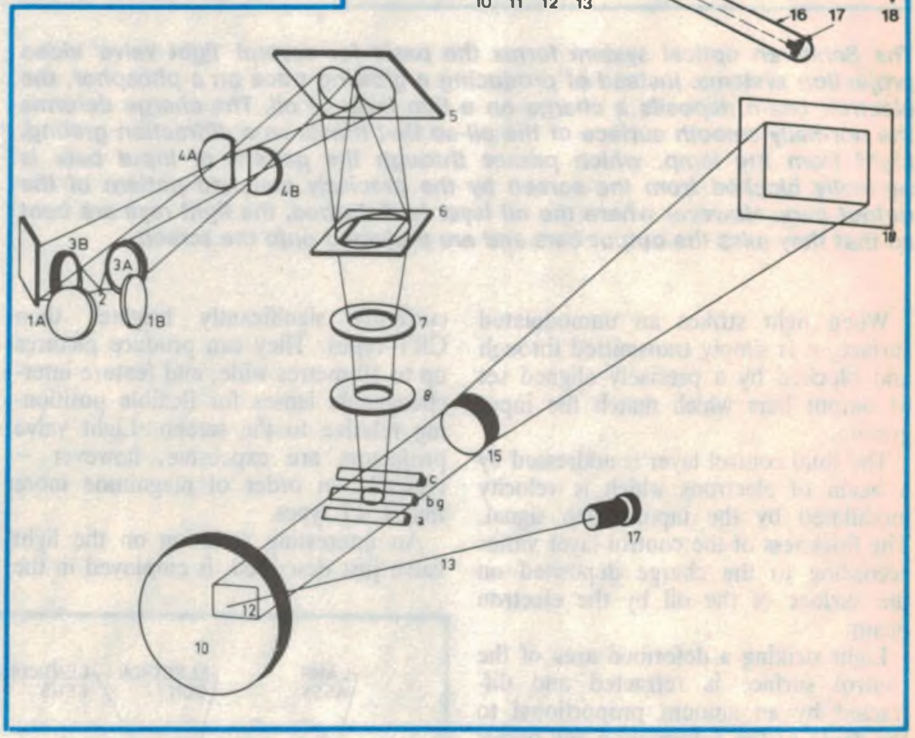
Much work was done on liquid crystal based light valves in the first half of the 1980's. Several systems were marketed for specialised data projection applications, in which an image was formed on a liquid crystal surface by addressing the crystal with light from a CRT or scanning laser beam.

The liquid crystal image was illuminated by a powerful lamp and then projected onto a screen. The system was and is capable of extremely high resolution character display, but several seconds are needed to produce a single image – so moving pictures were not practical.

Developments using LCD arrays in which each pixel was electrically addressed have been spectacularly successful in the last three years. A number of LCD data projection plates are now on the market.

In the 'Eidophor' video projector, the electron beam scans the oil layer on the surface of a spherical mirror. The deformations left by the deposited charge correspond to the brightness of the video signal at that point. Light rays from the lamp are bent by the oil layer as they reflect from the mirror surface.

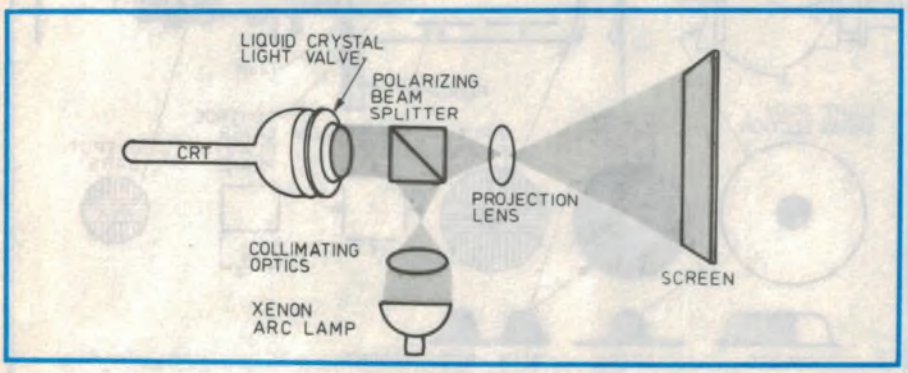




These resemble the LCD screens of many laptop PCs, and work in exactly the same way. Each pixel is a liquid crystal element which can be made to change from its transparent state to varying degrees of opacity by the application of a polarising voltage. Switching the individual pixels on or off produces characters or graphics.

The transparent LCD projection plate is simply placed on the platen of an overhead projector, and light passing through the plate is focused as an image by the OHP lens. The system works extremely well for monochrome computer data, with many brands and models on the market – but resolution is a long way short of video standards, and colour is still a problem.

There have been several announcements that colour LCD projection was imminent, and indeed colour video projectors based on this system were demonstrated in 1989 by a number of Japanese firms. Kodak demonstrated one such system in Australia, resembling a large 35mm domestic slide proj-



This system was developed by the Hughes Aircraft Company for projection of command and control information. Light from the CRT falling on the rear surface of a special sandwich of liquid crystal material causes the crystals to rotate and form a corresponding image on the front surface. This image is illuminated by a powerful lamp and its reflection is projected onto the screen. Currently, this system can only be used for projection of characters or graphical data.

ector with a tungsten-halogen lamp and single projection lens.

Dichroic filters provided light in the three primary colours, which were passed through three small LCD panels, rather like slides in the gate of a projector. The three colour images were then combined and passed through the common lens.

Resolution was fairly low, and the projected picture had a distinct 'mosaic tile' look – but it clearly looked like a promising way to go. However the product was never marketed in a PAL version, and the NTSC version has now been quietly dropped by Kodak in America.

Despite this many other companies are actively researching LCD projection. Current difficulties revolve around the speed with which the pixels can be made to switch and the fact that with only a few degrees of opacity, the contrast scale is limited and does not allow for differentiation between fine shades of grey.

Nonetheless it is in this area that big improvements are expected over the next few years.

Light valves with a variety of other control media are currently also being researched. One system uses a CRT which produces a dark area, rather than a glow, when scanned. Other promising systems employ crystal structures which may be switched by a current pulse to polarise incident light in different directions.

The future

'Direct view' displays will always be able to provide a superior contrast ratio and resolution than projection onto a screen surface. Large scale active-matrix LCD displays look like the safest bet currently, to produce the best large screen television sets in the future.

However for flexibility in adapting to different video standards and for portability, projection systems must be favoured. CRT projectors still have some development left, and will probably remain well entrenched for the next five years at least. After that, watch out for systems with a separate light source and an LCD projection plate.

Hughes LCD video projector

The Hughes 'SuperProjector' shown on page 12 of this article (based on the Hughes LCD light valve) is available in Australia from Thomas Electronics, 12 Larkin Street, Riverwood 2210 or phone (02) 53 0721.

Technology Update:

US chip makers see image controller bonanza

One of the semiconductor industry markets expected to grow most dramatically during the coming decade is that for dedicated image controllers. These are the chips that will form the 'brains' inside the next generation of page printers, computer display terminals, scanners, fax machines and photocopiers – all of which are predicted to mushroom in both offices and homes...

Until now, the personal computer industry has had an image problem. Or, more accurately, an *imaging* problem. The personal computer boom, as with most electronic revolutions, has had difficulty keeping all its sub-markets together, in the head-long rush into the future.

The piecemeal result has become especially apparent as personal computers move into the corporate world. While the computers themselves – thanks to the rise of 32-bit microprocessors, large capacity memory and sophisticated software – have grown in power and performance, many peripheral devices that play crucial roles in the support of these machines have lagged behind.

Nowhere has this been more true than in the devices that deal with the visual input and output of personal computers: laser page printers, scanners, graphics terminals and, increasingly, facsimile (fax) machines (see Fig.1). The need for these office or desktop imaging devices and systems multiplies every year. Yet their performance lags.

In many applications, office imaging systems have become a serious drag on the performance of the computers they are supposed to help. It is not uncommon to hear office workers grumbling about waiting for the printer.

There are several explanations for why the imaging market has fallen behind. One is focus: with the personal computer industry skyrocketing, semiconductor makers, not surprisingly, focused on building ever more powerful microprocessors and other chips for these products. Putting matching chip-level intelligence into peripheral components was given a lower priority.

Another reason was market size. The system CPU business has dominated the microprocessor business. As late as 1988, system CPUs represented 64% of the 4.3 million 32-bit microprocessors sold world-wide. Even within the office peripheral sub-market (21%), imaging devices represented sales of just 140,000 units.

Given the fact, nearly all semiconductor businesses chose to ignore the imaging business, at best awkwardly modifying their existing system CPUs for the job.

National leading

One company that broke the ranks was National Semiconductor Corp. As early as 1985, the firm identified a nascent imaging market and set out to meet it.

What National saw – and other semiconductor companies are now only beginning to recognise – is the extraordinary demand pull which millions of personal computer owners throughout the world would bring to bear on the office imaging business.

That pull is being felt right now, and will grow ever-stronger through the 1990's. Semiconductor industry watcher Dataquest now predicts that by 1993, the demand for microprocessors for the

The new Epson GQ-5000 laser printer, just released in Australia and designed for desktop publishing. Based on a Motorola 68000, it prints 6 pages per minute and provides 13 internal outline fonts plus 11 bit-mapped fonts, in sizes from 2.16 to 240 points. It also provides Centronics, serial and video interfaces.

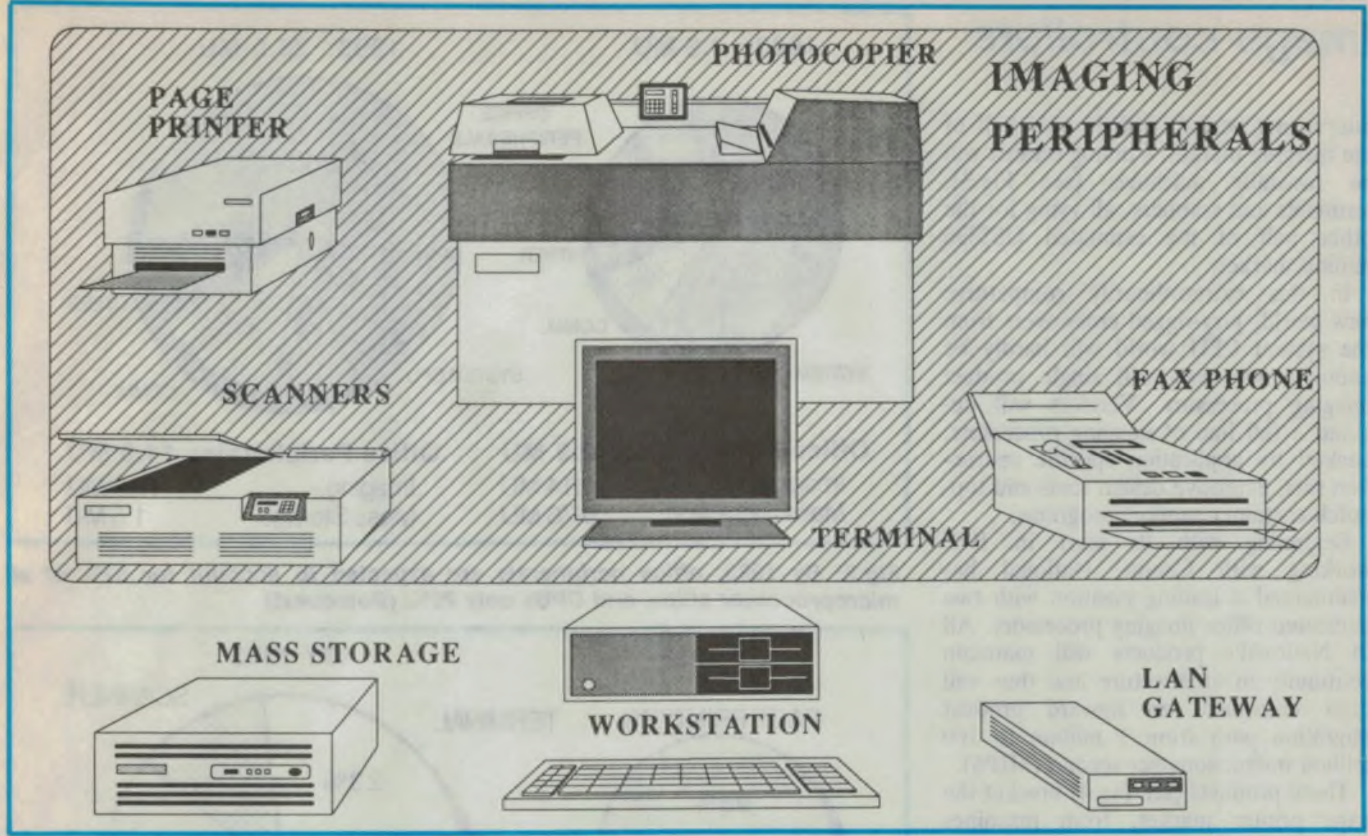


Fig.1: Desktop imaging devices and systems are proliferating in the modern office environment – presenting an enormous challenge and opportunity for makers of image controller chips.

office peripheral market will grow to 52% of the total 32-bit industry. Meanwhile, system CPUs will drop to just 26% (see Fig.2).

And while that reversal in market slices is taking place, the pie itself will grow larger. Much larger: more than six times its 1988 size, to 28 million units.

But within all this explosive growth, no market will grow faster than office imaging. By 1993, Dataquest predicts the office imaging peripheral market will reach 13.3 million units – an astounding 100-fold growth in just five years.

Page printer boom

Currently the fastest growing office imaging market is in page printers. Right now, 95% of the market for 32-bit microprocessors for office imaging products is dedicated to page printers. This market includes laser printers. Manufacturers of these devices are now beginning to recognise the importance of 32-bit embedded processors, for the print speed and resolution they'll need to keep up with the new computer workstations.

In the next few years customers will expect full colour, mixed-mode text and graphics at equivalent speeds, resolutions or print density as great as 1200 dots per square inch (four times the current standard) and printers with print speeds as high as 80 pages per minute. Needless to say, this will require ever more powerful embedded processors.

Furthermore, by 1993 the page printer business, despite growing 36-fold in the

The new Hewlett-Packard LaserJet IIP printer, a low cost unit which prints four pages per minute with a noise level of only 47dB. It provides 14 internal fonts, 512K expandable memory, and a slot for font expansion cartridges – including Adobe Postscript.

intervening period, will be only half of the imaging market. Coming on fast will be facsimile machines (see Fig.3), terminals and scanners, all vying for the other half of the estimated US$336 million market.

In this extraordinarily competitive new world, jury-rigged cross-overs from the system CPU world will hardly be enough; nor even will single product imaging processors. Vendors will demand a full line of imaging processors, backed by application specific instruction sets, extensive design tools and top-notch customer support programs.

Beginning with its start in 1985 working with Canon, National has maintained a leading position with two dedicated office imaging processors. All of National's products will maintain continuity in architecture and thus will offer customers an upward product migration path from 1 million to 100 million instructions per second (MIPS).

These products (see Fig.4) bracket the page printer market, from machines built for the personal computer market all the way up to ultra-fast printers for centralised computer centres.

Fax and the future

The page printer business is only the first of many burgeoning imaging businesses. Next up will be the fax and scanner markets, which, because of their many technical commonalities, might be considered a single business. In both, the price drops that heated competition will demand commensurate reductions in the number of components in each box.

For example, contemporary fax machines are filled with 25 to 40 integrated circuits. That number will be halved in machines due to appear early this year, and halved again by the end of the year. The result will be cheaper, more functional and higher reliability fax machines. But it can only be accomplished by pulling together all of fax's major functions onto a single chip.

In other words, a sophisticated 32-bit imaging embedded system processor is required, with a powerful application specific instruction set. And most of all, considerable experience in designing solutions for the imaging market.

New players

It is little wonder, then, that the world's major semiconductor companies are suddenly scrambling to compete in this hot new business. But succeeding in

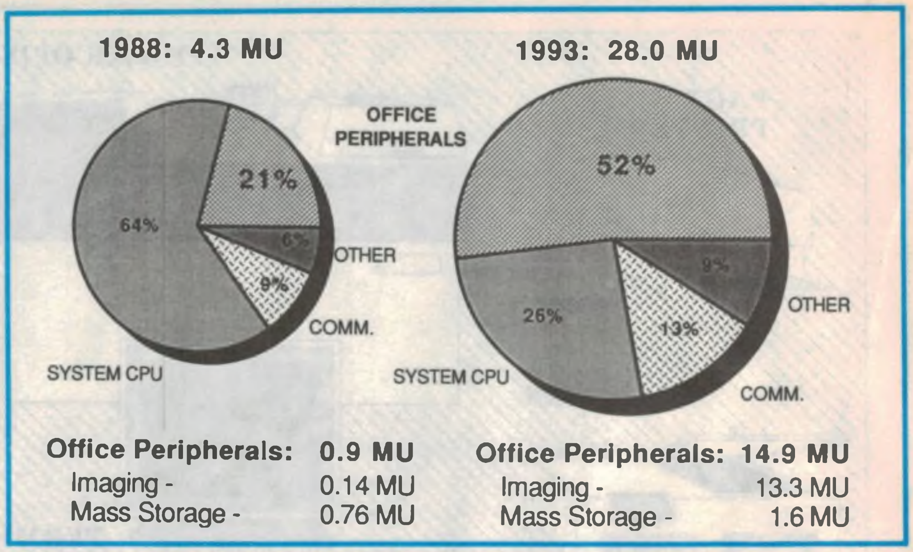


Fig.2: By 1993, office peripherals are expected to account for 52% of all microprocessor chips, and CPUs only 26%. (Dataquest)

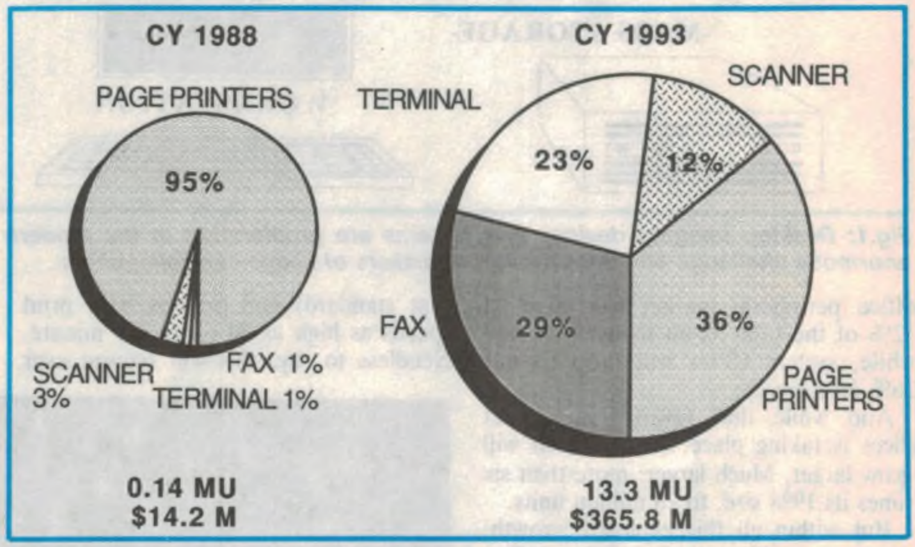


Fig.3: Fax, scanners and other applications are expected to rival page printers in imbedded image processor use, by 1993.

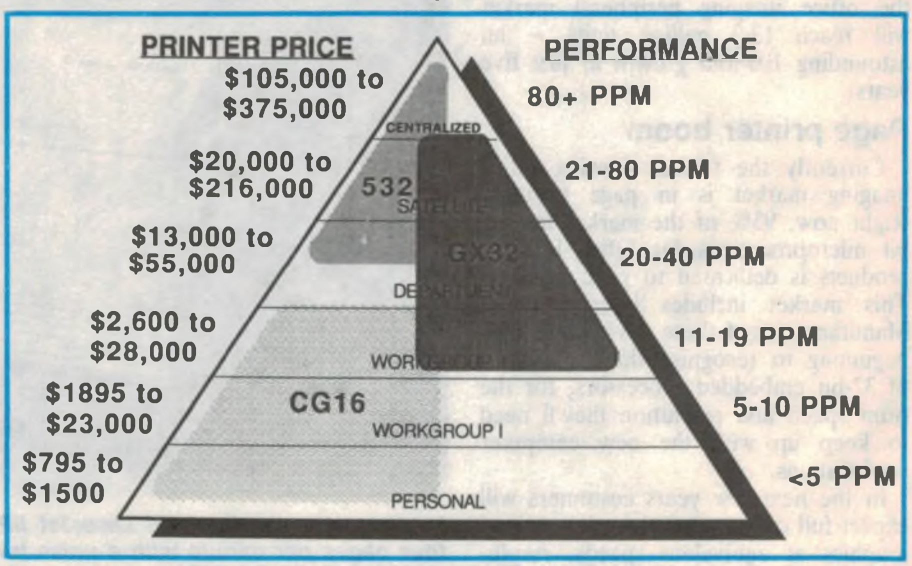


Fig.4: National Semiconductor's imaging processors cover page printers from the 'personal' to the centralised computer centre level.

the office imaging business will require more than merely renaming existing system CPUs. In fact, the market already has begun to mature, and it demands levels of committment from suppliers that few to date have been willing to make.

Late in 1989, Intel threw its weight into the embedded controller ring with the industry's first 80960 superscalar processor, capable of processing at up to 66MIPS. Intel officials said their new product is ideally suited for high-end laser printer applications, scanners, and faxes.

At more than US$300 per chip, however, the Intel processor will probably not find itself built into low-to-medium performance peripheral devices. Most likely, the i960 will be found in high-end laser printers, which print between 100 and 200 pages per minute. In fact, Canon has announced that it will use the Intel chip for its high laser printers.

Having lost the battle for the 32-bit systems market to Intel and Motorola, National Semiconductor appears to be going all-out to ensure its early committment to the image controller market will make it a major contender in that market. If it succeeds, the company may finally join Intel and Motorola in enjoying the benefits of having a highly successful mass-market processor.

Losers likely

The dilemma for chip vendors is that true 'embedded processors' for imaging must be the equivalent of the semi-custom ASICs found in other electronics systems. It must begin with a standard microprocessor, and then add an ASIC set that customers can use effectively for an office imaging application. Furthermore, it must feature modularity for maximum hardware integration and application customisation. Finally, because the embedded controller typically must be less than 1/4th the cost of the entire system, this entire system solution package must offer a superb price/performance ratio.

Few semiconductor companies in the world can do all of this. Either they are lacking the basic processor, or haven't the design tools in place to help the customers define an application specific processor. Some simply haven't yet made the committment to full customer service that the market will require.

And that's only the start. As the office imaging market grows, it too is beginning to both segment and grow more sophisticated. Those chip makers that can't adapt to, or keep pace with this change will be left far behind.

A look at what's available:

Amateur radio kits in Australia & overseas - 1

Here's the first of two articles surveying the construction kits that are currently available both here and overseas, for the radio amateur. In this first instalment we look at kits available in Australia and the USA, with those available elsewhere following in part 2.

by THOMAS E. KING, VK2ATJ

Affluent amateurs possessing the latest cordless remote CQDXEA 07AA1 Mk3 two tone transceiver equipped with 47 knobs, 74 switches, dual disco drives, teletext, audio fader, over-the-horizon radar detector, illuminated inner-face graticule, solid-state ignition and a hot water tap for making tea may just want to skip over this feature.

Dyed-in-the-wool homebrewers from the days of 'steam radio' – the kind who delighted in making their own valves and braiding their own coax shields and who still enjoy creating their own surface mounting devices and repairing RAM chips – may also want to give it a miss!

For the 18,000+ other licensed radio amateur operators in Australia, however, this survey of amateur radio kits from around the world could well meet a particular need. As well, it could also rekindle some of that dwindling interest in experimentation which has been such a debated 'Forum' topic in recent issues of *Electronics Australia*.

Kit construction is a happy medium between 'buy it and plug it in' appliances and 'design it then build it all from scratch' equipment. Even though it has none of the former and little of the latter, kit construction offers a learning experience, a sense of pride in doing it yourself and a not-to-be-forgotten saving over comparable ready-built commercial equipment. And for amateurs interested in experimentation, the basic work has already been done. The sky's the limit for modification and experimentation of kitsets.

There's a king's ransom of QRP kits available from both Australia and overseas sources. It was this segment of the amateur radio fraternity that I originally had in mind, while writing and telephoning companies on three continents to prepare for this article. But there's so many more interesting and useful kit projects available – most of them unknown in Australia – that the feature just had to be broadened. In this way a wider base of amateur radio enthusiasts – those interested in ATV, VHF,

Athens-based C&A Electronics offers a range of VHF and HF amateur kits, including QRP rigs. More details next month...

Packet or even individuals needing power supplies or test equipment in kit form – may also find something of use.

And finally, there's another group of licensed amateurs and would-be amateurs who may find this survey of particular interest: readers of *Electronics Australia* living in developing countries in Asia and the Pacific. The absence of funds to buy commercial equipment and the unavailability of critical components (or in many cases, any components) keeps many hobbyists from even thinking about an amateur licence. Hopefully this special kit survey shows that where there's a will, there's often a kit!

To start the ball rolling, we look at what's available right here in Australia. The format we'll be using is to deal with each supplier of amateur radio kits, in turn.

Australia

All Electronic Components
118-122 Lonsdale Street, Melbourne, Vic 3000. Phone (03) 662 3506.

This 30 year old Melbourne-based company has a number of speciality services for the ham and SWL. Apart from custom manufacture of PCBs and extensive component sourcing, the company produces a wide range of kits which were originally published as projects in Australian electronics magazines. Nearly three dozen communication equipment kitsets are available, including:

* Remote control transmitter switch $72.44
* Remote control receiver (for above) $41.67
* Power supply (for above) $19.47
* Active antenna $44.04
* Listening post $35.52
* Antenna matching unit $23.86
* Shortwave radio (*ETI* July 1989) POA
* Audio compressor $64.24
* Aircraft band converter $46.63

Assembling a kit can be an enjoyable way to get into amateur radio at low cost, as Michelle Smith demonstrates.

* Computer driven radio teletype transceiver $204.25
* RTTY modulator $32.46
* Voice operated relay $29.82
* Weather satellite decoder $31.51

Dick Smith Electronics
PO Box 321, North Ryde NSW 2113. Phone (02) 888 3200, Telex AA20036, Fax (02) 888 3631.

"For several years, this all-Australian company was not only an innovative force in amateur radio kits, it also stocked the country's largest range of build-it-yourself HF and VHF gear," said Bill de Rose, Dick Smith Electronics' Kits Manager. Representative of the type of amateur kits formerly produced and still available – while stocks last – was a 30W transceiver (80, 40, 20 or 15m (or 10m) coverage, depending upon the optional module purchased), and a series of 2m and 70cm GaAsFET preamps and power amps.

Mr de Rose anticipates that similar kits will again be available. Due to the dramatic rise in cost of specialised components needed for most amateur kits and the high cost of research and development, it's highly unlikely that the company will in future, carry such a diverse range of hobbyist equipment. Mr de Rose said that Dick Smith Electronics will consider producing kits in response to projects appearing in Australian electronics and amateur radio magazines.

The first of these was launched in mid-1989 with the release of a VHF FM monitor receiver for monitoring the local repeater. The 'short form' monitor receiver kit sells for $59.50 and includes all components as well as a custom designed PCB. The company is also looking into producing a kit for the 1W VHF FM transmitter design described in the November 1989 issue of *EA*.

A few other Dick Smith Electronics radio hobbyist items should also be of interest, especially to readers in developing countries with limited funds.

Of interest to the budding SWL or amateur needing an inexpensive shortwave radio is the $69.95 Dick Smith Receiver kit (K-6355). Using a single AM radio IC in a sophisticated design that keeps components to a minimum, the radio tunes from 480kHz to around 17MHz in three bands. The kit includes PCB, all components, box and a silk screened and punched front panel. This kit would suit budget-minded amateurs-to-be in developing countries if a simple BFO circuit were to be added.

At the time this article was being prepared, Mr de Rose supplied the following list of Dick Smith amateur radio kits still available in limited quantities:

K-6300 UHF transceiver $179.00
K-6301 40/80 ch upgrade suit K-6300 $5.95
K-6309 UHF GaAsFET preamp $99.00
K-6311 VHF GaAsFET preamp $79.00
K-6313 2m linear amp (100W) $229.00
K-6316 VHF power meter $29.95
K-6323 RF attenuator box $59.95
K-6326 80m low power CW Tx $39.95
K-6327 80m VFO kit suit K-6326 $29.95
K-6328 80m dir conv Rx $49.95
K-6330 HF transceiver with 80m module $299.00
K-6331 HF linear amp (200W) $249.00
K-6332 HF up-grade 40m $19.95
K-6333 HF up-grade 20m $19.95
K-6334 HF up-grade 15m $19.95
K-6337 HF up-grade 10m $19.95
K-6339 Morse RTTY decoder $129.00
K-6349 6m booster amp $249.00

Until sold, these amateur kits are available in many Dick Smith Electronics stores. Country readers can make enquiries direct to the head office in North Ryde.

An even less expensive way to enter the SWL scene is available. Easily affordable by all schools is Dick Smith's *Fun Way Into Electronics*. A Funway gift box priced at $29.95 includes a detailed book of projects, a complete set of components and a resealable plastic breadboard. As well as safely teaching basic electronics (all projects are battery operated and use no dangerous voltages or components), there are a number of useful projects for anyone wishing to

Amateur radio kits

A good project for the beginning SWL or amateur is this three-band shortwave radio, available as a kit from Dick Smith Electronics.

become involved in the amateur or SWL hobby: a crystal set, a Morse code communicator, the 'world's smallest transmitter' and a simple amateur band receiver for 2-6MHz. Funway Part 2, priced at $12.95, has a shortwave receiver project built on a PCB.

Two power supply kits offered by Dick Smith Electronics will be useful. Complete with case, front panel and transformer, the Powermate 2 kit sells for $119 and is capable of delivering 13.8V at 5A. For heavy duty applications try the VK Powermaster, whose $169 'short form' kit allows the use of optional transformers to meet specific heavy current needs.

"Because the name 'Dick Smith Electronics' is so well known", said Mark Abicair, "we get – and encourage – mail orders from around the world."

A number of procedures have been developed to speed the delivery of equipment. "We respond to a request for information within 24 hours," said Mr Abicair, "with the reply detailing the method of payment and the air freight rate."

Electronic World

30 Lacey Street, Croydon, Victoria 3136. Phone (03) 723 3860/3094. Fax (03) 725 9443.

Hundreds of 80m direct conversion receivers have been sold. This popular project comes as a 'bare bones' kit with PCBs, semiconductors and all wound components, for $95. A suitable case is $15.70. An all-mode receiver, it covers 3.5 to 3.7MHz. Sensitivity is 0.4uV for 10dB SNR while selectivity is 50dB down at 100Hz.

An easy to build CW-only transmitter is perhaps the least expensive RF kit available in Australia. It operates on the 80m band (a 3.579545MHz crystal is $3.50) with a power output of 4W. It costs only $29.95, with a suitable case priced at $7.75.

Electronic World has a number of other Drew Diamond VK3XU kits, including a crystal calibrator/marker at $29.95, a crystal checker $22.95, a MOSFET RF power amp $29.95, MOSFET CW VFO 80m transmitter POA and a direct conversion receiver for 80, 40 and 20m – also POA.

A two page computer printout supplied by Electronic World includes many other kits: C.W. Howes amateur kits from the UK, wireless mic and shortwave projects from *Talking Electronics*, numerous RF and test equipment kitsets and several UHF remote transmitter/receiver items from Oatley Electronics. Send an SASE for a complete listing.

CW Operators QRP Club

3 Durham Avenue, Lockley, SA 5032.

In the latest issue of *Lo-Key*, the journal quarterly of the CW Operators QRP Club, four kitsets are available: a 3.5MHz CW QRP transmitter for $77.00, a VFO for $18.00, a SWR meter and 21MHz VFO each for $27.00. All items are available only to members. Write for details.

Altronics

PO Box 8350, Perth Mail Exchange, WA 6000. Phone (09) 328 1599. Telex AA94186 (ALTRON), Fax (09) 328 4459.

While this domestic hobbyist company does not yet manufacture any amateur radio kits, it does carry some interesting pieces of test equipment in kit form.

Daryl Freeman, Altronics Kit Manager said that "The company's 1GHz Digital Frequency Meter kit sells for only $299 and outperforms many other instruments twice its price." Featuring a Hewlett Packard 8-digit display, the DFM has four different gating times in both the 10/100MHz and 1GHz ranges.

More compact and less expensive, at $99, is a 50MHz Digital Frequency Meter. Featuring high input impedance, an overflow LED indicator and kHz and MHz LED indicators, all components mount onto a single PCB – even the selector switch.

Ideal for powering mobile HF and VHF amateur transceivers is the Altronics 13.8V high current power supply kit. Capable of providing 7.5A continuous and 10A intermittent, the $139.50 supply features a regulation of +/–50mV at 7.5A.

A number of other test equipment kitsets are also available:

* Transistor/FET/Zener tester $49.95
* Digital capacitance meter $79.00
* Bench amp/signal tracer $65.00
* RF detector probe $12.00

Microwave Specialists

5/14 Legon Road, South Oakleigh, Victoria 3167. Phone (03) 544 8870.

Amateurs wanting to go UHF can now do so easily and inexpensively, thanks to the efforts of this small company in Melbourne.

The company is one of the few UHF specialists in the world to stock 1296, 2304 and 3456MHz transverter kits. All units can be used with any 2m transceiver operating from 1 to 10W. As well, microwave amplifiers are available to provide power outputs of 2W, 15W and 30W. Prices and specifications are available on application.

Apart from UHF kits, the company sells 10GHz Gunnplexers with 10mW to 100mW output, a 10W TWT (travelling wave tube) for 10GHz dishes, feeds and antennas, other hard to obtain RF components and surplus bits and pieces for the homebrew enthusiast.

Koning Electronics

8 Roberts Avenue, Hoppers Crossing, Victoria 3030. Phone (03) 748 6026.

John Koning, VK3EBB, has designed a heavy duty power supply usable with many solid state HF and VHF rigs. The 13.8V, 15A power supply kit with linear regulation and crowbar over-voltage protection comes with "a very large heatsink, transformer, case and all other parts." Postpaid price is $220.

Stewart Electronic Components

PO Box 281, Oakleigh, Victoria 3166. Phone (03) 543 3733, Fax (03) 543 7238.

One of the newer entrants on the Oz amateur scene is Stewart Electronic Components. Two kits are currently available, with several more to be introduced in 1990.

Launched in mid 1989 is a commercial quality printed circuit board and a full kit of components for a 100mW 2m transverter. Based around a BF981 dual gate MOSFET preamp and a BF981/BFR96S two stage amplifier, the transverter can be built for use with a 10m or 6m IF. Price for the BX933 PCB is $33. Three module sections are needed (receive converter, transmit converter and a common local oscillator) and are sold separately.

The second new kit is a 100mW 6m transverter, again built around three modules. A parts kit for the 6m receive converter is $63.60 while the parts kit for the 6m transmit converter is $37.20. An injection oscillator (without a crystal) is $34.80. The BM935 PCB is $37.20. Crystals are $19.20.

Future PCBs and kits are expected to be a 10W, 2m amplifier (using a Mitsubishi hybrid power amp module) and a 6m power amp module. Still further down the drawing board are a host of other amateur projects, certain to be of interest to amateurs in Australia and throughout the world.

United States of America

Radiokit

PO Box 973, Pelham, New Hampshire 03076. Phone (603) 657 2235, Telex 887697.

Kits, kits and more amateur radio kits are sold by Radiokit, a specialised equipment, component and accessory mail order outlet. Three different American-designed low power transceivers are among dozens of items of amateur kit interest.

Featuring a superhet receiver with 0.5uV for 10dB S/N sensitivity, Radiokit's US$199.95 75-metre compact SSB transceiver provides 30W output over the 3.8 – 4MHz portion of the band. All circuitry is contained on two PCBs and housed in an attractive predrilled and lettered cabinet.

For the 20m CW enthusiast Radiokit has two options – a 15W Travelradio (US$159.95) and an ultra miniature 5W QRP-20 transceiver (US$119.95). The Travelradio has a crystal filter, selectable 600Hz audio filter, S meter, VOX style break-in with adjustable delay, 70Hz offset and sidetone. Measuring just 1-7/8″ by 4″ by 4″, this 'DX station in your pocket' offers 0.3uV or better sensitivity, sidetone and dual Cohn 4- pole IFs.

The company has also developed a Micro 20 receiver for 14-14.4MHz. Retailing for US$69.95, it utilises a Signetics NE602 mixer IC, crystal filter and a 3″ by 1″ PCB!

A transmatch kit handling 1500W+ and offering coverage from 1.7 to 30MHz is available for US$169.95 (basic kit) and US$375 (deluxe kit).

Other interesting Radiokit do-it-yourself projects are as below, with all prices in US dollars:

* K9CW Microprocessor based memory contest keyer, $109
* Oscar 10 PSK Demodulator $139.95
* Smart Squelch (AM, FM, SSB) $54.25
* Packet Radio PSK Modem (1200 baud) $99.00
* Broadband preamp (20dB gain 270Hz to 608MHz) $49.95
* Active Antenna $25
* L-Meter $29.95
* R-X Noise bridge (1.5 – 30MHz) $39.95
* Solid State T-R switch (for valve rigs) $16.95
* Broadband balun (3MHz – 30MHz) $32.95.

Popular for a number of years, the Mizuho range of QRP CW transmitter and receiver kit has helped many amateurs get on the air cheaply.

Radiokit is the American distributor for dozens of British amateur kits and modules, notably Minisynth and Cirkit units. These include (prices again in US dollars):

* DSB160 HF Transceiver (160m 2W CW/SSB) $86.75
* DSB80 HF Transceiver (80m 2W CW/SSB) $86.75
* DSB2 HF Transceiver (20, 30, 80, 160m 2W CW/SSB) $84.25
* DFM20/30 module for the above $84.50
* Case/hardware for any transceiver $56.50
* FC177 digital frequency display $58.50
* Minisynth PLL VFO $59.50
* Conversion kit (160, 80, 30 or 20m) $13.50
* HF Amplifier (broadband 1.6 – 30MHz, 1W in/15W out) $75
* Micro Match ATU $75
* Preamp (1.5 – 30MHz) $35
* CMOS Keyer (6 – 50WPM) $53
* QRP PA (3W PEP) $51
* 2m power amp/receiver preamp (2.5W in/22W out) $117
* 2m preamp $11.50
* 2m – 10m Converter $52
* 2m GaAsFET masthead preamp $159.50
* 50MHz Converter (2m or 10m out) $67
* UpSAT/2m receiver $108
* VHF weather satellite receiver $115
* Wideband amp (14 – 70MHz 40dB gain) $18
* Multiband preamp (10, 6 or 4m) $19.50
* Multiband upconverter $93.50
* UHF to VHF converter (70cm – 144MHz) $63.50
* UHF to HF converter (70cm – 28MHz) $52
* 70cm preamp $13.50
* 4m/6m transverter $136
* 23cm converter (10m or 2m output) $57
* 70cm 10W power amp (2W in/10W out) $102
* Active SSB/CW filter $43
* Audio speech processor (all modes) $32.50
* Parametric equaliser $125.50
* CW filter $27.75.

Radiokit also has a number of other interesting items in its 64-page catalog, including printed circuit kits (etchant chemicals, protective coating and resist pens), helical filters for VHF and UHF circuits, a wide range of components for home brew projects (even filament choke kits, B&W air wound inductors, coax relays, toroids, ferrites and beads,

Amateur radio kits

reduction drives, enclosures) and PCBs for a number of ham projects (IARU transceiver, packet radio PSK modem, 20m CW transceiver, CMOS 2m synthesiser, 40m transceiver, compact SSB receiver, OSCAR 10 telemetry demodulator, etc.). Many of these projects are also available in full kit form.

Heath Company
PO Box 8589, Benton Harbor, Michigan 49022. Overseas Orders (International Division) phone (616) 982 3512, Telex 201497 or Fax (616) 925 2949

Helping countless amateurs around the globe with instructional courses and quality amateur radio kits, the Heath Company is perhaps the best known kit company in the world. "Currently available from Heath is virtually everything from an all-mode HF transceiver and a matching 1000W linear amp, to a novice amateur course and a CW code practice oscillator", said Ed Pomeroy, Export Sales Manager.

A system package combining the novice course and oscillator is US$49.90. More advanced study guides such as the one covering the USA's General and Extra licences are US$24.95 each. Computer learning software (IBM compatible) is available for the Novice at US$39.95, General at US$34.95 and Extra at US$49.95.

For the novice, low power operator and ham on holiday, Heath has the HW-9 QRP CW transceiver. Designed to cover the lower 250Hz of the 80, 40, 20 and 15m amateur bands, the US$249.95 4W CW transceiver can also cover the 30, 17 and 12m WARC bands and the lower 250Hz of the 10m band with the optional US$39.95 HWA-9 Band Pack. The transceiver has continuously variable RF output, front panel relative signal/power strength meter, AGC, product detector, an active audio filter, 0.5uV or less for 10dB S+N/N and selectable selectivity.

A matching QRP wattmeter which reads SWR from 1.1:1 to 3:1 is US$49.95. A 100W antenna tuner with 4:1 balun is also priced at US$49.95. It has connectors for coax, balanced line and long wire antennas.

On the higher power side of the Heath coin is the 100W SB-1400HF all-mode transceiver, offering 20 memory channels, a 100kHz to 30MHz general coverage receiver and dual VFOs. Priced at US$799.95, the slimline kit finished in grey has narrowband (500Hz) CW and wideband (6kHz) AM IF filters, a noise blanker, a triple conversion receiver, 1uV sensitivity above 1.5MHz and user-selectable tuning rates.

The matching SB-1000 linear amplifier, priced at US$699.95, provides 1000W PEP output on SSB, 850W out on CW and 500W out on RTTY over the 160, 80, 40, 20 and 15m amateur bands. (Also included are WARC bands at 80% of rated output.) The amplifier uses a single 3-500Z tube.

A deluxe antenna tuner has been produced, to be used with the SB-1000 or any high power linear. With its continuously variable inductor, precise matching is assured from 1.8 to 30MHz. Priced at US$299.95, kit SA-2060 is not only a wattmeter, but allows operators to select a dummy load or any of three antennas.

Designed specifically for the avid shortwave listener, Heath's SW-7800 covers 150kHz through 30MHz continuously in 30 overlapping 1MHz bands. Featuring dual conversion, AGC, muting for use with a transmitter, and a front panel jack for taping program material, the US$299.95 synthesised shortwave receiver will operate on any DC source from 11 to 15V.

In reflecting amateur growth in packet and AMTOR, Heath has released the US$279.95 HK232, a Packkit multi mode TNC supporting all common baud rates for Baudot RTTY, ASCII and CW from 5 to 99WPM. Radio links rate are supported to 1200 baud (9600 with external modem) and computer data rates to 9600 baud.

Nine other smaller but very useful amateur kits have appeal for amateurs needing specialist services. Prices are again in US dollars:

* Antenna noise bridge $49.95
* Active SWL antenna $49.95
* VLF converter (10 to 500kHz) $49.95
* Programmable memory keyer $129.95
* Multimode SSB/CW/RTTY audio filter $79.95
* Dual HF wattmeter $129.95
* Remote coax switch $79.95
* Remote control decoder $79.95
* 'Cantenna' dummy load $24.95

Distributors of Heath amateur radio equipment have been established in several countries on the continent. Where over-the-counter purchases are not available, the International Division of the Heath Company will dispatch kits by air parcel post or air freight. All orders must be accompanied by payment in US funds either via bank draft, bank cheque, bank transfer, letter of credit or VISA/Mastercard numbers.

Smaller firms

Throughout the USA there are a number of small to medium size companies producing amateur radio and shortwave listener kits. These are listed below together with examples of their wares – again with the prices in US dollars:

Q-Products (Larry Price, N7BNJ), 10412 36th Street E, Puyallup, Washington 98372, phone (206) 841 7465 (evenings), sells a range of VHF amplifier kits. Prices and specifications are on application.

A specialised company, Bel-Tek, of PO Box 125, Beloit, Wisconsin 53511 has developed a CMOS Keyer kit for $9.95. Compatible with grid block, cathode keyed and solid state transmitters and offering a speed range from 5 – 50wpm, the kit comes complete with PCB and all parts. Complimenting this project is a memory kit for $14.95. It can store two messages of up to 50 characters each and play them back at any speed.

For CW operators, Bel-Tek has designed a $19.95 CW Audio Filter kit. Easily connected between your transceiver and speaker, the audio filter has 90, 130 and 200Hz selectable bandwidths and a 800Hz centre frequency.

Looking for an antenna in kit form? Antennas West, of Box 50662-W, Provo, Utah 84605 (phone (801) 373-8425) manufactures Quickkit G5RV

Stylish and compact, this Heathkit 8-band transceiver is an amateur's dream QRP rig.

loop and dipole kits. Three models are available: full size (80-10m) for $34.95, half-size (40-10m) for $24.95 and quarter size (20-10m) for $19.95. As well, there's a Marconi adaptor kit for $4.95 and an antenna launcher kit for $14.95. Fully weather sealed and using quality non-corrode components, Quickit antennas require no measuring or cutting and can be completed in minutes.

Need a touch tone decoder-controller? Norcon Engineering, of PO Box 1607, Mooresville, NC 28115 – phone (704) 664-7817 – has the $44.95 D-16, which decodes all 16 digits plus one 4 digit sequence. Operating on 12V DC, it has speaker muting and is crystal referenced. The TD-16A $16.95 controller adds four latched outputs to the TD-16 and can directly drive four relays.

Use your low frequency scope as a spectrum analyser, after completing the $399.95 specialised kit from A & A Engineering, of 2521 West La Palma, Unit K, Anaheim, California 92801, phone (714) 952 2114. From the same company is a $269.95 benchtop direct digital frequency synthesiser kit.

Many amateurs consider a quad to be the optimum HF antenna. The Cubex Company, PO Box 732, Altedena, California 91001, phone (818) 798 8106 manufactures a two element, triband quad kit for $269.95. The boom and wire are not included. The kit does include fibreglass arms, end spiders, a boom/mast coupler, clamps and an instruction manual.

The current catalog from All Electronic Components in Melbourne includes many amateur radio kits.

Offering a range of QRP CW transmitter kits and components is W1FB, PO Box 250, Luther, Michigan 49656. An SASE with sufficient postage (IRCs) for overseas mailing will bring a catalogue.

In late 1988, *QST* magazine featured a three-channel CW emergency transceiver. The 1W 40m CW rig was described as 'portable power for ham radio hikers, boaters, campers and pilots'. A two-board set (drilled, solder plated, glass epoxy PCBs) is available for $9.95 from Far Circuits, 18 N 640 Field Court, Dundee, Illinois 60118. The company also has boards for other transmitters, receivers, transceivers and ham gear.

Specialising in ATV converters and 2m VHF amplifier kits, Communication Concepts Inc. of 121 Brown Street, Dayton, Ohio 45402 (phone (513) 220 9677) also sells HF linear amplifiers. On the ATV kit scene are three converters: ATV2 (420 – 450MHz) at US$44.95, ATV3 (420 – 450MHz, GaAsFET) at US$49.95 and ATV4 (902 – 928MHz, GaAsFET) at US$59.95. An audio squelch control for ATV is US$39.95. A 35W 2m amp kit is US$79.95 while the 75W version is US$119.95. A 100W 420MHz SSB/FM/ATV amp is US$129.95.

Phew – that's all for this month. In the second of these articles we'll look at what's available from India, the UK, Greece, Japan and West Germany.

Computer software review:

ChiWriter - the scientific WP

Typing up a paper, report, manual, magazine article or course assignment can be something of a nightmare if it contains maths formulas, expressions or chemical equations. But this needn't be the case any more, thanks to the availability of this low cost scientific word processing package for IBM PC compatibles.

Despite the tremendous popularity of word processing, it's surprising how many papers and reports are still typed up on conventional typewriters – mainly because most word processors aren't designed to let you include things like superior and inferior figures, Greek symbols, and maths symbols like square-root and integration signs.

Nor is it easy, with most word processors, to introduce fractional line spacing – so that equations with things like multi-term quotients can be shown properly. At least with the typewriter, you can shift the carriage up and down manually, to put things where they should go...

Of course the other approach is to prepare and type out the bulk of your work with a WP, just leaving gaps and blank lines where the 'tricky bits' are to go. Then someone with a sharp eye and a steady hand puts these in afterwards, with a drawing pen, ruler and various assorted lettering guides.

Both of these approaches are very messy, of course. But traditionally, they've been the only practical alternatives for those who couldn't afford a full-scale typesetting system, and the highly skilled operators needed to drive it for this kind of specialised work.

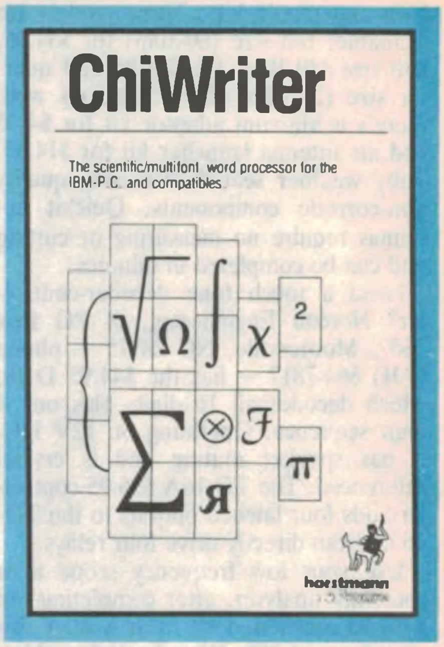
The arrival of PCs improved this position a little, with a few 'scientific' WP packages gradually becoming available. But until now these have been quite expensive, and beyond the reach of most private individuals.

Enter ChiWriter, a low cost scientific/multifont word processing package for IBM-PCs and compatibles. Written by a chap called Cay Horstmann, in San Jose, California, it has been written specifically for anyone who needs to write scientific, engineering, mathematical, symbolically logical and other technical material – and also people who need to write in foreign languages, complete with authentic acutes, graves, umlauts, cedillas and whatever.

Incidentally ChiWriter is pronounced 'ky-writer', and its author's first name is apparently also pronounced as 'Ky'.

Now about two years old, ChiWriter has apparently been revised and upgraded from the original. By all accounts it has acquired quite a following in the USA, and looks set to achieve the same here.

Essentially it's like a standard word processing package, except for being much more flexible than usual when it comes to the range of type fonts available for both the screen display and the printout. It's also rather more flexible regarding vertical spacing. So you not only have access to a much greater range of symbols and other weird characters, but the ability to put them almost anywhere you wish on the screen and printed page



And Chiwriter will work with a variety of printers. The basic package works with a standard low cost 9-pin dot matrix printer, while optional supplementary driver disks allow it to support more exotic printers such as 24-pin and laser units.

On the system hardware side, it needs at least 384K of RAM, either two floppies or one floppy and a hard disk, and DOS 2.0 or later. It is basically designed to work with a CGA video adaptor, although again an optional supplementary disk is available to allow the use of an EGA or other hi-res monitor.

ChiWriter comes with some 14 different fonts, which may be called up at any time using the function keys. Eight of them are relatively 'normal': standard, small, italic, bold, underlined, Orator, Script and Gothic – see Fig.1. The remaining six are much more specialised: Foreign, Symbol, Greek, Linedraw, Math I and Math II. It's these which really set ChiWriter apart from

Substituting this result in equation 27,

$$V_{12} = \frac{1}{Q}\int_1^2 F\ ds$$

Electromotive force $= \oint E\ ds = -\frac{1}{c}\frac{\partial\Phi}{\partial t}$

Here we make use of Maxwell's equation:

$$\nabla \times E = -\frac{1}{c}\frac{\partial H}{\partial t}$$

Resonant Frequency $F_o = \dfrac{1}{2\pi.\sqrt{L.C}}$

Fig.3: The kind of things you can do with ChiWriter. This is 80% of actual size, from a standard 9-pin dot matrix printer.

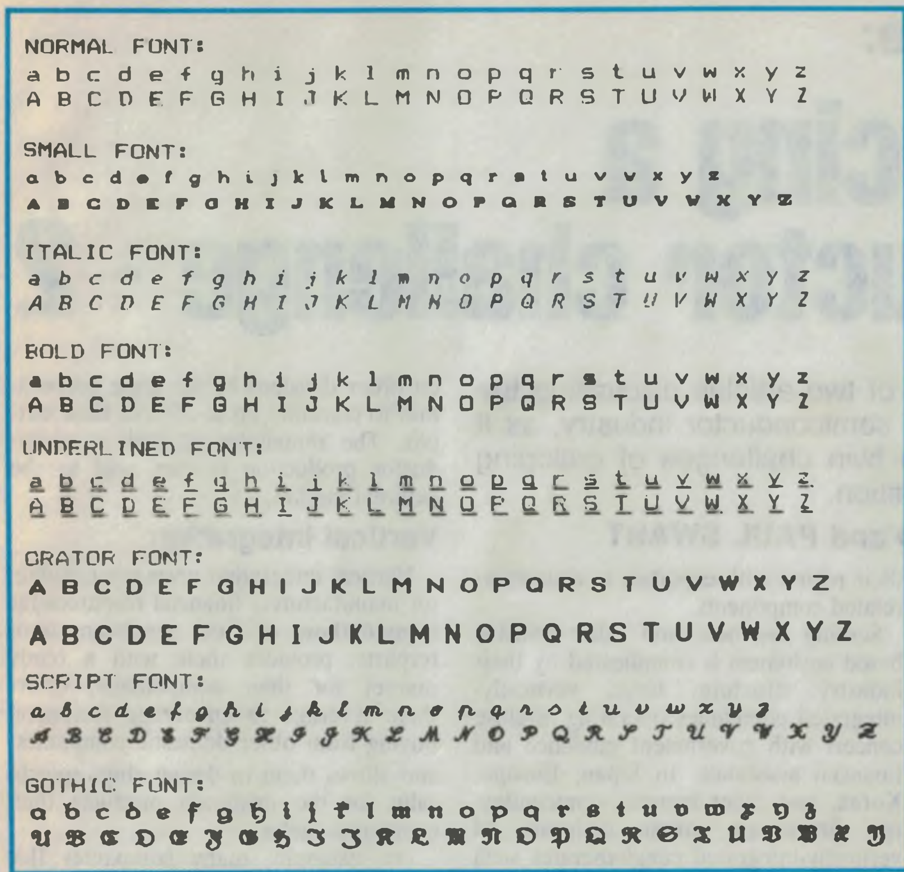
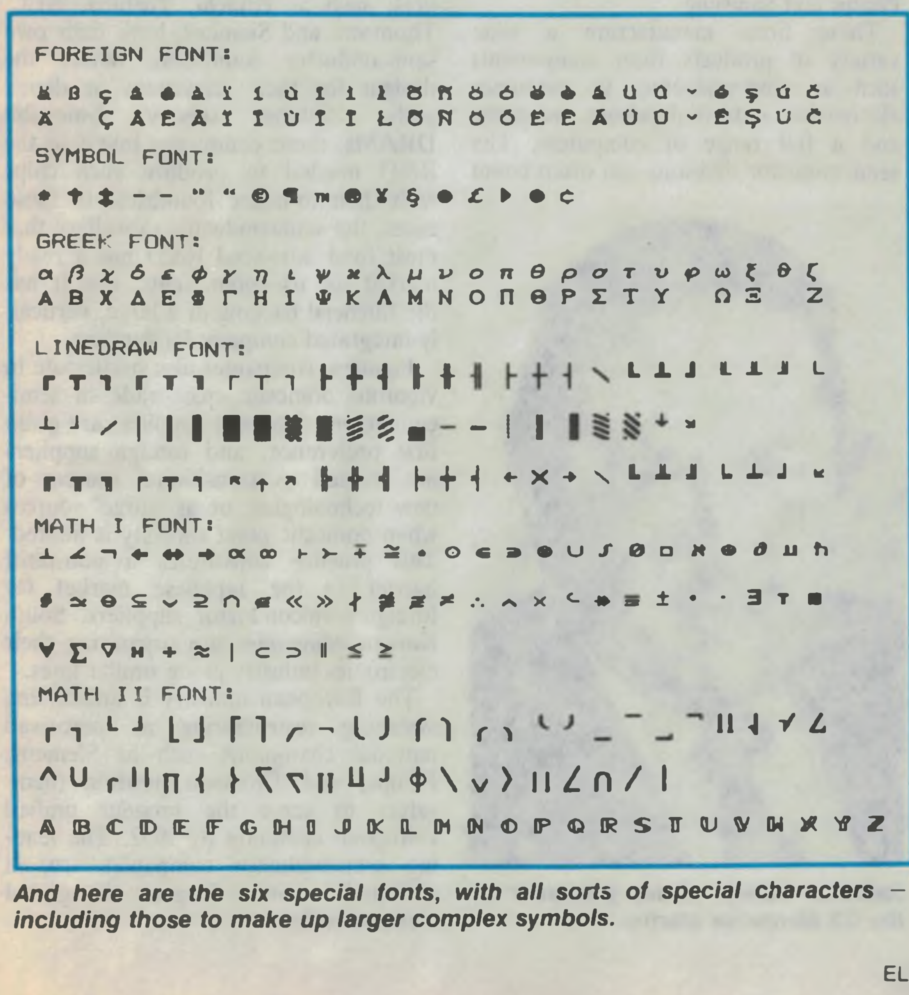


Fig.1: The eight relatively normal ChiWriter fonts, 80% full size.



And here are the six special fonts, with all sorts of special characters – including those to make up larger complex symbols.

other word processing packages (Fig.2).

Actually you aren't limited to these 14 standard fonts, either. There are other fonts available as optional extras, to suit specialised areas such as organic chemistry.

In addition, ChiWriter also includes a facility called Font Designer, which allows you to design your own weird and wonderful symbols for specialised applications.

For each 'designer symbol' you produce both a screen version and a printed version, and generally the printed version has rather higher resolution. For a CGA adaptor the screen characters use an 8 x 10 matrix, while the versions printed on a 9-pin printer use a 16 x 24 matrix. With an EGA or VGA adaptor the screen resolution increases to 8 x 16, while the printed resolution increases to 40 x 30 for a 24-pin printer or 32 x 50 for a laser printer.

In each case Font Designer lets you design the screen and printed versions of the each character side by side on the screen, using easy cursor control.

Using it

Thanks to ChiWriter's Australian distributor Symphase, I was able to borrow a copy of the program and try it out over a period of some weeks. Here's what I found.

In use, it's a little like Microsoft 'Word', with a command function menu system which appears along the bottom of the text screen. And like most modern word processors, it's essentially 'WYSIWYG' – what you see (on the screen) is close to what you're going to get on paper.

Operation doesn't seem quite as friendly as many of the latest packages, but it's not bad. Inevitably it also takes you a fair amount of time to master the techniques of placing the symbols and other special characters where you want them, and with the right horizontal and vertical spacing. Or at least, it took *me* a fair while to do this...

On the whole, though, I found it a very impressive little package, and one which seems likely to 'fill the bill' for a lot of specialised word processing applications. Once you get the hang of it, you can do things with it that simply aren't possible with any normal word processor (see Fig.3). And you can do them with surprisingly little fuss, too.

At the quoted price of $160, it certainly seems excellent value for money.

Further information on ChiWriter is available from Symphase, its Australian distributor, at PO Box 200, Dromana 3936 or phone (059) 87 1373. (J.R.) EA

Technology Update:

The US facing a semiconductor challenge - 2

Here's the second of our series of two articles discussing the changes taking place in the US semiconductor industry, as it pools its resources to meet the twin challenges of galloping technology and overseas competition.

by JEANNE ALFORD and PAUL SWART

The formation of US Memories brought a lot of 'firsts' with it, including the first time major US system houses have been willing to share the burden of the huge risks and costs involved in setting up major DRAM facilities.

Memory chips are the lifeblood of any system house. It is no coincidence that IBM produces its own DRAMs. The giant does not want to become dependent on foreign sources for a component whose scarcity, artificially created or not, could bring its production lines to a screeching halt.

Although a US-based DRAM production capacity will be able to protect the US computer industry from foreign market manipulation, the memory field is but one component of an overall strategy to bring technological and market leadership back to the United States.

Key to the success of this strategy is for the US semiconductor industry to play a much greater role in the worldwide consumer electronics markets.

To accelerate their participation in the advanced consumer market, American semiconductor companies must not only forge tighter links with US-based systems companies, but must also develop closer relationships with European and Japanese electronics industry leaders. Accomplishing these new relationships will be a major challenge.

American share of the worldwide consumer electronics market has dwindled during the past 10 years. America's share in sales of semiconductors used in consumer products has followed suit. Although one-third of American semiconductor sales are to overseas markets, Asian and European consumer electronics manufacturers often prefer to buy components either from their own companies or from other companies in their region with expertise in consumer-related components.

Serving Japanese and other non-US based customers is complicated by their industry structure: large, vertically-integrated companies operating in close concert with government guidance and financial assistance. In Japan, Europe, Korea, and other regions, semiconductor firms are often divisions of vertically-integrated conglomerates such as Toshiba, Fujitsu, Hitachi, Siemens, Philips and Samsung.

These firms manufacture a wide variety of products from components such as semiconductors to consumer electronics, industrial robots, weapons, and a full range of computers. The semiconductor divisions can often count on other divisions of the same corporation to consume up to 35% of their output. The remainder of their semiconductor production is then sold to the external market.

Sanford 'Sandy' Kane, president of the US Memories startup.

Vertical integration

Vertical integration gives semiconductor manufacturers financial resources far beyond those of their American counterparts, provides them with a ready market for their components, offers them leverage to encourage reciprocal buying from other domestic companies, and allows them to design chips specifically for the upstream products their companies make.

For example, many companies that are designing advanced consumer products, such as Hitachi, Toshiba, NEC, Thomson, and Siemens, have their own semiconductor foundries. Where the designs for their televisions or digital audio systems specify 4-megabit DRAMs, these companies invest in the R&D needed to produce such chips with their in-house foundries. In these cases, the semiconductor subsidiary that must fund advanced R&D has a ready market for its components, and it has the financial backing of a large, vertically-integrated company for funding.

Japanese companies also participate in vigorous domestic cross-trade in semiconductors. Japanese suppliers are given first preference, and foreign suppliers are treated as transitional sources of new technologies, or as 'surge' sources when domestic plant capacity is limited. This practice constitutes a non-tariff barrier to the Japanese market for foreign semiconductor suppliers. South Korean companies are organising their electronics industry along similar lines.

The European industry is undergoing sweeping restructuring as perceived national champions such as Siemens, Philips, and Thomson position themselves to serve the broader unified European economy by 1992. The leading semiconductor companies are all affiliated with large, integrated electronics firms.

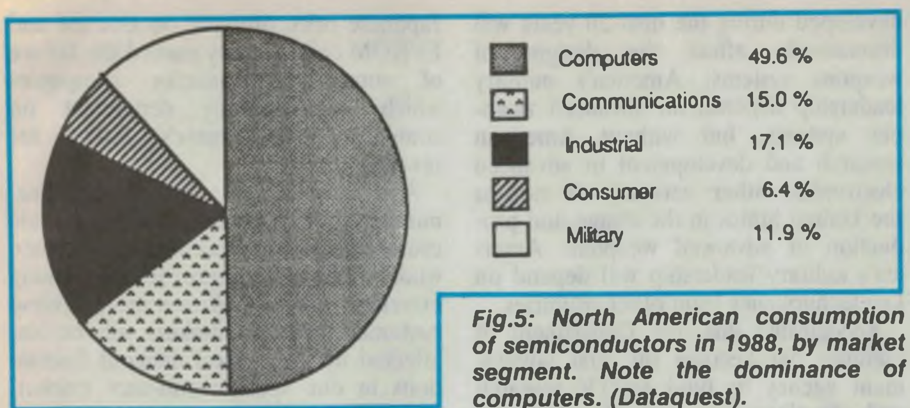


Fig.5: North American consumption of semiconductors in 1988, by market segment. Note the dominance of computers. (Dataquest).

US domestic market

In the United States, on the other hand, most semiconductor companies are merchants, which are not owned by or affiliated with manufacturers of end-user products. American semiconductor firms are, for the most part, solely in the semiconductor business, and rely on external sales to 'arm's-length' customers or distributors.

America's open-market policies have encouraged domestic end-use manufacturers to buy components from the lowest qualified bidder, foreign or domestic, explained Andy Procassini, president of the Semiconductor Industry Association.

"Simply speaking, American semiconductor firms are not assured a lion's share of their domestic market, and must compete with foreign suppliers for customer design commitments and production-level sales to US-based systems companies. The US merchants undertake a far greater risk in making R&D investments in advanced components for sale in the uniquely open US electronics market, compared with the Asian and European industries which socialise the risk," Procassini said.

SRC, Sematech, US Memories

The US semiconductor industry has embarked on a number of cooperative initiatives to counteract its disaggregated structure.

- The Semiconductor Research Corporation is an industry-founded cooperative effort which annually awards fundamental research contracts to US universities, at an annual rate of US$25-30 million.
- Sematech, the industry's process development consortium aimed at recapturing the US lead in manufacturing technologies, operates on a US$200 million annual budget supported by the industry – with the US government matching funds.
- US Memories, a DRAM manufacturing consortium, including several producers (Intel, AMD, National Semiconductor, and LSI Logic), as well as users (IBM, DEC, H-P), to restore the US to its former role as a major player in the global memory market. This consortium will supplement the DRAM output of Texas Instruments, Motorola and Micron Technology as well as the captive production of companies like IBM.

Advanced electronics race

The United States government and industry leaders are now belatedly awakening to the economic importance of advanced electronics development, the one most often discussed being HDTV. Major non-US competitors, however, have been pursuing such development for years through joint industry-government research projects.

The Japanese have a long history of research and development in advanced electronic products, including flat-panel displays and semiconductors. The Japanese government has spent over US$700 million on advanced television R&D, and has established a domestic HDTV broadcast standard, enabling Japanese firms to proceed with development of HDTV receivers, VCRs, and broadcast systems. Since part of HDTV technology is semiconductor technology, part of the government R&D funding has gone to semiconductor design and production research.

American-based semiconductor companies, supported by the US government through the market-access provisions of the 1986 US-Japan Semiconductor Trade Agreement, must press to become first- and second-source suppliers to the Japanese companies currently developing the first wave of HDTV and advanced consumer electronics products.

Recently, the Electronics Industry Association of Japan, said it is planning for a joint US Japanese task force to define new ways for US semiconductor companies to get their products designed into future Japanese HDTV and other consumer-oriented products.

In Europe, electronics manufacturers in the European Community (EC) are also in partnership with government to accelerate the development of advanced electronics. The EC's 'Eureka' project devotes US$200-250 million annually to HDTV research and development, part of which also includes semiconductors. The EC has agreed on a broadcast standard that will result in full HDTV service in 1997.

The United States, in contrast, has only just begun organised efforts at advanced electronics research. Last fall, the Defense Advanced Research Projects Agency (DARPA), announced a 2-year, US$30 million program to fund HDTV research and development. In early June, the Pentagon awarded the first five HDTV development contracts, all of which dealt with advanced display technology. Other contracts, involving semiconductor designs were expected to be awarded in the latter part of 1989.

The Federal Communications Commission has delayed its decision on a domestic HDTV broadcast standard until 1991. There have been several private HDTV rsearch efforts in the United States in universities, including the David Sarnoff Laboratories currently administered by SRI International and other private ventures.

IC market losses

Some look upon the loss of American leadership in consumer electronics during the 1970's and 1980's as a natural and harmless evolution of the US economy. Historically, the United States has ceded world leadership in such key industries as automobiles and steel, only to become first in new industries that offer equal or greater economic benefits.

The economic losses suffered from the decline of the American steel and automobile industries were offset by rising jobs and revenue in the electronics industry, and the waning consumer electronics business was offset by rising global leadership in computers and telecommunications products.

One Japanese computer industry official, in fact, recently proposed that it is foolish for the US to attempt to narrow the huge lead Japan has in DRAM technology. Instead, US firms should focus on other technologies and markets where it still has a major advantage.

Semi Challenge

The suggestion drew harsh criticism from US officials, including IBM president Jack Kuehler. "To admit defeat is to be defeated," he replied.

Technology for computers, consumer electronics, and telecommunications will continue to converge. Current developments in advanced consumer electronics technology will affect future developments for computer and telecommunications products.

American failure to achieve a leadership posture in advanced consumer electronics research and development will eventually reduce US firms' ability to compete in all electronics markets of the future. During the past five yearsalone, for example, US companies' market share in semiconductors for the computer segment has slipped dramatically, largely due to Japan's ascendance in DRAM production.

Defence needs

Beyond the impact on the US position in the world economy, however, there are other pressing reasons why participating in advanced electronics such DRAMs is important to America.

The advanced electronics technologies developed during the next 20 years will dramatically affect the designs of weapons systems. America's military leadership depends on advanced weapons systems, but without American research and development in advanced electronics, other nations will surpass the United States in the design and production of advanced weapons. America's military leadership will depend on key technologies from other countries.

Recognising this, the Department of Defense has become the first government agency to fund HDTV research and development, and the National Security Agency is funding construction of its own secure semiconductor fabrication plant.

Finally, participation in the advanced consumer products market will provide a profitable outlet for proven US leadership in digital semiconductor design, developed over four decades of leadership in the computer sector, and will offer US semiconductor manufacturers a more diversified customer base. Today, US semiconductor makers rely too heavily on demand from the computer systems segment of the semiconductor market in America.

In fact, a recession in the computer market in 1984 and 1985, coupled with Japanese price pressure on DRAM and EPROM chips, nearly caused the failure of some semiconductor companies which were heavily dependent on computer manufacturer's orders for revenue.

And because of this dependence, minute market changes for computers cause chipmaker's revenues to fluctuate wildly, making long-term R&D planning extremely difficult. With a more diverse customer base, chipmakers will be less affected by the cyclical demand fluctuations in one specific end-user market, and will be able to implement long-range development plans to remain competitive.

Despite the large lead other countries have in developing new technologies for applications in the consumer sector, the United States still leads the world in certain crucial aspects of advanced electronics, including software, computer architecture, digital electronics design, microprocessors, microcomputers, and telecommunications. American firms must find a way to build on these advantages to catch the next electronics wave, by expanding their portfolio to include high volume DRAM production and custom devices specifically required in the consumer market. EA

New low cost imported loudspeakers

Available in a wide range of sizes, these low-cost units from Jaycar Electronics feature high-density polypropylene cones.

With the steadily increasing price of imported goods these days, many foreign products have started to represent pretty dubious value for money – in fact loudspeakers seem to be a prime example. However some retailers have taken the bull by the horns, and arranged to source their stock *directly* from overseas, without the middle-men (er, middle-persons). The end result is generally a lower purchase price for the customer.

Such is the case with this range of drive units from Jaycar, which considering the features, appears to reflect excellent value for money. They are available in six standard sizes of 100mm (4"), 150mm (6"), 200mm (8"), 250mm (10"), 300mm (12") and 380mm (15"), and all feature the polypropylene cone material. Each driver also offers a high-compliance surround material, long throw voice coil/spider structure, generous magnet assembly and a pressed steel frame.

The 380mm driver itself is quite an impressive unit, with a power rating of 120W RMS and a free-air resonance of only 18.3Hz. It should offer a formidable acoustic output and low frequency response in a well designed cabinet.

To assist such a design, Jaycar's catalog provides more detailed specifications on all of the drivers, including the relevant Thiele-Small parameters – in the case of the 380mm driver the Qts is listed as 0.336 and the Vas as approximately 300 litres. From these figures, our resident LEAP loudspeaker design software indicates that when mounted in a 120L vented enclosure tuned to 21Hz, the driver would provide a very flat response down to about 24Hz. This could be the basis for a high quality multi-way loudspeaker system, or become a potent sub-woofer in its own right.

The other drivers may be assessed in a similar manner. The 300mm unit has a power rating of 80W RMS, and LEAP calculates that a (rather large) 150L cabinet with a vent tuned to 19Hz would yield slightly peaked (+1.5dB) response down to 18Hz – not bad at all! However if this sized box is a little cumbersome, a sealed 100L cabinet should be flat down to 30Hz. Also, the 250mm driver (rated at 70W RMS) will deliver a smooth response to 22Hz in a 78L box tuned to 25Hz.

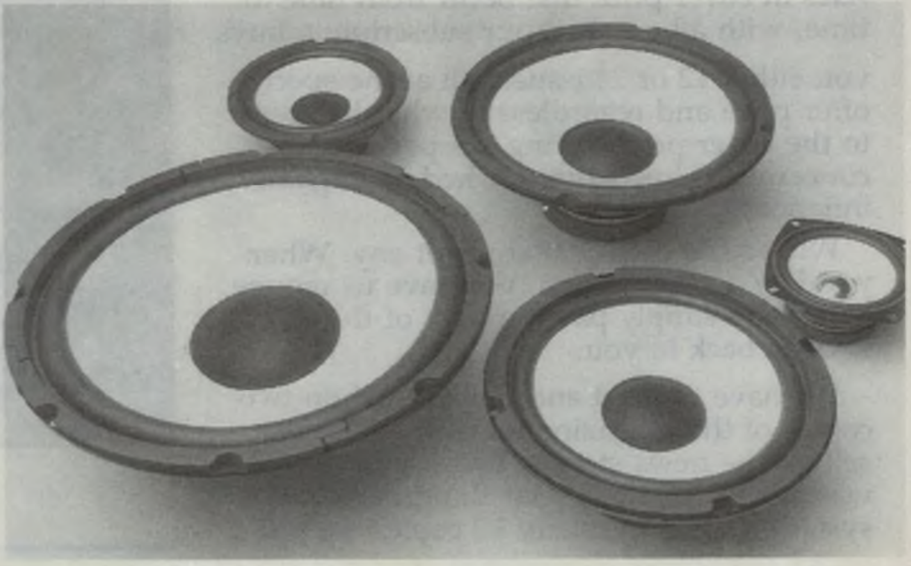
In the case of the 200mm unit (60W) LEAP recommends a sealed enclosure of around 20L, producing a response down to 45Hz – since the driver has quite a high Qts figure of 0.787, an effective vented design is not possible. The 150mm (30W) unit however, offers a slightly peaky (+/–1dB) response down to a creditable 24Hz in a 32L vented box tuned to about 29Hz, or a 3dB point of 50Hz for a 28L sealed enclosure. Lastly, the small 100mm driver is really only suitable for a sealed cabinet, which will sustain the response down to about 100Hz in a 9L box – hardly sub-woofer material, but quite appropriate for the midrange driver of a multi-way system or a restricted full-range application.

So all in all, there should be a loudspeaker in this range for just about any application.

At the time of printing, the prices for the drivers are (in order of size) $129.50, $69.95, $52.50, $39.95, $29.50 and $13.95. When compared to other drivers of similar quality (local or imported) this range from Jaycar shouldn't strain the budget, whether you are simply replacing old speakers or constructing a multi-way system from the ground up.

When upgrading an old system, remember to check that the existing cabinet volume is suitable for the replacement driver. A small percentage difference from ideal will make little difference in practice, but a large error may produce a lumpy or restricted response. Also, when considering which driver is appropriate for an existing box, remember that it is much easier to reduce an enclosure's volume (by physically closing off a section, or even installing a few bricks!) than it is to increase the dimensions.

As you can see from the picture, the drivers are visually quite striking with their white cone, and black dust cap and surround. Note however that there are only five drivers shown, since the 380mm unit missed its photo session. Nevertheless, you can see the entire range at your nearest Jaycar store, or simply order your needs on Jaycar's 008 022 888 toll-free line. (R.E.)



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Most of the time, the saving for subscribers is around 17 per cent, with the added bonus of the opportunity to win a valuable prize. However, every so often we are able to offer an even larger discount, for those who are really only interested in getting the magazine itself — at the best possible price.

This is one of those times. From now until the end of February, 1990, we are making the following offer: a full 12-month subscription for only $35, or a 24-month subscription for just $70. These figures are for subscriptions within Australia, and INCLUDE postage!

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Jim Rowe

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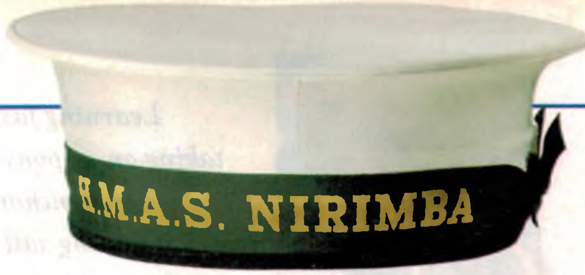


HMAS NIRIMBA, QUAKERS HILL, SYDNEY

The Royal Australian Navy enlists about 240 young men and women as trainee apprentices each year. They are divided into two groups. Intake A in January and Intake B in July.

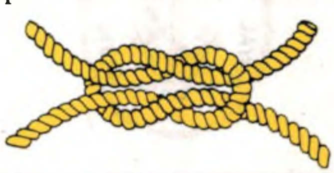
All new apprentices start their training at HMAS NIRIMBA just west of Sydney.

Here the young apprentices learn their skills on well maintained machinery in light, airy, clean workshops, in an environment dedicated to achieving the highest possible skills in trade and technical training.

There is plenty to do during these first two years and all young apprentices are encouraged to take part in spare time activities such as sports of all kinds and their own personal hobbies. These can range from Go-kart racing to bush walking and camping expeditions.

APPRENTICE TRAINING PART ONE.

The first part of apprenticeship training takes place at HMAS NIRIMBA just west of Sydney, and lasts for two years. The working year is split into two terms of 23 weeks with 4 weeks leave over Christmas and a further 2 weeks leave mid-year. When the settling-in period is completed work starts in earnest in the apprentices' chosen branch.



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ETW*ETP	Electrical/Fitter Mechanic
ETC*/ETS	Radio Fitter Mechanic
AIR ENGINEERING	
ATA	Ground Engineering (Airframes/Engines)
ATWL	Ground Engineering (Instrument/Electrical)
ATC	Radio Fitter Mechanic

*These job categories are open to males only.

NAVY HANG ALL

APPRENTICE TRAINING PART TWO.

At the completion of the first two years, all apprentices are promoted to either SEAMAN or WRAN and posted to their next billet.

* The second part of apprentice training takes place on board ship, or at any one of the many naval establishments all around the country.

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complete their training at sea with on-the-job training.

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*Females cannot be employed in combat or combat-related duties.

EA/JAN

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NAP 30

Sony's 'mighty midget' CCD-TR55

Just how small CAN you – or SHOULD you – make a video camcorder? That's the kind of question our bemused Editor has been asking, ever since he was able to try out an advance sample of Sony's new and incredibly small CCD-TR55 (being released in Australia this month). Here's what he found, written after the initial daze wore off:

by JIM ROWE

Every so often, in my kind of job, you get to try out a new product which seems to make a lot more impact than most of the others. There's something about it that tells you it represents a milestone of development, and forces you to stop and reflect on just how far the technology has come, and where it seems to be heading.

Or as we say in the trade, it blows your socks off!

The new Sony CCD-TR55 video camcorder was certainly one of those products, for me. Camcorders have been getting smaller and smaller over the relatively few years since they first appeared, and superficially it might seem that this is simply yet another stage in this progression. Episode N+1 of *The Incredible Shrinking Camcorder* saga, if you like.

I suppose this tended to be my expectation too, before I actually saw the advance sample 'TR55. But it didn't take long to evaporate, when the little beast actually arrived.

The fact is that this camcorder really is *tiny*. You don't realise how tiny, until you hold it in your hand. It measures a mere 179mm long, from lens hood to rubber eyecup, with a cross-section only 106 x 107mm. And the weight is a mere 790 grams (1lb 12oz, in old money), not counting the battery pack and tape cassette which add about 150g and 30g respectively.

When you consider that we're talking about a complete colour TV camera and video recorder combination, this is pretty darn impressive. Especially when you realise that the Video-8 tape cartridge itself measures 95 x 62 x 15mm.

This camcorder is, if anything, both smaller and lighter than the average Super-8mm sound movie camera, before they went off the market. Yet the 'TR55 offers up to 1-1/2 hours of filming/recording, at the normal tape speed (twice that at the slower LP speed), and also has features like a 5-speed electronic shutter, with speeds of up to 1/4000th second. As an old home-movie enthusiast from way back, even I can see why making home movies on film has become ancient history.

In fact when I started to use the 'TR55, I couldn't help think back to the first mono video recorders and cameras, when they came on the market back in the late 1960's. The cameras alone were bigger than the 'TR55, and the recorders were about three times the size and weight of today's most solid home VHS recorder. Each had multiple circuit boards inside, and the recorders in particular had literally *hundreds* of discrete transistors and diodes.

Back then I had a part time job fixing the monsters, to help save up for our house deposit. I remember how complicated they seemed, and how long it took me to understand how all the circuit sections worked (expecially the head drum servo). And they were only very basic *monochrome* gear – child's play compared with the 'TR55 and its full colour, with hot and cold automatic TTL focusing and light level control, white balancing, 6:1 motorised zoom lens, insert editing, fade in/out, digital superimposition and electronic shutter. They were also relatively big and easy to get at, for servicing.

But enough nostalgia. Back to the 'TR55, with five times the horsepower and all of it crammed into a package less than the volume of a housebrick. How have they done it, those Sony wizards?

First of all, and most impressively, by basing the recorder on their incredible new 'FL Mecha' 8mm deck mechanism, previewed in mid 1988. This is not the first camcorder to reach the local market using this deck – a couple of other recent models have used it, as Sony is making it available to other manufacturers. But the 'TR55 is certainly the smallest to appear to date, and the first to show just what degree of miniaturisation the FL Mecha really makes possible.

Looking at the 'TR55, you can easily imagine now what the next version of the Video Walkman is going to look like, based on the same mechanism. You also find yourself wondering how even the Sony engineers could manage to make things any smaller – assuming we would want them to. Surely this is 'about as fur as they can go', or ought to go. The next step would be a postage-stamp sized camera and viewfinder that clips to your specs, and a recorder that slips into your shirt pocket!

The FL Mecha has half the weight, a third of the volume and half the thickness of the original 8mm video mechanism, used in just about all Video 8 camcorders to date (and also the Video Walkman). It has a thickness of only

29mm, when operating, with a weight of only 185 grams. Its total volume is only 250cc, which is incredible considering that the cassette itself accounts for just on 90cc.

To produce the FL Mecha, Sony engineers had to reduce the video head drum diameter to 26.7mm – smaller than any other drum produced to date. This involved switching from two video heads to four, as with VHS-C, and increasing the tape wrap from 221° to 292°.

However as well as coming up with the smallest head drum produced to date, Sony also managed to fit the complete head drum motor *inside* the drum itself. Considering that the drum assembly is less than 25mm high, and also includes a 'flying erase head' as well as the four video heads and their rotary transformers, this seems to me a miniaturisation achievement of almost mind-boggling proportions.

Mind you, the rest of the deck is pretty impressive, too. The two speed direct-drive capstan motor is also only about 27mm in diameter, and about 4mm thick – roughly the same volume as two 20-cent pieces. Similarly all of the mechanism gearing is confined to a layer only 5mm thick, beneath the cassette loading area.

Inside the 'TR55 on the other side from the deck is the 6:1 motorised zoom lens (11 – 66mm, F/2.0) and the

The CCD-TR55 together with a Video-8 cassette, to demonstrate its compact size.

camera itself, with its 12.5mm CCD sensor capable of giving good pictures with illumination levels from 100,000 lux down to 300 lux, and acceptable pictures down to a mere 5 lux. The lens also has a 'macro' feature, which provides focussing down to 10mm.

Above this is the electronic viewfinder, in a telescopic cylinder which swings up by as much as 90° for convenient viewing. Inside the viewfinder is a tiny monochrome CRT with 13mm diagonal screen, and a magnifying eyepiece whose focus is adjustable to suit the user's vision.

The electret microphone is built into the front of the camera case, while the compact 6V battery pack or power adaptor clips to the rear. Most of the camera controls are built into the 'bulge' around the zoom lens assembly on the left-hand side, while the VCR controls are found on the top of the case along with the 'Tele-Wide' zoom lens rocker tablet. The recording On-Off control button is at the rear on the right.

Fairly obviously, the 'TR55 is designed to be held in the right hand, with the forearm vertical so that the viewfinder is at your right eye. A strap holds the camera firmly in the palm of your hand, with your thumb able to operate the recording button and your first and second fingers at the zoom lens control.

Although the camera controls can all be operated manually, if you wish, Sony has also provided an 'Auto Lock' switch which converts just about everything into automatic operation. And this is the normal operating mode, where all you have to do is hold the camera still, adjust the zoom lens for the shot you want, and press the recording button to begin recording. Focus, exposure, white balance and the rest are all looked after for you, making it as easy to use as the traditional box brownie.

At this stage, you may well be wondering where the electronics are. Where is all the circuitry, to make it all happen – has Sony somehow discovered how to do away with it?

No, not at all. Everything is there, tucked away on no less than 13 different multi-layer PC boards located in the nooks and crannies inside the case. There are some 50-odd IC's, many of them either LSI or VLSI, and of course all of the circuitry is of the miniature surface-mounted variety. A marvel of the modern electronic art, although I suspect it will be anything but easy to service...

Trying it out

So much for the 'TR55 in terms of technology. But how does it perform in practice?

The only advance sample that the nice people at Sony Australia were able to

Below: A larger than life closeup of the top control panel on the sample 'TR55, a Japanese model.

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Sony camcorder

provide was a Japanese version, operating on the NTSC system and with most of the control functions marked only in Japanese. However this was no real problem, because they were also able to supply advance copies of the manuals for the Australian PAL version. We were also able to play back the NTSC recordings through our trusty KX-14CP1 multi-mode monitor, so that for all practical purposes we might well have been trying out the PAL model.

And as you'd expect from Sony, the performance was virtually indistinguishable from the earlier and bulkier models.

The basic horizontal resolution of the new CCD camera sensor seems to be around 250 lines, with the record/play system reducing this to a little over 200 lines. Its sensitivity is impressive, with very reasonable pictures possible in lighting levels so low that a film camera simply wouldn't be in the race.

I was very impressed with the ALC system, too, which adjusts to quite major changes in subject lighting within a fraction of a second. And the TTL (through-the-lens) automatic focussing works very well indeed, responding to changes in subject within a few seconds. There's a little 'hunting' back and forth, but it soon locks on to a setting which is almost always right.

The VCR side of 'TR55 is also very easy to use, and seems to deliver results every bit as good as the larger machines. The replay pictures are steady and clean, with very low noise. And there's virtually no rolling or other instability when one shot/recording is added to the end of the last, thanks to the way the VCR automatically re-synchronises the head drum to the end of the previous recording.

This also makes superimposing titles and/or replacement scenes a snack, thanks also to the 'TR55's flying erase head. And of course you've got all of those fancy features, like optional fade in and out, a built-in title memory, optional date and time superimposition, and so on.

Incidentally, the 'TR55 also provides all of the normal facilities for a monitoring earphone, remote control, direct video and audio input/output, external microphone etc. For operation back at home it will also operate directly from the battery charger unit via an adaptor lead.

There's really everything that most of us are ever going to need, so the 'TR55 doesn't seem to involve any real penalties – despite its tiny size. In fact the small size and light weight seems to offer two nice advantages: (a) you can hold it a little steadier, and (b) your right arm doesn't get so tired!

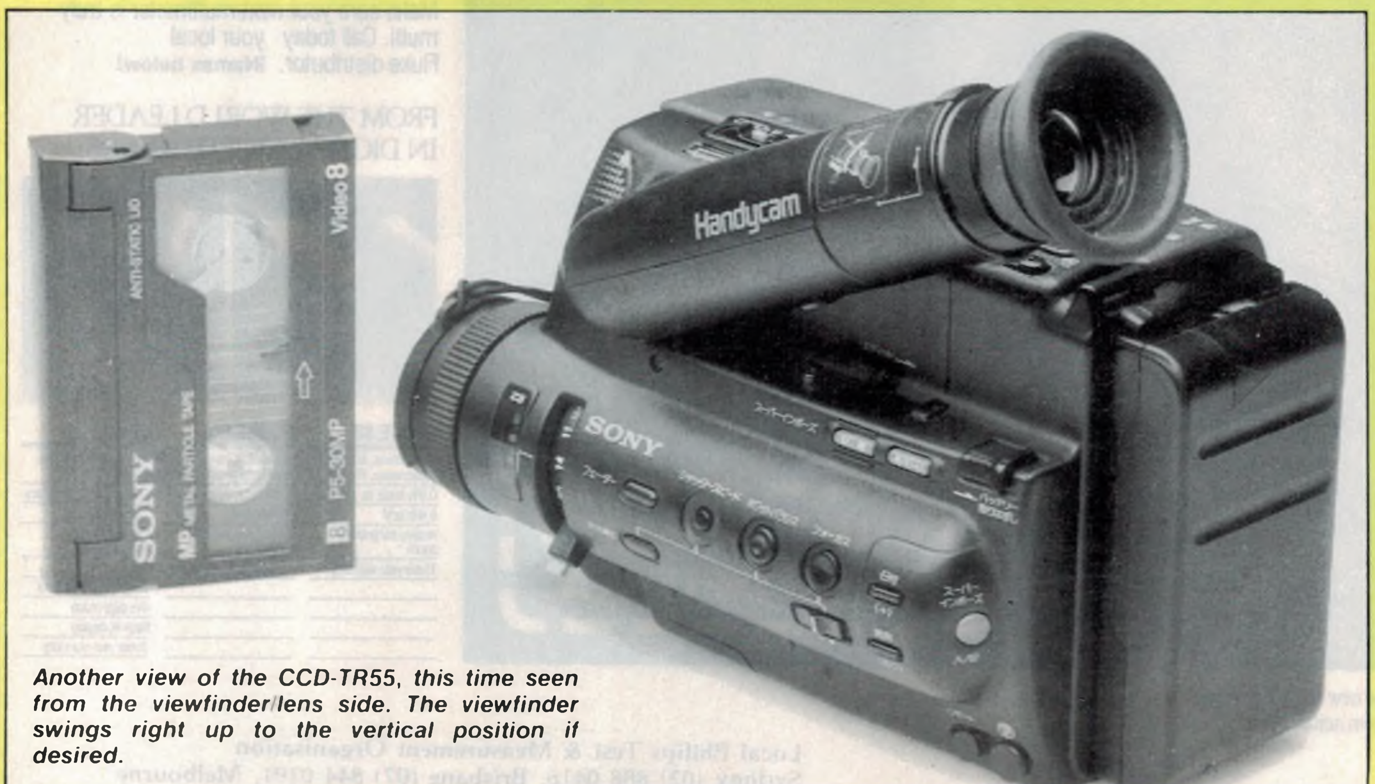
On the negative side, the only real fault I could find was that with some subjects, the monochrome viewfinder can make it a little tricky to make sure you're getting the best shot. Not that this is a problem specific to the 'TR55, of course; it applies to virtually all of today's domestic camcorders.

On the whole, then, the CCD-TR55 seems to be an excellent little machine – with all the right features, good performance and everything squeezed into the smallest camcorder package yet produced. In fact it's pretty well as small as you'd want camcorders to become, before the controls would become too small to be operated by adult male fingers.

So don't spend any more effort making them any smaller than this, Mr Sony. You might be able to, before long, but what would be the point? Better for your innovative engineers to spend their time coming out with a high-band version offering even better picture resolution, and perhaps changing to a full-colour viewfinder. (Never satisfied, am I?)

As mentioned earlier, the CCD-TR55 is being released in Australia this month, so you should be able to see it for yourself at your nearest Sony video stockist. The price is expected to be about $2500, making it excellent value for money.

Finally, my thanks to Sony Australia for the opportunity to try out their one-and-only advance sample of the 'TR55. Thanks folks, and I'd say you have a real winner on your hands!



Another view of the CCD-TR55, this time seen from the viewfinder lens side. The viewfinder swings right up to the vertical position if desired.

The gentle art of scroungin g

When the availability of parts needed to build electronic projects becomes a problem, in terms of straightforward over-the-counter buying, those 'in the know' don't let this worry them. They simply resort to scrounging, salvaging or 'resurrecting'. Here's how YOU can do it, too.

by TOM MOFFAT

"I can't build anything! I can't get the parts! So I'll just have to buy a ready-made one instead." How many times have we heard that excuse for the demise of home-brewing electronic gear?

Well, as from now, that excuse is hereby abolished, because you CAN get the parts to build just about anything you want to. All you have to do is apply yourself to a bit of sniffing around, and not be too proud to use the occasional 'pre-owned' bits.

Ah! Pre-owned – in other words, 'used'. Pre-loved. Something somebody else has no further use for.

Some people are silly enough to chuck things out just because they are no longer the best and latest. This is not to be discouraged, because their loss is your gain.

To be on the receiving end of these useful rejects, you must be in the right place at the right time. By the application of some careful thought, and by using the information detailed herein, you can increase the odds of your being the one to prevent the untimely destruction of something truly useful. So here are a few areas where you can shake the tree and make the goodies come tumbling your way.

Old television sets

The defunct TV set has traditionally served as the best source of parts to build amateur transmitters, power supplies, and even quite luxurious stereo amplifiers. Unwanted televisions are almost always black and white, and generally come in two flavours: small portables and big console models.

If it still works, you should think carefully before disassembling a portable black and white telly. It could be used as a second set for a kitchen or bedroom. Your spouse and/or kids may grizzle "but we wanted a colour set". You can respond that a colour set would cost over $400, and this one cost zilch. It's better than no TV at all, isn't it? (IS it?)

Black and white portable sets also make useful computer monitors.

Our little beach shack is equipped with a Kreisler portable black and white set, that was thrown in as part of the purchase of a kid's bicycle. It had stopped working only that morning, and its value to its owner had suddenly fallen to zero. Its problem turned out to be a dud filter capacitor in the power supply, and a blown fuse. The set was back on the air within half an hour.

The Kreisler has performed perfectly, except for one hiccup two minutes before midnight on New Years Eve a couple of years ago. A well-known Prime Minister was about to make a speech, presumably to welcome the 1988 Bicentennial year. As soon as he appeared on the screen the set erupted with a bright flash from the rear and promptly died. The flash had been caused by another fuse blowing. When the fuse was replaced the set again worked fine. The trouble was put down to hot air overload.

Most rejected console sets will be valve models. Although no longer trendy, valves make quite rugged and useful amateur transmitters. It might be hard to buy valves nowadays, but valves in good working condition can certainly be scrounged from TV sets. There are many designs around for transmitters made from TV 'sweep tubes'.

Wrecking an old telly should be undertaken with thoughtfulness and caution. 'Wrecking' is really the wrong word – 'careful disassembly' is more appropriate. Your first task is to get rid of the picture tube. If it is a black and white one, its commercial value will be nil. You must NOT simply put it out with the garbage or something, because a picture tube represents a dangerous bomb which can implode, showering glass everywhere.

One way to dispose of a picture tube, perhaps not quite approved of by the authorities, is to wrap it in an old blanket and smash it. You can lay it on the ground face down, completely wrapped in the blanket, and then whack the tube's neck with a big stick. It should break off cleanly, leaving the main bulb of the picture tube intact, and without its vacuum.

If you're worried about being so close, you can stand back and throw rocks at the completely wrapped picture tube. The whole thing may break in this case, making its disposal somewhat messy. Regardless of how you do it, you should pick up the blanket, still containing broken glass and tube remains, and carefully dispose of them. NO glass should be left behind using this method.

The most valuable part of an old telly is its power transformer. It may be capable of producing around 700 volts AC at several hundred milliamps, as well as 6.3 volts at several amps. This is absolutely ideal for powering an amateur transmitter, or a valve stereo amplifier. If you had to go out and buy a transformer like this nowadays, you could expect to pay well over $100 for it – if you could get one!

Before removing the transformer, identify the leads that go to the mains, the high-voltage rectifier, and the valve heaters. Once the transformer is removed you can apply power to the mains winding and measure the secondary voltages produced. Be careful! These voltage levels are LETHAL. Other things to recover from a defunct TV include the valves, the valve sockets, speakers, useful-looking hardware, and don't forget to recover as many screws, nuts, and washers as possible.

TV sets aren't the only electronic devices worth saving. Old stereo amplifiers are useful, and if you manage to score an old radiogram from the fifties or earlier, don't let it get away. These are suddenly becoming trendy and quite valuable as collectors' items. So where do we get them? Here are a few suggestions:

The 'tip'

Useful electronic devices should never be allowed to get this far, but if they do, *you* can be the one to save them from death and burial. Trouble is, scrounging from tips is discouraged in many places, and totally outlawed in others.

Officially, anti-scrounging laws are based on health grounds. But unofficially, the real reason is that possession of tip booty is usually considered the privilege of tip attendants and garbage truck workers.

This is the voice of experience speaking: During my university days, my summers were spent working as a garbage collector, and one of the fringe benefits was the right to 'first pickings'. Every afternoon after the garbage run, the truck would go to the tip full of rubbish which was quickly dumped. We would then return laden with the day's scrounged treasures. My best score was a large military-style power supply which I later sold for $200.

During a trip to a municipal tip a few months ago, I spotted a large TV of fairly recent manufacture. As I started to recover it, the tip attendant came roaring over in his ute and proceeded to recite various council by-laws concerning tip scrounging. But as I gave up and drove away, the tip attendant was seen to be loading the TV into his own ute. Is this justice?

The way to overcome the problem of tip attendants is to visit an *unattended* tip. This would include most tips in country towns, and there are probably several useful tips within driving range of your home.

Don't make a pig of yourself though. My latest visit to a country tip was to offload a bag of garbage and a carton of beer bottles. But I returned home with a rope ladder from a ship, two plywood real estate signs, a large roll of used copper tubing, and the glass door from an old oil heater. The stuff all looked useful for something, although my wife wasn't really impressed!

Council clean-ups

Annual council clean-ups should be declared public holidays. That way you could spend the whole day scrounging, and with enough stamina you could cover your entire suburb!

Clean-ups are those days when residents are asked to place 'big stuff' they no longer require beside the road, for later collection and disposal by special trucks. Big stuff means anything too large to fit in a normal rubbish bin, and covers such items as furniture, lawnmowers, and – would you believe – old TV sets.

As far as I know there are no laws against making your own collection before the council truck arrives. But, especially if you live in a ritzy area, there is a social stigma associated with pre-empting the annual council clean-up. You know the old story: "There goes that Moffat again! And look what he's got this time! How can his wife put up with him?"

It helps if you're not well known in the area. Then you can put on a track suit and pretend to be a jogger. Your expedition should be mounted at first light, hopefully before any snoopy neighbours are up. A track suit would also help explain your presence to any inquisitive police.

The technique of the pre-cleanup scrounge is to jog along the footpath, slowly enough so you can carefully inspect each pile of potential treasure. When you see something useful you can either mentally mark it for later collection in your car, or grab it and run straight away.

You can help pass the time while dragging a large TV set down the road by cooking up in advance the explanation you will give to any cruising police patrol.

No – just joking! I don't think the police will be bothered, only your snooty neighbours. In the area where I live, clean-up day brings forth people you never suspected were joggers. I

DISCARDING OF OLD PICTURE TUBE.

sometimes think the truck goes away empty, after all the goodies on the footpath have simply changed owners in the same street. And the next year most of the treasures are out again, except in front of different houses...

Seriously, though, council clean-ups are really too good to pass up. They are an excellent source of TV sets, stereograms, and other electronic devices that are still quite healthy. Most times they've just gone out of fashion.

I was visiting Sydney recently on clean-up day, staying at my brother-in-law's house. On the footpath, in front of the house next door, was a complete home entertainment centre that must have cost thousands new. It had a big TV, stereo, tape deck, and separate speakers, and it looked to be in perfect nick. I was just about to drag it to safety when I thought – "What next? How would I ever get it home on the plane?".

Oh, the frustration! Looking at that thing and thinking, within a couple of hours it would be on the tip. My brother-in-law didn't want it (the fool!). Let's only hope some jogger came along in time.

Government auctions

Government auctions, I suspect, are a devious scheme to gather helpless scroungers into one place where they will then spend heaps of money on things they have absolutely no use for, but are too good to pass up.

The auctions keep money flowing through the economy, while occasionally allowing an outlet for embarrassing purchasing mistakes made by governments. Why else would a brand new ten-thousand line telephone exchange, still in original packing, go off for $100?

Some stuff goes at giveway prices – after all, it's only taxpayers' money – but don't let it go to your head. In the

Scrounging

heat of bidding I have seen things like surplus electric heaters bring more than they would if you just went into Myers and bought one. Items like household goods and clothes are keenly sought after, but electronic instruments and radio gear usually go for a song.

Beware of second-hand dealers at auctions. If they see you drooling over some oscilloscope or signal generator, they will decide it must be worth something so they'll bid against you. You must look upon your potential treasure with disinterest and even scorn, and only begin drooling after the hammer has fallen.

A memorable auction orgy occurred in Hobart several years ago, when the ABC offloaded all their black and white televison cameras, having replaced them with colour. Amateur radio operators from all over the state suddenly saw themselves as amateur television operators, and converged on the auction like flies to rotten meat. There was plenty for everyone, and soon many amateur homes had their own TV studios, complete with Marconi studio cameras, camera control centres, sync pulse generators – the works.

But when the newness wore off, owners found that these valve-laden television monsters took up a lot of space, drew 2000 watts each, and generated lots of heat. Their owners eventually gave them away to younger electronic enthusiasts and schools. My own holding of two complete studio camera chains has now been reduced to a couple of broadcast microphones I use on my ham transmitters. But that TV gear was good fun while it lasted, and well worth the $40 or so it cost me.

Government tenders

Government tenders are like government auctions, only they are conducted in writing in a kind of 'secret ballot' system. You are invited, usually through an ad in the paper, to view certain items for disposal. You can then write down an offer for the goods, seal it in an envelope, and hand it to the selling authority.

There are some very important points about this system. One is that you don't have any idea of the value other people are putting on the goods on offer. You also have no idea what value the government puts on the goods, but you can assume they don't want them very much; otherwise the goods wouldn't be up for grabs.

Generally there is no reserve on tender items; the highest bidder wins. You can usually assume high bidding on things with scrap metal value, such as copper cables or lead batteries. But the scrap value of radios, oscilloscopes, and signal generators is virtually nothing. So don't be afraid to put in some truly silly bids, especially if you can gang up with some other people and buy the whole lot of something.

Several years ago Tasmania's Hydro Electric Commission put up for tender some Pye VHF and UHF base stations that had been used as point-to-point radiotelephones. Their transmitters were rated at 50 watts, continuous duty. A group of hams got together and tendered for the whole lot, which I think was around ten units. The price: $3.45 each! One of these radios eventually became the Hobart two-metre amateur repeater, for a cost of under four dollars.

Similar tender efforts have kept Tasmanian amateurs well supplied with two and six metre mobile FM rigs, with some units purchased for a couple of dollars each. It sure beats shelling out several hundred dollars for a Japanese commercial rig!

Dropping broad hints

This last scrounging technique requires the utmost in skill and finesse. It usually takes place within the home of a kind and generous electronics enthusiast, who has no idea that he has opened his door to a Trojan horse.

You know this person has something you need. You also know that this person doesn't need the item himself, but considers it too good to part with. There is a certain pride of possession.

Say this person has a large tuning capacitor which you need to build an antenna tuner. You know it is impossible to purchase such a capacitor through normal sources, so the only alternative is to scrounge it. When viewing this tuning capacitor sitting there on the fellow's shelf, avoid undue drooling, as in the auction advice above.

There is a technique my dog uses while trying to scrounge my dinner, which shows he's not *really* interested in my dinner, but would hate to see it go to waste should I not need it any more. He will not look directly at the dinner, but instead stares intently at the wall. Surveillance of the dinner only takes place through his peripheral vision. This method allows careful study of the dinner, while avoiding giving an impression of 'undue lust'.

You can approach the tuning capacitor problem the same way. While staring at the wall, you notice the tuning capacitor is an absolute ripper. But its owner doesn't notice that you notice. So you have time to work out what is needed to shake the capacitor loose from its happy home.

"What have you been doing with yourself since you retired?", you ask. "Oh, I've been operating on the air a bit. And I've been thinking of getting a computer... maybe a kit. But my eyes aren't quite what they used to be, and I'm a little worried about building a kit. And I don't know a lot about computers anyhow."

There you go then. He has the capacitor, and he needs some advice on computers, and maybe a little help in building one. You want the capacitor, and you have good eyes, and... (still staring at wall) "I've been trying to build an antenna tuner, but I can't find any good air-spaced tuning capacitors. I did build a computer once..."

"Hey, I've got a capacitor that might just help you..." Oh! What a surprise! How fortunate! There's a capacitor sitting right there on the shelf! So a deal is struck. He's happy, you're happy. This is only a hypothetical example, of course, but it shows what can be accomplished with a little horse-trading. You haven't diddled the poor fellow, you've just done some basic market research before closing the deal.

Although things like tuning capacitors are hard to come by, they do exist; they're just in private hands instead of in the shops. Many such treasures will never be used unless it's you who uses them, but you must be fair in arranging a donation from a former owner. Make sure he gets similar value back from you in return; you will enhance his well-being as he enhances yours.

Right! Get those track suits on, or follow a garbage truck. Begin to establish your 'junque box', because you'll soon need it. Over the next few months we'll be looking at ways to turn your ideas into (hopefully) working electronic contraptions.

When I Think Back...

by Neville Williams

Raymond Allsop - WW1 wireless operator, engineer, FM pioneer

Raymond (Ray) Allsop is well remembered for his contribution to the Australian sound-on-film industry and for his largely unrequited love affair with FM broadcasting. Less well known is the fact that he was a licensed radio amateur at 13, a wartime shipboard operator in his teens and the inaugural chief engineer of Australia's first official wireless broadcasting station.

Raymond Cottam Allsop was born on March 11, 1898. Bitten by the proverbial wireless 'bug' at age 10, he was one of the true industry pioneers in Australia; yet he lived long enough to glimpse the emergence of modern-day electronics in its many forms.

An enthusiast and a visionary, at least some of his efforts in the intervening years, through to 1972, are probably better appreciated in retrospect than they were when he was diligently promoting his views to the regulatory authorities and to industry associates. But more about that later.

Formally educated at Sydney Grammar School, Ray Allsop received his wireless 'baptism', while still a schoolboy, at the hands of Father Shaw – a controversial priest/enthusiast who set up an experimental wireless station (callsign XPO) at a Roman Catholic seminary in Randwick, Sydney, not far from the Allsop family home.

Officially responsible for the financial affairs of the seminary, Father Shaw combined business with pleasure and duty(?) by gradually increasing the scope of his wireless activities until they culminated in the Shaw Wireless Company, complete with factory, orders, staff and overheads – to the sometime discomfort of church authorities.

But that is a story in itself, which was recalled in the 'Bright Sparks' historical series broadcast on ABC Radio in 1988 during the bicentenary celebrations.

It is sufficient to say that, on leaving school in 1913, Ray Allsop was apprenticed to Father Shaw's Company which was, at the time, building Australian Coastal Wireless stations for the Commonwealth Government.

Ray Allsop at age 25, pictured on his appointment as Radio Engineer to New Systems Telephones, a company which later came to be known as Emmco and still later STC. (From Australasian Wireless Review, May 1923).

An amateur at 13

In the meantime, he had picked up enough about the mysteries of wireless, presumably from Father Shaw's activities, to gain an experimental licence from the PMG in 1911. This enabled him to set up his own spark type wireless telegraphy station at the family home in Barker St, Randwick.

As described in the *Australasian Wireless Review* for June 1923, Ray's pre-war amateur installation comprised (and I retain the original terminology):

RECEIVER: A loose coupler and loading coil, aerial tuning condenser, perikon and other crystal detectors. Iron pyrites and silicon were used but his best work was done with galena. He used to tune in Macquarie Islands, all the coast stations and the incoming shipping.

TRANSMITTER: A 2 kilowatt alternator, driven by a 5 horsepower motor using City Council current supply. The transformer stepped up the current to 20,000 volts. The transmitting condensers were of the Leyden jar type and the inductance was the usual helix. The spark gap embodied a patent invented by the Shaw Wireless Company. It involved a stream of compressed air, conducted through one of the electrodes, which was hollowed out for the purpose. The air, blown through the spark, drove off the ionised gases and made for a more even spark discharge. The air was compressed by a Kellogg 4-cylinder pump.

With the transmitting set, *ARW* says that "Mr Allsop has been picked up in the Great Australian Bight, a wonderful amateur achievement in those days".

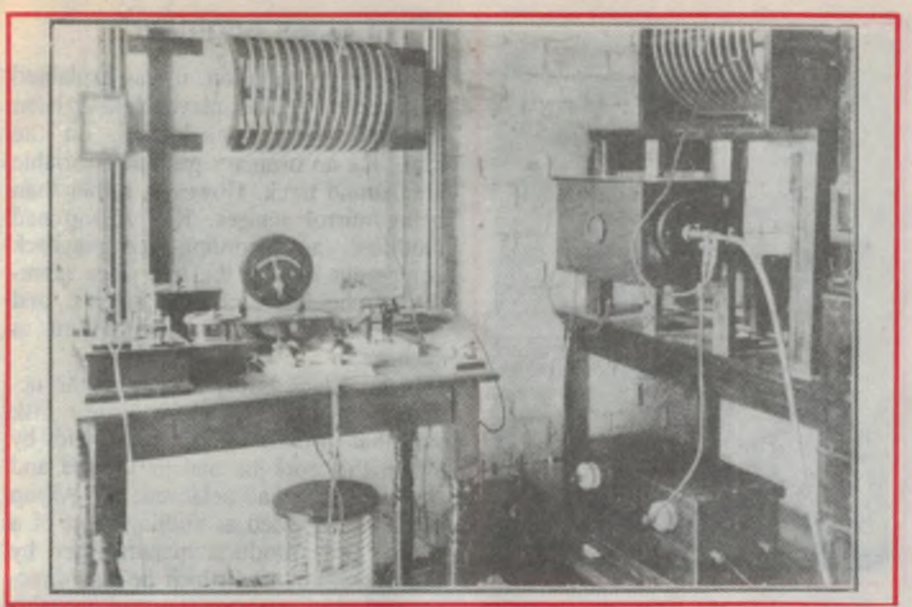
It also notes that he had a Lodge-Muirhead coherer in 1910, with a Morse Tape machine as part of his receiving equipment. On the shelf under the main transmitter was a standby spark discharge transmitter using a 2" spark coil.

Reading this account, I could not but contrast the resources that Ray Allsop had as a teenager to the few humble oddments that most young enthusiasts had to make do with in the *post* World War 1 generation.

Wartime operator

While still a teenager, he obtained his Australian and New Zealand commercial certificates and served as ship's wireless officer on a number of vessels engaged in the Australasian trade: among them the *Levuka*, *Riverina*, *Wyandra* and *Cooma*.

In 1916, he joined the RAN troopship *Argyleshire* as senior operator. It was



Ray Allsop's pre-World War I spark type wireless telegraphy transmitting and receiving equipment, as pictured in The Australasian Wireless Review for June 1933.

subequently torpedoed in the English Channel, barely making it back to Davenport. Ray Allsop was duly returned to the laboratory of the Wireless Works at Randwick which had, by then, been acquired by the Naval Authorities.

In 1918, he was appointed senior wireless officer on the troopship *Indarra* and served in that capacity until a couple of months after the Armistice was signed. He returned once again to the laboratory at the Randwick Naval Wireless Station and remained there until it was taken over by the Repatriation Department.

By that time, its activites had broadened to include the production of military packsets and special wireless apparatus for the Navy.

As soon as it became legally possible, Ray Allsop had resumed his amateur station activities (callsign 2YG), turning his attention to radio telephony. He claimed, in fact, to have been the first Australian experimenter to communicate in that mode, on shortwave, direct with the UK and USA. This was in 1924.

His interest in telephony was actually just one facet of a growing interest in audio technology, extending to sound recording and the then-intriguing subject of cinema sound – 'talkies'.

With the shift in his technical interest and the transfer of the Randwick works to Repatriation, Ray Allsop decided, in early 1923, to join New Systems Telephones Pty Ltd, whose parent company was one of the largest telephone and wireless equipment manufacturers in the British Isles. Their sights were clearly on the wireless/radio boom that seemed certain with the anticipated recognition of radio broadcasting in Australia in that same year.

Founding engineer, 2BL

As an engineer with New Systems Telephones (later STC) Ray Allsop was directly involved in the establishment of Australia's first official broadcasting station, 2BL Sydney, which is listed in the *Macquarie Book of Events* as aving commenced service on November 23rd, 1923. There is more to it, however.

Sponsored at the time by Broadcasters Ltd, managed by W.J. Maclardy, the venture had the backing of the now defunct *Guardian* newspaper. The same Mr Maclardy was the Managing Editor of Wireless Newspapers Ltd and who, in August 1922, had launched the first issue of *Wireless Weekly*, the distant ancestor of today's *Electronics Australia*.

Racing against the calendar, and other hopeful broadcasters, the original 10-watt (some say 15W) transmitter was constructed by Ray Allsop and duly installed on the roof of the *Guardian* building in Philip St, Sydney by Messrs Allsop, Maclardy, "with the assistance of Mr E.Joseph, the well known wireless expert, and several others"; this was on a miserably wet Friday afternoon in late October 1923.

With the permission of Mr J.J. Malone, Chief Manager of Telegraphs and Wireless, it went to air with the experimental callsign 2HP on 350 metres (875kHz) – described at the time as 'short waves' and preferred, because reception was less prone to atmospheric interference than on long waves (1000+ metres).

Despite the very limited power, listener response was immediate – embarrassingly so for the *Guardian* newspaper, which had allowed the station to 'borrow' its telephone numbers B7111 to B7117. According to *Wireless Weekly* (October 26, 1923) "all seven lines were jammed" during that historic Friday afternoon and evening – and for much of Saturday, with local and trunk calls. (A modern newspaper is more likely to have several hundred lines).

In both *Wireless Weekly* and *Australasian Wireless Review*, the signals from 2HP were reported as being heard widely throughout NSW.

On November 1, 1923, the *Guardian* announced that scheduled services would begin within about two weeks. Their objective was 12 hours per day of free broadcasting – an intention that apparently got tangled up for a while with the ill-fated Fisk sealed-set scheme, mentioned earlier in these articles (July 1989).

The official service began on November 23 with the callsign 2SB, but this was subsequently changed to 2BL (for Broadcasters Ltd) to minimise possible confusion, as heard, with 2FC. In February, 1924, *ARW* was lavish in its praise of the sound quality of the new station, with credit being given to engineer Raymond Allsop for the many improvements which he had been able to effect in the short time that it had been on air.

At this very early stage Palings Ltd also became involved and organised a series of concerts from their concert hall, presented by musician/songwriter Oswald Anderson with Ray Allsop handling the technical arrangements. Commencing in February 1924, they were claimed to be the first officially broadcast concert series in Australia, with Oswald Anderson as Australia's first professional radio announcer.

Historic broadcasts

But in those days, at least, Allsop the engineer was still very much the amateur operator/enthusiast as well. In 1925, he intercepted a shortwave (HF) test transmission from KDKA in Pittsburg, USA, the world's first broadcast station, and relayed the program over 2BL.

In 1927, he organised a similar rebroadcast of PCJJ Hilversum, Holland and such was the public response that he decided to go one better.

At the time, the BBC had not set up

its overseas service and Ray Allsop arranged, through the Netherlands Consul in Australia, for Hilversum to pick up 2LO London and relay the signal on 30m (10MHz). It was picked up at the Allsop home in Roseville, Sydney, and fed by landline to Coogee for rebroadcast over 2BL – the first time voices from London and the sound of Big Ben had been heard by Australian broadcast listeners.

1928 saw yet another epic broadcast, when Kingsford Smith flew across the Pacific from Oakland to Brisbane. Sydney Newman transmitted continuous Morse homing signals from the AWA radio centre at Pennant Hills, Sydney while Ray Allsop and Tom McNeil shared a long listening vigil, interpreting the code messages from the Southern Cross and keeping 2BL listeners up to date with the plane's progress.

For good measure, it would appear that, about this time, Ray Allsop and another pioneer amateur, Don Knock, were acting as writers and consultants to *Wireless Weekly*. An article in the July 5, 1929 issue classifies Ray Allsop as the Associate Technical Editor – an arrangement that apparently lapsed when Ross Hull took over in mid 1929.

By then it probably didn't matter, anyway. As the late Philip Geeves points out in 'Australia's Radio Pioneers', published in *EA* for April 1989, Ray Allsop had developed an absorbing interest in sound motion pictures.

Back in 1921 he had worked out a scheme for synchronising a wax cylinder with motion picture film, but was realistic enough to admit that sound technology had a way to go before it could be mated successfully with film presentation.

The abovementioned issue of *Wireless Weekly* carried an article titled 'Developing the Raycophone', in which he describes his earlier efforts as: "necessarily dilletante dabblings".

Talkie equipment

This time around, he developed a highly practical range of 'Raycophone' supplementary sound equipment, with which existing silent projectors could be converted for the new sound-on-film 'talkies'. Geeves records that, despite intense opposition from the major American suppliers, he provided the sound in almost half of Australia's cinemas at a fraction of the cost of imported equipment.

The highlight of Allsop's affair with cinema sound came on Sunday evening, April 10, 1938 when he arranged and presented a technically historic film show to delegates attending the World Radio Convention in Sydney.

As pictured in the 1938 World Radio Convention Record. An IRE council member at the time, Ray Allsop demonstrated to delegates stereo sound reproduction and stereo film sound at Sydney's Plaza theatre.

As a councillor of the IRE and Director/Chief Engineer of Harrington's-Raycophone, he had sought and obtained the cooperation of Hoyts for use of the Regent and Plaza theatres for the occasion. Located on opposite sides of George Street, just up from the Sydney Town Hall, they were conveniently located and readily able to be linked by twin, specially balanced audio lines.

Two high quality microphones were set up in the stalls of the Regent, about 20′ (6 metres) apart, facing the Regent Theatre orchestra. At the other end of the line, amplifiers and large theatre style multi- and bi-cellular horn loudspeakers recreated the sound on the stage of the Plaza theatre.

To most of the audience, it was the first time that they had heard what we now know as stereophonic sound – certainly on anything like the scale demonstrated on that evening.

This was followed by a demonstration of stereophonic sound on film, featuring pianist/entertainer Jack Lumsdaine, soloist Shiela Ridette and two un-named table tennis players.

Only once before had film stereo sound been demonstrated anywhere in the world – in New York during the previous October – before the Society of Motion Picture Engineers (SMPE), of which Ray Allsop had become a Fellow.

'First class engineer'

At the presentation, it was explained that recording and playback had been achieved using what looked, on the film, like an ordinary push-pull variable area sound track. However, rather than being mirror images, Ray Allsop had modified the recording and playback equipment so that the two sides represented the left and right signals, and were duly sensed and reproduced as such.

In introducing Ray Allsop on the occasion, IRE President Sir Ernest Fisk said that in the motion picture field, by virtue the work he had performed and the results he had achieved, Mr Allsop could be regarded as nothing short of a genius. The products manufactured by the organisation of which he was director and chief engineer stamped him also as a first class engineer.

At the time, Harrington's-Raycophone was represented in all Australian capitals and in New Zealand, and had installed their equipment in 375 theatres. However, as the era of add-on sound equipment passed, they found it increasingly difficult to compete with the resources of their much larger overseas competitors and the brand-name ultimately disappeared.

After serving on the council of the IRE, Ray Allsop was elected IRE President for 1947-8, in very distinctive company and succeeding such notable pioneering figures as Sir Ernest Fisk, N.S. Gilmour, J.J. Malone, A.S. McDonald and D.G. Wyles. He was succeeded in turn by Murray Stevenson, long-time engineer of radio 2UE in Sydney and later chief engineer of ATN TV, key station of the 7-network.

FM broadcasting

In the wake of his preoccupation with motion picture sound, Ray Allsop was seemingly bitten by yet another wireless 'bug', this time in the form of FM (frequency modulation) broadcasting.

It had long been appreciated that a radio carrier could be modulated in a number of ways, but the development of technology was such as to favour the use of amplitude modulation (AM) for both radio telephony and public broadcasting.

By nature, however, AM was prone to interference by atmospheric and man-made (electrical) noise – a fact that Major Edwin H. Armstrong of Columbia University highlighted in May 1936, with a landmark paper in the *Proceedings of the IRE* (USA) entitled 'A method of reducing disturbances in radio signalling by a system of frequency modulation'.

As reported in *Radio & Hobbies* for July 1939, the paper was backed up by a lecture to the Radio Club of America, at Columbia's Pupin Hall and by companion papers delivered by messrs Weir, Flyer and Worcester from GE (General Electric Co) at Schenectady.

Experimental transmissions were made from W2XAM at Alpine, NJ (42.8MHz, 20kW) and 2AG in Yonkers, NY (110MHz, 1kW). The tonal purity, carrying power and freedom from noise was described as amazing, especially when the power from 2AG was reduced to only 1 watt, by bypassing the output stage of the transmitter.

Said Major Armstrong: frequency modulation transmission has moved ahead of program source equipment.

Support from GE

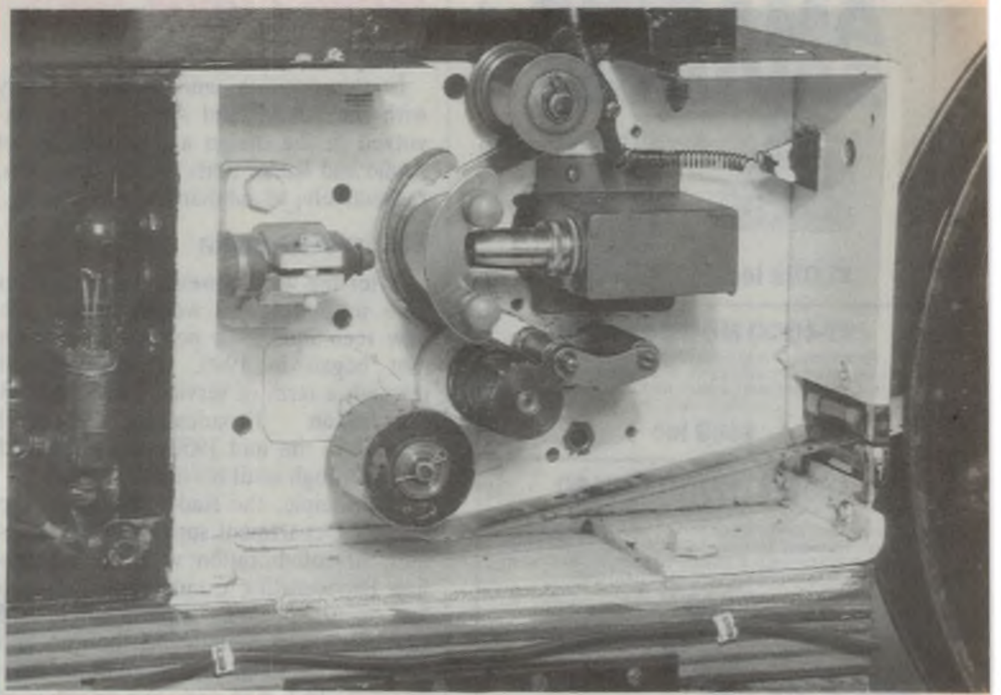
In *R&H* for October 1939, Dr W.R.G. Baker, Head of GE's radio and TV division, is quoted as saying that, within a year, high fidelity static-free transmission would be filling America's airwaves; this was to a delegation of college and university professors. FM transmitters could be built, he said, for about one quarter the price of a typical AM transmitter and, because of the nature of VHF transmissions, there would be room for more networks and an almost unlimited number of stations.

In tests before representatives of the Federal Communications Commission and the Interdepartmental Radio Advisory Committee, GE officials were reportedly able to demonstrate a 96% reduction in atmospheric and man-made noise, compared with typical AM reception.

The November 1939 issue of *R&H* emphasised the on-going interest in FM broadcasting in the USA, with the release of receivers able to intercept experimental transmissions. An article on the theory of FM was reprinted, by arrangement with *Shortwave Craft*.

But World War II had intervened and, in the March 1940 issue, *R&H* Editor John Moyle conceded that, in Australia, FM broadcasting would have to be set aside until the cessation of hostilities.

As a former ship's radio officer and founding engineer of Australia's first broadcasting station, Ray Allsop had good reason to welcome FM broadcasting, with its relative freedom from noise interference. But he, too, had a part to play in the new war, being commis-



A modified but still identifiable example of Ray Allsop's original 'Raycophone' sound head for 35mm theatre projectors, which enabled many Australian cinema owners to convert to sound at an affordable price.

July, 1929 WIRELESS WEEKLY Page Nine

Developing the RAYCOPHONE

By RAY ALLSOP

(Associate Technical Editor, Wireless Weekly.)

How a young Australian wireless engineer produced the first all-Australian talkie installation. This outfit is now being operated in a number of city and suburban theatres and compares more than favorably with British and American machines.

The vital part of the Raycophone is indicated by the arrow. Enclosed here is the sensitive photo-electric cell.

EIGHT years ago I became interested in the synchronisation of sound effects with photographic moving film; and succeeded with a series of experiments towards designing an efficient machine, capable of reproducing behind the screen the sounds associated with the actions of the shadow people. I was working on the principle now known commonly as the "Vitaphone;" which reproduces sound effects and speech by the wax disc medium. I was succeeding with these experiments; but eventually abandoned them. They were necessarily dilettante dabblings at the time.

At any rate, broadcasting was a better proposition eight years ago than Synchronised Films. But when I found that Synchronisation had succeeded over the other side so well that it constituted a menace to the silent film, and that talking films on both disc and sound track bases were being manufactured in commercial quantities, and that these innovations were coming out to Australia, I decided to attempt bringing my old plans to fruition, and worked on them during my spare time.

The synchronisation of sound with films was a comparatively easy matter. With

which are amplified and reproduced through loud speakers.

With the disc method of operating talking films the disc machinery is geared to the electric motor which runs the cinematograph; and, as a result of this carefully calculated gearing the synchronisation is again perfect, and the sound is taken out through the same amplifying channels as are used for the amplification of the sound-track film.

So it will be seen that synchronisation is obtainable with quite simple devices. And once you have attained to perfect synchronisation there is nothing more to that branch of the machinery. The whole trouble with talkies is not synchronisation; but amplification. You have to fill enormous theatres with the sounds taken from a revolving disc, or a strip of film. This involves deep problems of reproduction and acoustics, on which it would be impossible for me to touch in the limited space available. It is enough to say that by careful experimenting, we have evolved amplifiers and loudspeakers which compare more than favourably with overseas productions, and are now manufacturing complete [illegible] for sale

In July 1929, Wireless Weekly carried this article on his talkie work, written by Ray Allsop himself – described as the magazine's Associate Technical Editor.

When I think back

sioned Lt Commander, RAN.

In this position, and working closely with the RAAF and Army, he was involved in the design and production of Asdic and Radar units for the detection, respectively, of submarines and aircraft.

FM in Australia

After the war, however, he wasted no time in putting his weight behind the new technique – a personal campaign that began in 1946. It was pursued through a term of service on the ABCB (Australian Broadcasting Control Board) in the mid 1950s and continued right through until his death in 1972.

In principle, the Radio Branch of the PMG's Department supported his views and, in collaboration with the Australian Broadcasting Commission, went so far as to licence 'experimental' FM transmitters in Sydney, Melbourne and Adelaide in 1948, and another in Brisbane in 1952. Fed with one or other of the ABC programs, they were not publicised to any extent and not regarded as an obligatory ABC service. Even so, they built up a keen following among the hifi fraternity.

Ray Allsop was delighted, of course. At least it was a start.

But the transmissions also consolidated opposition from the entrenched commercial AM broadcasters, who had no desire to share the advertising revenue 'cake' with newcomers – certainly not the 'almost unlimited number' of stations that had earlier been predicted in the USA. It was conceded that the experimental stations might ultimately provide the basis for an ABC service but, in 1948, the newly appointed ABCB put their collective minds at rest by decreeing, from the outset, that no commercial FM stations would be licensed in the forseeable future.

What's more, the decision did not appear to upset the major Australian equipment manufacturers. The pent-up demand of the war years remained to be filled with new AM receivers, and up ahead was the prospect of television. Why complicate the situation with FM – for the sake of a vocal minority of hifi nuts, who usually preferred overseas equipment anyway?

Looking back on that period, I have the lasting impression that Ray Allsop's dedicated pro-FM campaign made him a prime target for the many 'we-don't-need-FM' industry executives. They enjoyed putting him down. His real objective, they said, was a station, a network of his own. And they guffawed when he was later offered an experimental licence, on condition that he did not broadcast music!

The VHF FM band (88-108MHz) survived the introduction of television in 1957, but when the allocations were reorganised in the early 1960s to secure more TV channels, the FM band was decimated and the ABC experimental transmissions were terminated.

In announcing their decision, the ABCB suggested that, if and when Australia needed FM broadcasting, space for it would be found in the UHF sector.

The TV broadcasters were encouraged by their own success, receiver manufacturers were delighted with the wider market and AM broadcasters were assured by the indefinite postponment of FM. Just about everyone else was content – except Ray Allsop and an emerging body of music lovers.

And Ray certainly didn't miss any opportunity to make his point. In a long letter to the Editor of the *Australian Financial Review* (October 6, 1967) the man who had learned his craft with a spark transmitter, a Morse key and a galena detector praised the initiative of AWA Microelectronics for having produced Australia's first batch of integrated circuits.

While this had important implications for the defence industry, he said, it also held promise for the ultimate production in Australia of UHF receivers using the FM principle "(for many years recommended by the Post Office as the most satisfactory means of expanding the broadcasting system)".

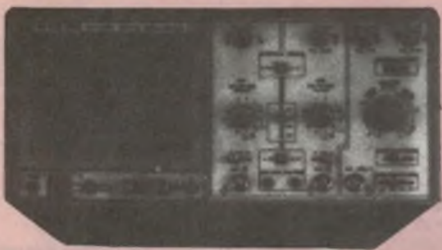
In the *National Times* for January 13, 1971 he was reported still to be actively campaigning for the introduction of FM broadcasting – this when they announced that he had been awarded the OBE in the Queen's New Year Honours List, for pioneering work and services to radio.

Ironically, he died at age 75 on March 19, 1972 – about the time that the Whitlam Federal Government were re-examining the whole structure of the radio industry, and of radio and television broadcasting.

Had he but lived another couple of years, he would have heard the decision to clear the 88-108MHz band and to establish FM-stereo broadcasting in Australia.

In one sense, that is another story. But 25 years of dedicated campaigning by one of Australia's radio pioneers *had* to have something to with it.

OSCILLOSCOPES



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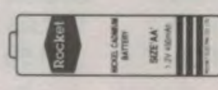

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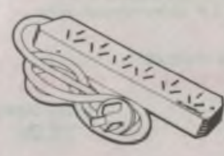

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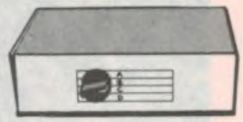

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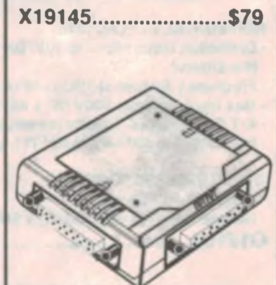

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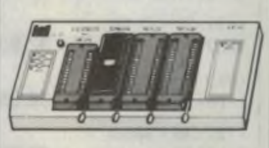
- Memory Expansion Slot
- Optional 2-8MB memory card
- Supports LOTUS-INTEL-MICROSOFT (LIM) Expanded Memory Spec. (EMS) version 4.0
- Supports Page Interleave Mode using 100NS DRAM
- BIOS: AMI or PHOENIX
- Turbo Light and Hardware Reset connector
- Keyboard or Hardware Reset connector
- Power Good Signal on board
- Baby size main board
- Without Ram

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

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

X18090....................$700
- 20MHz

X18092....................$895



MIDI INTERFACE CARD - DS/401
The MIDI DS-401 Card is the PC standard MIDI interface that runs most popular PC music programs for sequencing, recording, composing, music printing, patch editing, music instruction and many other applications.
- Run all programs designed for the Roland MPU-401 architecture
- Socketed EPROM for easy user replacement
- 1/3 length (short) card will fit in any computer accepting standard expansion card, including laptops
- Including "Y" cable, external connector box to transport is unnecessary

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

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

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

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

IBM* CARDS

G7 MONOCHROME COLOUR CARD
Supports colour graphics, TTL and composite monitors with printer port
X18007....................$139

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

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

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

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

RS232 (SERIAL CARD)
WITHOUT CABLE
Supports 2 asynchronous communication ports. 50 baud to 9600 baud.
X18026....................$39

RS232 & CLOCK CARD
WITHOUT CABLE
Supports 1 asynchronous communication port. 50 to 9600 baud with Clock.
X18028....................$59

CLOCK CARD
X18024....................$49

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

GAMES I/O CARD
Features 2 joystick ports.(DB15)
X18019....................$29

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

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

2 M/BYTE EXTENDED/ EXPANDED MEMORY RAM CARD
X18052....................$225

3.5 M/BYTE EXTENDED RAM AT* CARD
X18056....................$275

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

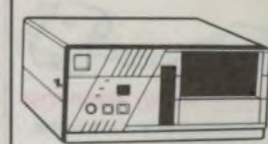
FLOPPY DISK DRIVE CONTROLLER CARD
These cards will control up to 2 sided 360K IBM* compatible disk drives.
- For 2 Disk Drives

X18005....................$52

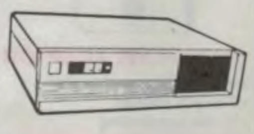
POSTCARD DIAGNOSTIC MODULE
Pinpointing component problems in IBM* compatible motherboards can take hours. Usually the whole system has to be working to isolate the troubled area. But not so with the new Postcard Diagnostic Module. So no other cards are necessary to test a bare motherboard.
"It now only takes seconds."
Simplified debugging for:
- Field service- for on-site repairs or maintenance depot work
- Manufacturing test- for burn in test flaws and to do quality control
- Inspection- Postcard simplifies incoming and outgoing test processes on stand

X18048....................$849

CASES



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



IBM* XT COMPATIBLE CASE WITH AT* STYLING
Features security key switch, 8 slots, and mounting accessories
Size: 490(W) x 145(H) x 400(D)
X11091....................$99

TOWER COMPUTER CASING
Remount your computer to give it that professional look.
- Accepts XT, AT, Baby AT and 386 boards
- Horizontal full height hard disk drive mounting
- Room for 2 x3 1/2" and 2 x 5 1/4" floppy drives
- Full height HDD plus fan mount
- Size: 165(W) x 600(H) x 500(D)

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

DUST COVERS

DUST COVER
Keep your computer and accessories free of dust and grime while not in use
XT* Cover Set
C21066.................$14.95
AT* Cover Set
C21068.................$16.95

MODEM

ALLEGRO 24.24 SA MODEM
- Auto Dial Commands
- Auto Answer CCITT V25 Compatible, Auto Disconnect timeout: Hayes compatible
- Auto Range Selector: 300/1200/2400
- Modem capability: V21, V22, V22bis, Bell 212, Bell 212A
- High Performance: Better than 95% for binary transfers at Signal to noise ratio of 21dB and Receive data level- 34dB
- Telecom Approval C88/37/37a
- 12 month warranty

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

JOYSTICKS

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

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

ROD IRVING ELECTRONICS

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

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

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

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

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

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

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

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

LOCAL ORDERS & INQUIRES (03) 543 7877

POSTAGE RATES:

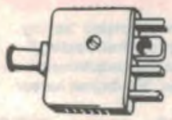
$1 - $9.99	$2.00
$10 - $24.99	$3.00
$25 - $49.99	$4.00
$50 - $99.99	$5.00
$100 +	$7.50

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

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

ROD IRVING ELECTRONICS

TELEPHONE CONNECTORS



TELEPHONE PLUG
AUSTRALIAN
- Solderless Terminal lugs
- Colour: Cream

Y16016....................$4.95

TELEPHONE INLINE SOCKET
AUSTRALIAN
- Solderless terminal lugs
- Colour: Cream

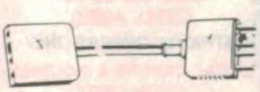
Y16018....................$4.95

TELEPHONE DUAL ADAPTOR
- Australian plug to 2 Australian sockets
- Length: 10cm
- Colour: Cream

Y16014..................$12.95

TELEPHONE DUAL ADAPTOR
- Australian socket to 2 Australian plug/ socket
- Length: 10 metres
- Colour: Cream

Y16015..................$11.95

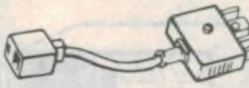


TELEPHONE EXTENSION CABLES
- Australian plug to Australian socket
- Colour: Cream
- Length: 10 metres

Y16012..................$11.95

TELEPHONE EXTENSION CABLES
- Australian plug to Australian socket
- Colour: Cream
- Length: 5 metres

Y16010..................$12.50



TELEPHONE ADAPTOR
- Australian plug to U.S socket
- Length: 10cm
- 6 way/ 4 contact
- Colour: Cream

Y16026....................$6.95

TELEPHONE ADAPTOR
- U.S. modular wall socket
- 6 way/ 6 contact
- Screw terminating
- Colour: Cream

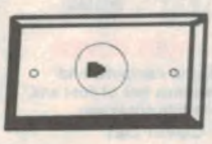
Y16002....................$3.95

MODULAR DUAL OUTLETS
- Single cable input to 2 modular socket outputs
- Surface mounting
- Screw terminating
- Colour: Cream
- 6 way/ 6 contact

Y16004....................$4.95

SURFACE MOUNT SOCKET
- U.S. modular surface mount socket
- 6 way/ 6 contact

Y16003....................$4.95



FLUSH MOUNT - SINGLE SOCKET
- Wall plate with modular socket
- Standard Australian size plate
- 6 way/ 6 contact
- Colour: Cream

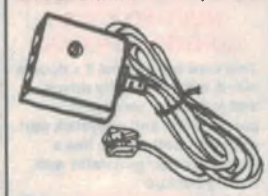
Y16005....................$3.95

FLUSH MOUNT - DUAL SOCKET
- Wallplate with two modular sockets
- Standard Australian size plate
- 6 way/ 6 contact
- Colour: cream

Y16006....................$4.95

TELEPHONE EXTENSION CABLE WITH REEL
- Allows 15 metres of telephone cable to be neatly wound in a portable storage container
- Colour: Cream

Y16013..................$24.95

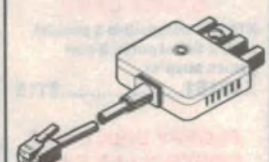


TELEPHONE EXTENSION CABLE
- Australian socket to U.S. plug
- 6 way/ 4 contact
- Length: 5 metres
- Colour: Cream

Y16017....................$8.95

TELEPHONE CURL CORD
- Length: 1.8 metres
- Colour: Black

Y16020....................$3.45

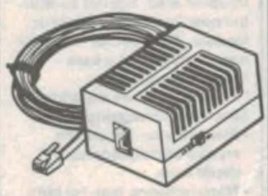


TELEPHONE EXTENSION CABLE
- Australian plug to U.S. plug
- 6 way/ 4 contact
- Colour: Cream
- Length: 2.5 metres

Y16029....................$6.95

TELEPHONE INLINE JOINER
- U.S. socket to U.S. socket
- Colour: Cream

Y16037....................$3.95



TELEPHONE EXTENSION BELL
- Allows you to hear the phone ringing when you are outside
- Colour: Cream

Y16042..................$29.95

GENDER CHANGER

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

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

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

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

DB15 GENDER CHANGERS
- Saves modifying or replacing non-mating DB15 connections
- All 15 pins wired straight through

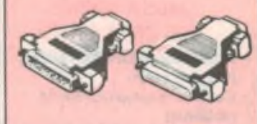
X15645 Male to Male
X15646 Male to Female
X15647 Female to Female
..............................$14.95

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

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

RS232 NULL MODEM ADAPTORS
- Pins 2 and 3 reversed
- All 25 pins connected

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



9 PIN TO 25 PIN CONNECTOR ADAPTORS
The perfect solution!
Features gold plated pins
- DB9 Plug to DB25Socket

X15668..............$10.95
- DB9 Socket to DB25 Plug

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

RS232 MINI PATCH BOX
- 25 leads with tinned end supplied

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

GENERAL

PLASTIC UTILITY BOXES
Available with metal or plastic tops.

METAL TOP
- 150 x 90 x 50mm

H10101....................$4.50
- 195 x 113 x 60mm

H10102....................$6.25
- 130 x 68 x 41mm

H10103....................$2.95
- 83 x 54 x 28mm

H10105....................$1.95
- 120 x 65 x 38mm

H10110....................$2.95

PLASTIC TOP
- 150 x 90 x 50mm

H10111....................$4.95
- 195 x 113 x 60mm

H10112....................$6.95
- 130 x 68 x 41mm

H10113....................$2.90
- 83 x 54 x 28mm

H10115....................$2.25
- 120 x 65 x 38mm

H10120....................$2.95

(Less 10% for 10 or more cases)

MU SERIES PANEL METERS
DIMENSIONS LISTED BELOW

Q10500	MU45 0-1MA	$16.50
Q10502	MU45 50-0/50uA	$16.50
Q10504	MU45 0-100uA	$16.50
Q10505	MU45 0-50uA	$16.50
Q10510	MU45 0-5A	$16.50
Q10515	MU45 0-10A	$16.50
Q10516	MU45 0-20A	$16.50
Q10518	MU45 0-1A	$16.50
Q10520	MU45 0-20V	$16.50
Q10525	MU45 0-30V	$16.50
Q10530	MU52E 0-1A	$18.95
Q10533	MU52E 0-5A	$18.95
Q10535	MU45 VU Metre	$17.95
Q10538	MU65 0-50uA	$23.50
Q10540	MU65 0-1mA	$23.50
Q10550	MU65 0-100uA	$23.50
Q10560	MU65 0-20V	$23.50

NEWS HIGHLIGHTS

TELECOM TO INTRODUCE FASTPAC

Telecom has announced its commitment to spend $75 million over the next four years in introducing FASTPAC, its first broadband switched data service in 1991. Fastpac will use the Australian-invented QPSX – Queued Packet Synchronous Switch – technology from its joint venture company QPSX Communications in Perth.

QPSX is an information transfer system which allows rapid transmission of large amounts of telecommunications traffic through the public network. It turns any form of transmission into discreet packets of information, which are individually directed to their destination by attached codes.

The protocol was the brain-child of Robert Newman, an engineering honours student at the University of Western Australia.

His thesis project idea, developed in collaboration with his thesis supervisors, was picked up by Telecom's Research Laboratories, which provided expertise and funding over three years to enable the UWA team to demonstrate the viability of networks based on the QPSX distributed-queue dual-bus protocol.

SOLDERING STATION WINNER

The winner of the 'Lucky Draw' contest, run by All Electronic Components and Scope Laboratories in Melbourne during September and October, was Mr A. Dubinsky of 41 Lonsdale Avenue, Moorabbin 3189.

Our picture shows *EA's* Melbourne representative Nikki Roche drawing the winning entry, watched by All Electronic Components' manager Andrew Frolley and Scope Labs' manager Barry Macintosh.

Mr Dubinsky won a Scope ETC60L continuously adjustable soldering station, valued at around $220.

AUTOMATED TESTING FOR HY-Q

Hy-Q International, Australia's largest manufacturer of frequency control products, has recently upgraded its quality assurance department with the installation of two US manufactured Saunders Temperature Test Systems, controlled by HP2100 system computers.

The commissioning of this equipment allows Hy-Q to automatically measure all nine static and motional crystal parameters, on a total of 160 crystals per run. For optimum accuracy, each parameter may be measured at all temperatures from –55°C to +150°C, with steps as low as 0.5°C. As crystals within the test chamber may be of mixed frequencies from 1 to 300MHz, maximum utilisation of the system is ensured. Output from the system can be in either tabular or graphical form.

MOST POWERFUL CIVIL COMMUNICATIONS SATELLITE

Olympus 1 – Europe's most advanced communications satellite, built by an international team led by British Aerospace (Space Systems), has become operational after successfully completing a series of rigorous post-launch commissioning tests.

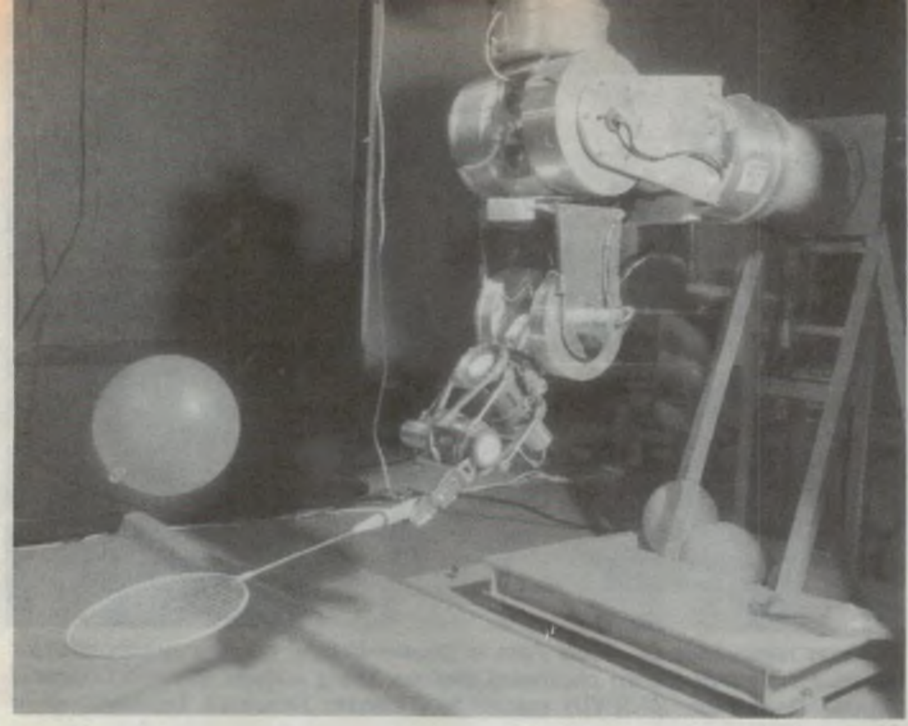
The spacecraft, the world's largest and most powerful civil three-axis stabilised communications satellite to date, was successfully launched by Ariane on July 11, 1989 from the Guiana Space Centre, French Guiana.

Following the launch, a period of in-orbit testing of the satellite from the European Space Agency's test facility at Redu, Belgium, was undertaken. The objectives of the tests were to check the functioning of the satellite's on board systems and communications payloads.

In all respects the satellite has performed to specification and the satellite has now begun its operational life, being used by an increasing number of European broadcasting, communications and industrial organisations.

One of the first on air was BBC Enterprises, which is using part of the spacecraft's high power DBS payload to broadcast a range of programmes – a service to be known as the 'Enterprise Channel.' The channel will offer BBC programmes with emphasis on current affairs programmes with a strong European slant.

Another transponder of the DBS payload has been allocated to Italy, to be used exclusively by the Italian national television company RAI for a pre-operational service. The DBS beam will be the most powerful in the world and viewers will be able to use receiving dishes as small as 30cm in diameter.



TOSHIBA ROBOT JUGGLES BALLOONS

Toshiba researchers have succeeded in gaining greater control of a multi-joint robot operating in conjunction with a vision processor that recognises and processes the images of moving objects. To demonstrate the new control technique, they have developed a one-armed prototype robot which can juggle up to two balloons without dropping them.

This is apparently the first robot with a general-purpose image processing system capable of such high-speed analysis and response to the movement of objects.

Today, technologies for the recognition of still objects are quite advanced and are used in factory automation systems. However, recognition of still objects and control of robot arms based on that recognition process requires extremely high speed image processing and accurate control technology. Toshiba's development will pave the way for the introduction of this technology into practical use.

Using two TV cameras, the balloon juggling robot, or 'Otedama Robot' as it is called, ascertains the balloon's movement three-dimensionally from two measuring points at a sampling rate of 10 times per second. It then determines the arm movement necessary to make the racket reach the estimated hitting position within the calculated time.

In the case of two balloons, the robot distinguishes one from the other by recognising the different colour of each balloon.

In achieving this technology, Toshiba researchers developed a new vision processor, or image processing system. The system consists of an 'overall image processing unit' and four 'local image processing modules.'

The overall image processing unit executes the processes which are applied throughout the whole sequence, such as conversion to edge-emphasised images to recognise the location of the balloons. This unit utilises Toshiba's general-purpose image processing equipment, 'TOSPIX-i,' which performs such processes at high speed.

After overall processing, the local image processing modules capture and analyse the movement of each balloon by obtaining the necessary data from TOSPIX-i through an image bus. Each module integrates a 32-bit microprocessor and other logic and memory ICs on a printed circuit board to attain high-speed parallel processing.

The arm of the Otedama robot utilises direct-drive motors, which make possible freer and more elaborate movements than conventional gear motors. However, control of multi-jointed robots using direct-drive motors is extremely difficult, because each joint must be controlled while simultaneously taking into consideration its influence on the other joints.

Toshiba engineers developed a new digital signal-processing (DSP) board to compensate for the complex interaction between joints by instantly calculating the time function of angles, angular velocity and the angular acceleration of each joint.

NEWS BRIEFS

- Melbourne-based ***Imark Communications*** has relocated to Unit 2, 75 Mark Street, North Melbourne 3051. The telephone and fax numbers are unchanged: (03) 329 5433 and (03) 328 4431 respectively.
- A controlling interest in radio communications firm ***Heyden Spike*** has been acquired by ***GEC Plessey Communications Australia*** (GPT). GPT's MD Godfrey Hole says the coming together is a positive step for both companies.
- Laser specialist ***Laser Electronics***, based in Southport, Qld is now the exclusive agent in Australia for Laser Diode Inc. of New Jersey. Laser Diode produces CW laser diodes and LEDs operating at 820, 1300 and 1550nm, pulsed laser diodes, arrays and matching electronics.
- The $90,000 contract to manufacture the Videotic Diplomat 'lucky envelope' ticket vending machine for clubs has been won by ***Megadata Manufacturing*** of West Ryde, NSW. The Diplomat features a custom 14" colour monitor, ticket printer and accounting/auditing systems.
- After over 40 years in Rockdale, hifi distributor ***Falk Electrosound*** has moved to a new office/warehouse complex at Waterloo, conveniently located between Sydney Airport and the city centre. The new address is Unit 1, 340 George Street, Waterloo 2017, phone (02) 318 0944 and fax (02) 698 3693. The firm distributes well-known brands such as NAD and KEF.
- Component and equipment distributor ***Soanar Electronics*** has been appointed sole Australian distributor for the US-based Cherry Semiconductor Corporation, maker of specialised digital and linear ICs. Soanar has also appointed Michael Leitch as manager of the company's recently formed connector division.
- Melbourne-based data comms specialist ***Dataplex*** has been appointed master Australian distributor for Israeli data comms maker RAD Data Communications. The RAD range includes a line of miniature interface-powered short range modems, multiplexers, sharing devices, converters and fibre-optic devices.
- The 5th Australian Software Engineering Conference (ASWEC '90) is to be held at the Hyatt Kingsgate Hotel in Sydney, from May 22-25. Papers and registrations should be sent to the Secretariat, c/- the IREE (Aust.), Commercial Unit 3, 2 New McLean Street (PO Box 79) Edgecliff 2027 or phone (02) 327 4822.

NEWS

OTC SEMINAR MARKS INTELSAT, INMARSAT ANNIVERSARIES

Late last year OTC Limited, Australia's overseas communications organisation organised a media seminar in Sydney to celebrate the 25th anniversary of Intelsat, the international telecommunications satellite organisation, and the 10th anniversary of Inmarsat, the worldwide mobile satellite communications organisation.

The seminar was launched by the Hon. Ros Kelly, Australia's Minister for Telecommunications and Aviation Support, who spoke of the country's belief in and need for satellite communications, its role as a founding member of the international bodies, and its committment to their future.

Also present at the seminar were Mr Dean Burch, Director General of Intelsat, based in Washington DC, Mr Olof Lundberg, Director General of Inmarsat, based in London, and Mr Steve Burdon, Managing Director of OTC – all of whom gave interesting and informative speeches.

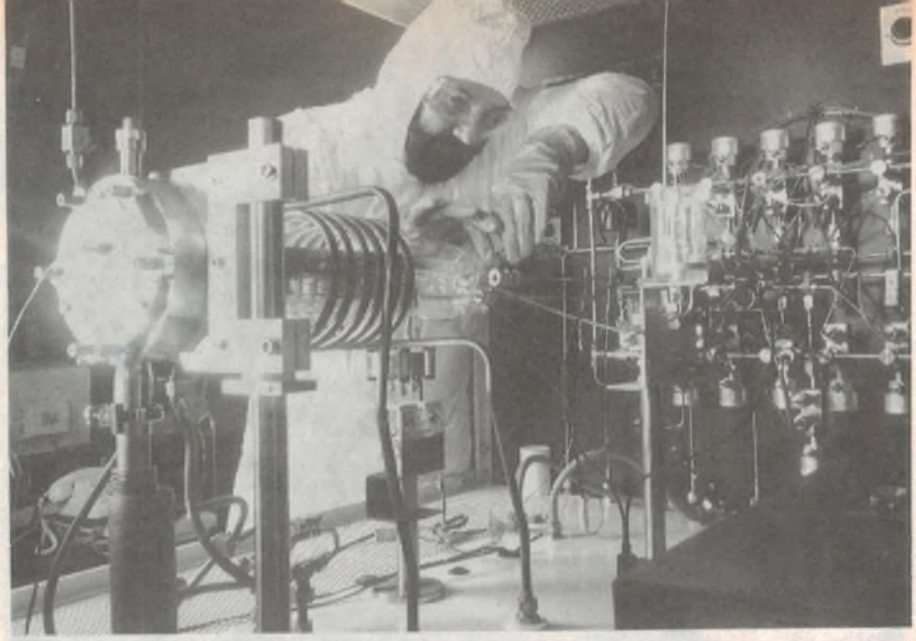
OTC also provided seminar attendees with a tour of Australia's satellite communications terminal at Oxford Falls, north of Sydney.

NEW SERVICE ORGANISATION FORMED

A new organisation has been formed and incorporated, to serve the needs to small and large Australian businesses operating in the areas of electronic sales, service, rental and installation. The organisation is to be known as the Electronic Services Industry Association (ESIA).

Stated aims of the ESIA include representing its members to government, semi-government and statutory authorities, assist its members in keeping abreast of technical developments, assist with the development of training courses, promote the highest levels of service at an affordable price, and provide a tribunal for the resolution of consumer complaints.

Further information is available from the Administration Manager, ESIA, PO Box 154, Carlingford 2218 or phone (02) 564 1991.



Telecom researcher Dr Geoff Pain is shown here preparing semiconductor wafers for state of the art photonics devices, using a Metal Organic Chemical Vapour Deposition (MOCVD) system at Telecom Research Laboratories in Clayton, Victoria.

OTC INTRODUCES STANDARD-C MARINE SATELLITE COMMS

A compact, low-cost maritime satellite communications system which offers telex and data messaging capability to and from virtually anywhere on the globe, has just begun pre-operational trials in the Pacific.

The Standard C system was pioneered by Inmarsat, the International Maritime Satellite Organisation, and is being introduced by the Maritime Business Unit of OTC, Australia's worldwide communciations company.

When it is fully operational, Standard C will support telex, data messaging and Safety of Life at Sea (SOLAS) traffic.

OTC has awarded a $3 million contract to DCC of the United Kingdom, for the installation of Standard C processing equipment at its two coast earth stations now under construction at Perth. The earth stations, complete with Standard C processing equipment, are scheduled to come on stream with initial service to vessels in the Pacific Ocean region in May 1990 and to the Indian Ocean region by October 1990.

The Standard C terminal is about the size of a briefcase, weighs about four kilos, and has a small, conical antenna which can be mounted almost anywhere on a vessel or vehicle. Its size and cost (between $8000 and $13,000) makes it practicable for small fishing boats, pleasure craft, lifeboats, cargo and container ships, tankers, passenger cruise ships, and survey and patrol vessels.

NEW AUSTRALIAN COMM NETWORK

A new communications network designed specifically to cater for Australia's future land based communication needs has been launched.

Developed by Australnet Limited, the new network currently consists of 26 strategically placed communication towers in Queensland, NSW and Victoria. In addition, Australnet is currently negotiating for additional communication tower sites, and is about to commence construction in NSW of the largest private communications tower in Australia.

Announcing the network, Australnet's Chairman, Mr. Phillip Loiterton said the new Australnet network, which will be operative in the early 1990's, is specifically designed to provide a wide range of 'state-of-the-art' communication services including trunking and conventional radio services, paging, cellular telephone communication, advanced radio communications, navigation services, entertainment radio network broadcast services and microwave communication for industry.

Australnet has secured substantial trunking frequencies in the 800MHz range as well as conventional VHF frequencies, and via their communication network they will be able to offer the land mobile communications industry major opportunities for improved communication and range of services.

SMT TRAINING FACILITY FOR VICTORIA

David White, Victorian Government Minister for Industry Technology and Resources (DITR) recently signed an agreement with Cima Electronics to establish a surface mount technology (SMT) facility which will enable manufacturers to adopt this leading edge technology.

Ron Tripp, Managing Director of Cima says "There is no doubt that surface mount technology will play a significant part in the industrial revolution which is taking place in Australia, and the availability of a facility where Australian manufacturers and potential users can learn in a practical manner the techniques of SMT is an important initiative."

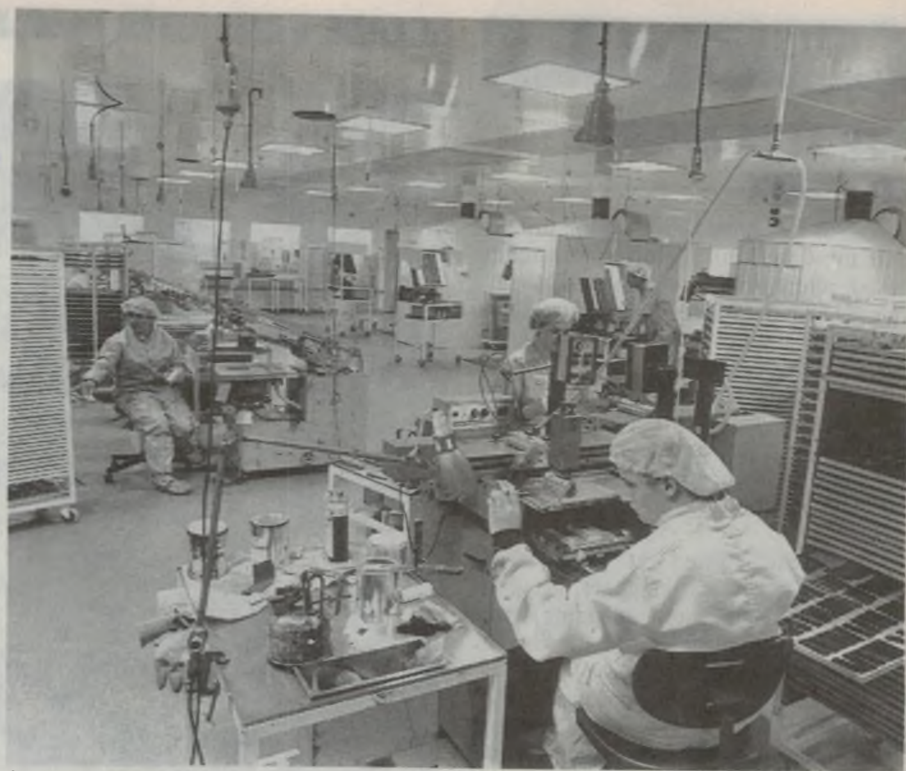
The Cima SMT facility will provide training for manufacturing, design and quality engineers and technicians through a comprehensive workshop program. Sales and service engineers will also benefit from attending these programs. Participants will build and manufacture SMT assemblies using the latest equipment and gain an understanding of all processes in a simulated production environment.

CCIR CELEBRATES 60TH ANNIVERSARY

Sixty years ago, in September 1929, the ITU's newly established International Radio Consultative Committee (CCIR) held its first meeting in the Hague.

A few months ago CCIR commemorated the event, with participation of some 450 delegates to study group meetings in progress, officials of ITU and international organisations. Technical study group meetings are underway in Geneva in preparation of the XVIIth Plenary Assembly, to be held in Dusseldorf in 1990.

The decision to establish the Consultative Committee which is today the CCIR was taken by the Third International Radio Conference, Washington, 1927. The original purpose of the CCIR was to carry out the necessary technical studies between international radio conferences. The first post-war Plenary Assembly was held in Stockholm, 1948. Under today's mandate of the International Telecommunication Convention (Nice 1989), CCIR 'studies technical and operating questions in radiocommunications and issues recommendations, with a view to world-wide standardisation of telecommunications.'



Instrument specialist VDO Australia has established what it claims is the country's most advanced print room facility, at its plant in Melbourne. The room is a pressurised clean room, with maximum dust particle size of only 30um to ensure high printing quality.

NOYCE, KILBY RECEIVE NEW AWARD

Engineers have always chafed at the attention lavished on scientists, particularly the glory associated with the Nobel Prize. Even school children can identify such Nobel recipients as Albert Einstein (physics 1921), Linus Pauling (chemistry 1954), and Marie Curie (physics 1903 and chemistry 1911).

Recently, the US National Academy of Engineering unveiled its answer to the Nobel Prize: the Charles Stark Draper Prize for engineering achievement. The prize: $350,000 and a gold medallion valued at $7700.

The first winners are Robert Noyce and Jack Kilby. Working separately in the late 1950's, Noyce and Kilby invented the integrated circuit chip and created the Information age.

Noyce is co-founder and vice chairman of Intel in Santa Clara, and now chairman of the Sematech research consortium in Austin, Texas. Kilby works as a consultant, formerly employed at Texas Instruments. They will split the cash prize. In a telephone interview from Austin, Noyce said he would donate his share to non-profit programs associated with Sematech.

Engineers have generally been excluded from the Nobel Prize roster because the Nobel Foundation in Sweden only honours basic scientific research. That creates a certain irony in Noyce and Kilby receiving the first Draper prize, which will be awarded every two years.

The late researcher, William Shockley, also a professor at Stanford University, received the Nobel Prize in 1956 with two colleagues for inventing the transistor – a fundamental scientific break-through. Until now, the inventors of the IC – which put thousands of transistors on a tiny piece of silicon – couldn't receive a similar award for their fundamental engineering break-through.

WORLD'S BIGGEST VIDIWALL

British Telecom has ordered from Philips what is thought to be the world's biggest Vidiwall, for its brand new Network Management Centre in Oswestry, Shropshire, UK.

Due to be delivered in early December, the Vidiwall, consisting of 140 monitors with 41" screens, will display a giant electronic map. This will be used to show what is happening at any time in British Telecom's communication system.

NEWS

AUSSAT LAUNCHES CITY LINK

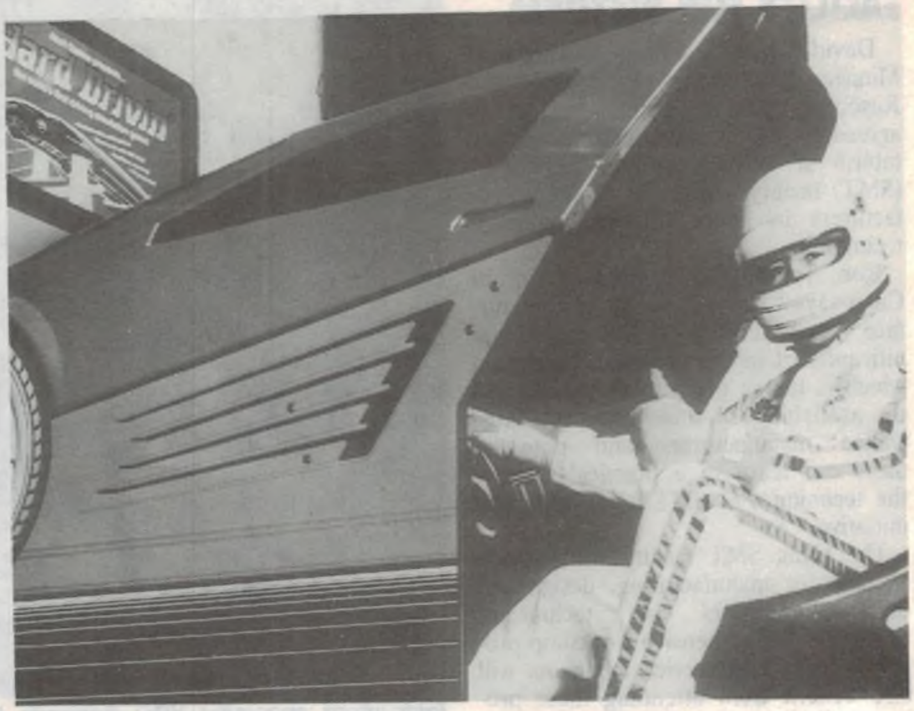
Aussat has launched a major promotion for City Link, a low cost satellite based alternative communications service designed to meet the requirements of Australian business in terms of security and diversity.

Offices are connected by a simple land line or microwave link to a City Link CBD node, and from there messages are sent directly to the local Aussat earth station for transmission around Australia.

Equipment located at each office within the network is compact, inexpensive and uncomplicated, meaning setup time and maintenance costs are kept to the absolute minimum.

City Link's success lies in the fact that it provides the customer with a secure 'door to door' service delivering reliable telephone, fax and data in either low, medium or high speeds (2.4kb/s to 2Mb/s). As either the primary communication network, or as a backup to other networks, City Link is both cost effective and ensures predictable pricing.

ARCADE GAME USES SINGLE-CHIP DSP



A state-of-the-art digital signal processor from Analog Devices brings a vivid sense of realism to Atari Inc's new arcade video game. Atari's 'Hard Drivin' driving simulation game uses an Analog Devices' ADSP-2100 for transformations, rotations, and translations of the game's polygon database. Because the system can manipulate 3-D images in real time, it recreates the illusion of driving an actual car.

'Hard Drivin' is said to represent the first authentic driving simulation for the amusement industry. It takes the driver through a simulated stunt course, including a banked turn, a drawbridge ramp/jump, and a full 360° vertical loop. When the obstacles prove to be too daunting for the driver, the game will replay in slcw, agonising motion the driver's untimely end.

Atari uses a five-processor design to attain the required realistic simulations. Motorola's 68010 handles routine system functions and monitors mechanical functions such as the steering wheel, gas pedal, and brake. Texas Instruments' 34010 graphic signal processor updates the graphic display and controls the video buffer memory, and an audio signal processor employs two additional processors.

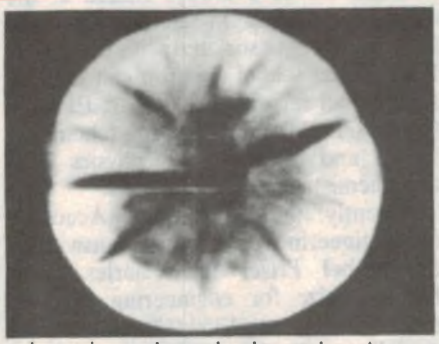
Analog Devices' ADSP-2100 executes the complex mathematical routines needed to manipulate a 3-D image in real time. The device can handle more than 1000 polygons within the required frame time. According to Rick Montcrief at Atari, "The ADSP-2100 replaces a board set of LSI and MSI logic, yet provides higher levels of performance. Future MHz versions of the DSP will add even more realism to 'Hard Drivin' and other arcade video games."

CHECKING POWER POLES WITH CT

How do you know when a wooden power pole should be replaced? They are liable to fail for two reasons that do not necessarily show outwardly – centre rot and termites. In both instances, the pole may appear quite solid but can collapse without warning, causing damage to the line and anything unfortunate enough to be in the general vicinity.

Traditionally tests have included tapping the pole with hammers and drilling test holes. An alternative is X-ray inspection, which is effective because of the different attenuation characticistics between the sound wood and the damaged regions. However, it is still difficult to determine the full effect of damage from a single radiograph.

Now staff in the Applied Physics Department at the Chisholm Institute of Technology in Victoria have developed a relatively low cost prototype X-ray computed tomography (CT) scanning system to produce cross sectional density images of the poles without taking them out of service. This system measures X-ray attenuation at a number of



orientations through the pole. A personal computer then uses the information to construct an image representing the density distribution across that cross section. These sectional images clearly show the extent and distribution of decay, making it possible to estimate the strength of the pole.

Chisholm Institute recently completed its prototype with a Philips high stability MG164 X-ray system. Eventually this will provide a practical inspection facility for the State Electricity Commission of Victoria.

Extensive field trials using the prototype are planned over the next year in a project jointly funded by the SECV and the Australian Electricity Research Board.

New Products and Monthly Specials!
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FORUM

Conducted by Jim Rowe

Computer bugs, viruses, worms, Trojan horses and other nasties

Reacting to recent press publicity about computer viruses and the like, Forum's original conductor and *EA's* former Editor-in-Chief Neville Williams was moved to set down his observations on the subject. Would I be interested in using them, he asked, as the lead item for this month's Forum? You bet I was. Here it is, with a couple of smaller items from readers tacked on at the end:

In a casual chat with a long-time acquaintance, conversation turned to the subject of computer security, hackers and 'viruses' of the electronic kind – a subject on which my friend holds some very strong views.

Said he: "Most of what we read about viruses is a load of old cobbler's – especially all that stuff in October about Friday the 13th. Dreadful things were supposed to happen to computers on the day but, as far as I can gather, very little did. The whole thing was a media beat-up!"

"If you ask me, computer viruses are like UFOs: they're talked about all the way from here to Moscow but there's no real proof that they even exist. Viruses ditto."

Thinking later about the conversation, I had to admit that a lot of the reports about computer viruses are inconclusive, at the very least. Some might even say they're 'rubbery'.

But what *is* a computer virus? My middle-aged *Macquarie Dictionary* is aware only of the common kind: 'an infective agent', it says, more particularly 'one smaller than a common micro-organism and requiring living cells for multiplication ... a corrupting influence', etc.

I have yet to find a concise, convincing definition of a computer virus, but here's one cobbled together from sundry sources:

COMPUTER VIRUS: An illicit, often self-replicating program, ranging in size to a few thousand bytes, that can lodge or lurk in a computer's operating system or files, and interfere with its normal operation. It may clog or stall the processing; may be communicated to other computers; may divert, corrupt or destroy data; may print odd-ball messages on the screen, or simply indicate that the system security has been breached.

Colourful phrase

The term carries the intriguing, even ingenious, implication that computers are like organisms, resembling a community of living creatures: able to be infected or corrupted by mischievous data planted surreptitiously in their electronic metabolisms.

James Lowe, Senior Editor of *Merriam-Webster's Dictionary*, reportedly described 'computer virus' as the 1988 phrase of the year; one that had earned a place in future editions.

Speaking of definitions, a number of other terms crop up frequently in this context. For example,

WORM: Another name for an illicit routine that has been planted in legitimate data. Some draw a distinction between worm and virus but, in most instances, they seem to mean the same thing.

TROJAN HORSE: To hackers, it commonly signifies a program that has been planted surreptitiously in a computer's operating system to intercept confidential data, e.g., passwords, so that they can be read back later. More generally, any legitimate program in which lurks a virus or worm.

BUGS: A term which refers mainly to operational faults in genuine programs, which escaped detection during pre-release testing. The detection of obscure bugs becomes progressively more difficult as programs become longer and more complex. Experts agree that bugs lurk in most modern programs and will show up sooner or later in everyday use.

Those reports

Some time back, I began clipping and filing selected press references to all this, with the idea that they might some day come in handy. Most are from the *Sydney Morning Herald* – for the very simple reason that, as a long-term retiree from the Fairfax organisation, I receive a complimentary copy each morning!

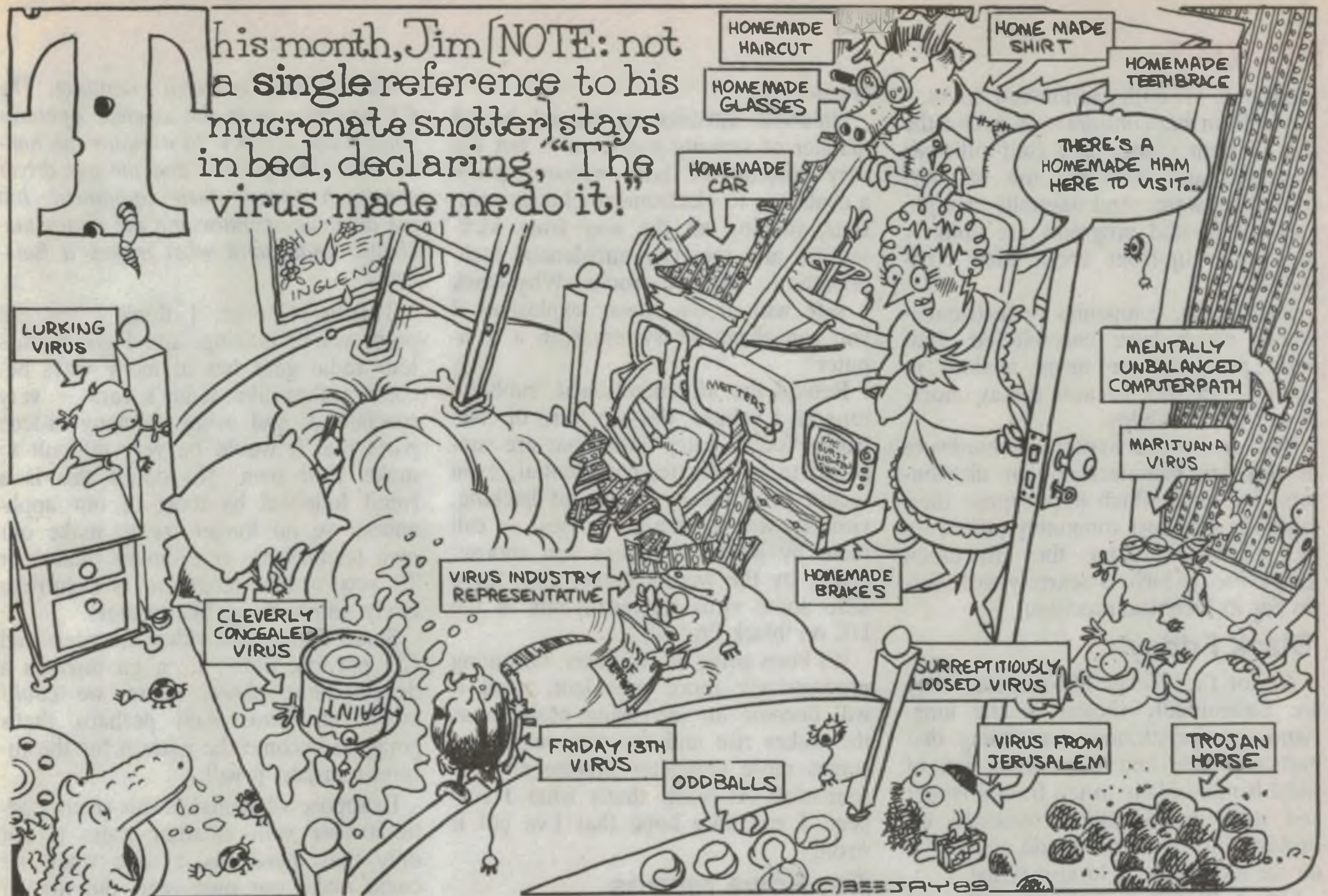
A clipping dated 21/11/88 says that a virus had allegedly penetrated the global computer system of the Murdoch owned News Ltd, which zapped the body copy of news stories, leaving intact only the headings and index. It was qualified by the observation that, being a once-only event, it might simply have been the work of an 'insider' – presumbly a disgruntled employee!

In the 'Virus Watch' feature (*SMH* 5/12/88) John McPhee, Chairman of the US Computer Virus Industry Association states that 300 virus related 'events' involving up to 30 strains of virus had been reported by the Society's 48,000 respondents (mainly PC users) during the preceding 8 months. It sounds a lot, until the figure (4%) is placed alongside the 7500 other events (96%) from the same survey, attributable to software bugs and user errors.

In the same article, Peter Norton from Norton Utility Programs (USA) is quoted as saying that "viruses are urban myths, like alligators in the New York sewers".

Again, a West German virus is reported to have stalled a dozen or so Apple Mac computers, in a suburban San Fernando Valley campus. The qualification: eradication necessitated hours of reprogramming – "a wonderful excuse for the late submission of term papers".

A clipping dated 16/1/89 directs attention to Friday 13th stories and says that a report in the London *Times* newspaper about the '1813' virus being picked up in Belgium, and related warnings



supposedly circulated by IBM, appeared to be totally without foundation. The same applied to a Reuters story about the virus having originated in Jerusalem.

That last one sounded so familiar that I queried the date I had written across it. Should it have read 16/10/89? But no, a check on the calendar showed that 16/1/89 was a Monday and that the previous Friday had indeed been the 13th. On that basis, you can expect further computer virus warnings on Friday 13 in April and July this year!

On 3/4/89, again under the heading 'Virus Watch', *SMH* Computer Editor Gareth Powell said that both he and fellow computer journalist Andrew Farrell believed that the dangers inherent in viruses had been blown up out of all proportion. I quote:

"Anyone who stuffs up a disc through their own stupidity tends to run around in small circles shouting: the virus made me do it, the virus made me do it".

Second thoughts

But having said that (and more), Powell concedes that Richard Rydge, from a predominantly mainframe background sees viral infections as a threat to computer science as we know it. The truth, says Powell, probably lies between those two views.

Increasing apprehension is certainly reflected in the clippings, with the passing months during 1989.

On July 5, the FBI was reported to have been called to investigate the so-called 'Scores' virus. Allegedly intended to sabotage programs at Electronic Data Systems (EDS) Dallas, Texas, it is said to have penetrated and destroyed data in NASA, the Environmental Protection Agency and other US Government instrumentalities.

On August 7, a report from Canberra said that computers in the Australian Defence Department had been penetrated by a virus which identified itself as 'Marijuana'. It is said to have gobbled up data and to have displayed a message on the screen: "Your machine has been stoned – Legalise marijuana". The trail led back to an officer, an unnamed Melbourne man, Swinburne Institute of Technology and a New Zealand University.

In the same issue, 'Virus Watch' noted that a report had been released by the US Government Accounting Office, covering the much publicised Internet incident a year earlier. A 'worm' program, allegedly created by Cornell University graduate Robert Morris, had brought down the Internet system linking the US Government and academia.

Back in Australia, a statement attributed to Price Waterhouse Microservices Partner Paul Apps warns companies and government departments alike of the growing threat of viruses, and the need not only to monitor and supervise their software but also to maintain back-up copies of all records.

Why so rubbery?

One could go on, but only at the risk of tedium. The real question is why the years of speculation, debate and misinformation, in a matter that should be readily reduceable to unequivocal, documented fact?

First off, virus programs are not developed, patented or publicised like other electronic products. They are devised and let loose surreptitiously, by computer 'freaks' whose aim is to create the greatest possible dismay or mischief – without exposing the source. Their existance is accepted only when enough people find out about them the hard way.

Again, while some viruses may be readily identifiable as such, it may be unclear in other cases whether a particular processing problem is due to a cleverly concealed virus or an as yet undetected software bug. There is plenty of room here for both caution and doubt.

A still further consideration is that the risk of both viruses and (self-inflicted) bugs increases with the use of 'borrowed' software. And naturally enough, users of pirated programs are unlikely to be too up-front about their complaints.

Then again, companies or instrumentalities which have encountered computer problems are never anxious to publicise the fact, because it may undermine their credibility.

Neither, for that matter, are hardware or software manufacturers or distributors. Incidents which may expose their fallibility are most commonly picked up by journalists from the proverbial 'grapevine', which is scarcely noteworthy for its technical precision.

'Black Friday'

As for the Friday 13th reports, they are undoubtedly rooted in the longstanding superstitions surrounding that particular day and date. If a can of paint is more likely to fall from a ladder and strike a thoughtless passer-by on Friday 13th, then one should equally be on the lookout for a lurking virus!

Or, if there's a 'computerpath' out there who's keen to let loose a virus, what more natural that they should plan for it to happen on a black Friday?

Taken together, all of the above provide as good a reason as any for software suppliers to publicise the fact that they had anti-virus programs available – and this they certainly did. Use them as per the instructions, and the slim chance of you actually encountering a virus would become even slimmer!

But it was also a golden opportunity to make another point: since the risk of picking up a virus is increased by using public domain programs or copies obtained from 'the friend of a friend', etc, it is much safer to use only original and genuine copies purchased from reputable suppliers (at the original price).

For journalists, that all added up to a story. Not a big one, mind you, but a different 'angle' on an essentially dull subject.

Am I being cynical? Perhaps so, and not without reason. But I do not share my friend's near-total dismissal of computer viruses as a possible threat to our on-going computer-based society.

Like it or not, logical or not, everything about us, our community and our country is being progressively committed to electronic data banks, accessible directly or on-line to those whom the law decrees.

Unlawful intrusion is barred by all manner of security measures – but the very existence of those measures poses a challenge to electronically literate citizens, ranging all the way from kick-seekers and mentally unbalanced technopaths to big-time crooks. Why crack a safe with noisy, messy explosives if you can cheat the system with a computer?

Behind the aforementioned 'rubbery' reports, I believe, lies a pattern of electronic 'forced entry' into what are supposed to be private, confidential, even secure precincts by means of hacking, viruses, worms, trojan horses – call them by whatever names you choose. (And, by the way, I gather that there *were* some virus related events in the UK on 'black Friday').

It's been going on for years, becoming progressively more prevalent. And it will become an increasing problem as the stakes rise and the community becomes more computer literate and resourceful. At least, that's what I suspect. I can only hope that I've got it wrong!

Jim Rowe returns

Thanks, Neville! I'm sure that many readers will find what you've written as interesting as I did. I was amazed to see that computer virus activities in the US are so well organised that they are now regarded as an industry, and with enough people involved to form their own industry association! (Or did *I* get it wrong, too?)

By the way, if any of our Forum readers would like to offer their own comments on this topic, please feel free to write in. With a bit of luck you'll encourage Neville to fire up his word processor and send in other contributions to Forum, from time to time. I don't mind in the least – it's not as if I don't have anything else to do!

To end up this month, three more letters have arrived on that subject that won't go away: amateur radio. The first came from George Craggs, VK2AYG, in Oatley NSW. George seems to think that I was wrong to even suggest that hams should be still trying to build their own gear. Here's the relevant part of his letter:

The amateur operator does not, as a general rule, construct his own equipment, for the same reason that a motor mechanic doesn't build his own motor car. It would cost too much and it would be difficult to get the parts.

This analogy is worth extending. The CB operator is to the amateur operator what a car driver is to a motor mechanic. The CB operator and the car driver can each operate their equipment, but the amateur operator and the motor mechanic understand what makes it function.

Thanks, George. I think I see the point you're making, and I guess amateur radio gear has in many ways become rather like today's cars – very specialised, and using so many hi-tech parts that it would be very difficult to make your own. No doubt this is a trend followed by most of our appliances; we no longer try to make our own telephones, or ordinary radios, or TV sets, or tape recorders, or even relatively simple things like toasters.

Some things, like video recorders and CD players, didn't even go through a development phase where we *could* build our own. And perhaps that's going to become the pattern for the future; I suspect it will.

I suppose what makes this seem a little sadder with amateur radio is not only that there *was* a time when we could make our own gear, but that at least for a while, making your own seemed to be the primary activity of radio hams – the reason why people even took it up. The demise of much of this activity therefore seems to have left a bigger vacuum, somehow.

But perhaps it's better to have built your own gear once and then lost the opportunity, than never to have built any at all? If that's true, today's older hams must have quite an advantage over newcomers to the hobby.

As for it being too expensive to build ham radio gear nowadays, you're probably right in a lot of cases. Not that the pre-built and tested gear is exactly cheap – have you seen some of those prices for the latest all singing, all dancing HF transceivers? Perhaps what we're really saying is that amateur radio has become largely a rich man's hobby...

I'm not sure if I understand George Craggs' reasoning when he extends his analogy to compare hams and CB operators, though. To me what he seems to be saying is that they both operate much the same equipment, in much the same way – the only difference being that the ham understands how the the gear works, while the CB operator doesn't.

In other words, they both do the

same things as viewed from the outside, but more is supposedly going on inside the hams' heads!

If that's what he's saying, it certainly sounds a bit contrived. And judging by how few hams seem prepared to try servicing their fancy multi-mode, multi-band monsters when they give trouble, I'm not even sure if it's true. Presumably most of the hams themselves don't feel they understand enough about the gear to fix it when it goes bung.

Moving now to the second letter, this came from Ian Crompton, VK5KIC of Richmond in South Australia. Ian is a long-time reader, and apparently feels that BeeJay's portrayal of me is quite appropriate: his letter addresses me as "Sharp-nosed Jim". A bit cruel, that one!

Ian has apparently also had a good deal of ill health, and has a very limited income from an invalid pension. He makes the point that the high price of current amateur radio gear has largely relegated hams like himself to what he describes as "a marginal role". He also points out the difficulties in pursuing ham radio if you're physically disabled:

In many cases, there's little you can do if you have strength or co-ordination problems with your hands, and/or limitations on the ability to stand or walk – let alone climb a ladder.

In situations such as these, the co-ax needed in order to mount an antenna above shack gutter level, or the material to make the cones for 'no loss' open-wire mode across to the clothes-line post tend to become the sort of expense you save up for 3 months to achieve.

In our terms, the professional approach costs BIG money, often in the order of 18 months' gross income.

So this K call plods along with calculating refractive indices from Meteorological Bureau data, and looking at what glimmerings of meaning can be given to the values calculated, from hearing snippets of a signal...

Thanks, Ian. You seem to agree with my point about ham radio having become a rich man's hobby, and I guess it's always posed a few problems for those with physical disabilities. I do hope you're still able to get some enjoyment from it, though, even though your activities are necessarily curtailed.

And so to the third and final letter this month, which came from Graham Hunt of Frankston in Victoria. Graham is apparently also a ham, with a limited call like myself, although he doesn't give his callsign. I haven't got space to quote all of his letter, but here's the part that seems most relevant:

It does not surprise me that most of your correspondents agree with your thoughts; this is because you are quite correct. Amateur radio has indeed gone 'down the gurgler', as the politicians would say. People seem to have forgotten the basic reason for having an amateur licence – to experiment in radio communications and thereby improve the art for everyone. It seems that the majority of amateurs only want someone to talk to, so they go out and buy a black box. In this respect they really are little better than CB'ers.

When I obtained my limited call in 1958 our equipment generally consisted of a mixture of home brew and converted war surplus items. Most of our time was spent in getting it going or improving it, and this was also the primary topic of conversation. Of course if you came on the air today with this type of equipment no-one would talk to you.

There was also something called 'CQ', which stood for 'general call'. I haven't heard this used on VHF for years. Most contacts now seem pre-arranged, and intruders are unwelcome.

It's been about 10 years since I last came on the air. I still listen sometimes, but all I hear is repeaters being triggered by 'button pushers' who say nothing. Could it be that behind every button pusher there is a frustrated amateur yearning to call 'CQ'?

Blame what you like – computers, technology or just plain people. But the era has passed, exactly as the era of valves, motor scooters and drive-in theatres has passed. And despite your optimism, I doubt that it will ever return.

Thanks for your comments too, Graham, and although the points you raise largely support what I've said myself, I still find myself hoping that your conclusion doesn't turn out to be true.

Surely there's still a lot of enjoyment to be obtained from the experimental side of ham radio, using simple and low-cost gear? I still remember what a thrill it was when I built up a little transistor transmitter for 144MHz, and worked across town on its tiny output of about 800 milliwatts. You don't need a lot of complicated and expensive gear to get this sort of satisfaction – in fact it's quite the opposite.

Perhaps I am a bit naive, but it seems to me there *must* be a way for today's would-be hams to get the same thrills for themselves. That's the idea behind the current series of simple modular ham gear, anyway.

THE BEST PLACE TO SHOP!

For Value and Selection.

HIGH CAPACITY NICAD CHARGER

- AAA, AA, C, D & 9 volt.
- Charges 600mAh AA, 1.8 & 2Ah C and 4Ah D cells at correct rate.
- Up to 8 batteries at once
- Reverse polarity protection
- Indicator lights for each cell.

Cat M-9506

Only **$39.95**

BARGAIN NICAD CHARGER

- Up To 8 Batteries in any combination
- Save money on batteries
- AAA, AA, C, D & 9 volt.
- With indicator lights for each cell
- Reverse polarity protection and built-in test meter.

Cat M-9505

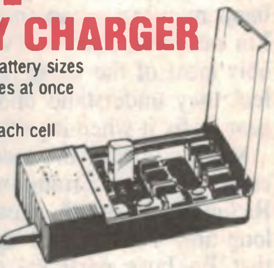
$39.95

SLIMLINE BATTERY CHARGER

- Two most popular battery sizes
- Up to seven batteries at once
- 6 X AA & 1 X 9V
- LED indicator for each cell
- Great Value!

Cat M-9508

$22.95



12 VOLT BATTERY CHARGER

- Quality and reliability from Arlec!
- Ideal for sealed lead acid and gel cell type batteries as in burglar alarms, etc.
- Output rated at 12V DC 500mA.
- Not suitable for batteries with current capacity 2.5Ah or less.

Cat M-9531

$29.95

PANTHER POWER POWER SUPPLY

- 12V @ 1.5A rated
- Peak rating - 13.8V @ 2amp
- Ideal for CB's, amateur, hand helds, etc
- Screw terminals for easy connection
- Also great as a service supply

Cat M-9545

$84.95

PANTHER POWER 13V @ 3 AMP

- Peak rating - 13.8V @ 4 Amp
- Ideal for 2m or small HF transceivers, etc
- Perfect for the bench!
- Heavy heatsink for max. output
- Overload/short circuit indicator

Cat M-9547

$120

RECHARGEABLE GEL CELLS

As used in countless applications such as alarm systems, emergency supplies, etc, etc. No leak, no mess, no fuss! You'll find the right one for most applications.

Type	Size (LxWxH)	Cat No.	Price
12V 1.2Ah	100x45x55mm	S-3315	$35.95
12V 1.9Ah	178x34x60mm	S-3316	$37.95
12V 2.6Ah	125x95x35mm	S-3320	$38.95
12V 6.5Ah	150x65x95mm	S-3322	$55.95

NICAD BATTERIES

It's the best way to go when you rely on battery power! NiCads can easily pay for themselves in no time. Just think about the money and waste you'll save.

Type		Cat No.	Price
AAA	180mAh	S-3305	$3.95
AA	0.5Ah	S-3300	$3.95
C	1.2Ah	S-3301	$9.95
D	1.2Ah	S-3303	$9.95
9V	Full Output!	S-3308	$19.95
Heavy Duty:			
AA	600mAh	S-3312	$4.95
C	2.0Ah	S-3311	$11.95
D	4.0Ah	S-3310	$14.95

NEW LOW PRICES - OZONE SAFE!

AIR DUSTER

High pressure inert gas for cleaning circuit boards, equipment, switches, etc before repairs or to improve performance. Ideal for those places you can't get to with a brush or where you can't risk damage to components. 400ml can.

Cat N-1150

Just **$24.95**

FREEZE SPRAY

A powerful non-corrosive refrigerant for use as a rapid and safe method of cooling small components, etc in electronic equipment. It's ideal for detecting faulty soldered joints and components which overheat. 400ml can. Your workshop shouldn't be without it!

Cat N-1110

Now Only **$19.95**

INFORMATION AT YOUR FINGER TIPS

THE ARRL YAGI ANTENNA DESIGN BOOK

Get the most from your antenna system! A comprehensive design and reference manual for Yagi antenna users. Helps you optimise the performance of your existing system or plan that system you've always wanted to install. Gives invaluable information on gain verses element number and boom length. With information on stacking of various types of Yagis and the correct types of feeder methods.

Cat B-2105

$35.95

LEVEL 11 RADIO & ELECTRONICS HANDBOOK

Is your expertise up to the level you'd like? Well, here's a great way to get it there! Over 150 pages covering advanced electronics theory up to the equivalent level of most technicians. Well presented in a clear and concise method following a classroom format. Covers areas such as single phase power supplies, single sideband modulation, digital circuits logic, Boolean algebra and more! By Ian Ridpath.

Cat B-2312

$22.95

AMATEUR RADIO AND ELECTRONICS STUDY GUIDE

A boon to amateur radio students! It's a clear, concise, easy to follow manual for the amateur syllabus. 210 pages designed to make learning easier using clear uncluttered text and large illustrations (and plenty of them). And it's all in a Students-Own note form. It has been tailored to fill the gap between high-level amateur radio handbooks and over simplified beginners manuals. By Ian Ridpath.

Cat B-2319

$22.95

DICK SMITH ELECTRONICS

Save Your Mags! **MAGAZINE BOOK BINDER**

You'd better pick up one of these before your 1990 magazines get out of hand. The Dick Smith Electronics magazine binder. Helps keep your library organised. Hard cover with metal spine and metal rods for secure binding. Easy clean vinyl cover. Holds 12 issues.

Cat B-4045

$7.95

GETTING THE JOB DONE - RIGHT!

Quality Tools And Soldering Accessories.

SCOPE 12V SOLDERING IRON

Ideal for outdoor work. Rated at 30-150 watts, so it's suitable for a wide variety of applications. Lightweight, easy to handle and beautifully balanced to make work easier. Comes with 6 metre power cable fitted with 2 alligator clips for easy connection to car battery, etc. Pack also contains spare elements and tip. It's fantastic value!
Cat T-1635

ONLY $79.95

MINI TOOL KIT!

20 handy mini-tools in a handy plastic case. Contains 5 open ended spanners (4.0-6.0mm__, 2 Phillips head screwdrivers, 3 Allen-Key drivers, 5 nut drivers (3.0-5.0mm), 5 flat screwdrivers and 1 tommy bar.
Cat T-4830

Only $19.95

WELLER SOLDERING STATION

The first choice of hobbyists, technicians and service people! Like all quality products it's the subtle aspects of design and construction which make it the best. Things like the non-burning silicon rubber soldering pencil lead, long life iron plated tips, lock slots on both sides of the soldering iron stand and wick fed tip cleaning sponge...to name just a few.

With 60 watts capacity, low (24V) output voltage, 1.2 metre iron lead and 3 metre transformer lead, lightweight soldering pencil and special "closed loop" temperature control.
Cat T-3000

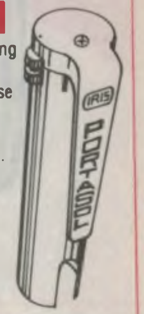
$160

POCKET SOLDERING IRON

Totally portable, butane powered soldering iron that fits easily in the shirt pocket. Provides up to 60 minutes continuous use at full power (equivalent of 60 watts).

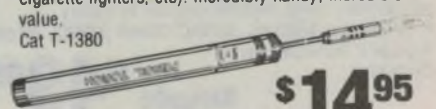
Temperature control from 10 to 60 watts. Ideal for service people, handymen, technicians, etc.
Cat T-1370

$39.95



ECONOMY PENCIL BLOWTORCH

Great for heatshrink work, silver solder, gold, silver, brazing, glass work, etc. Fits easily in the pocket. Powered by butane gas (the same as they use in cigarette lighters, etc). Incredibly handy, incredible value.
Cat T-1380

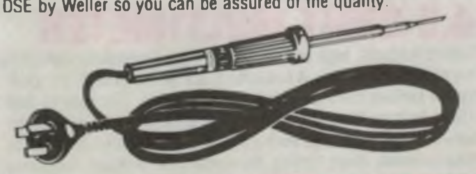


$14.95

15 WATT HOBBY IRON

Mains powered, general purpose iron that's ideal for project building, service and other low-heat work. Rated at 15 watts it saves the hassle of cooked components in hobby work. Made for DSE by Weller so you can be assured of the quality.
Cat T-1310

$25.95



UNIVERSAL TWEEZER SET

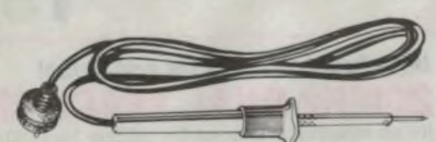
A versatile tweezer set that's a must for the workshop or toolbox. 4 different 110mm tweezers with fine point blades, flat blades, curved tips and even reverse action. They're all housed in a handy plastic wallet.
Cat T-4625

$10.95

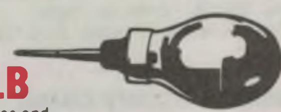
240 VOLT GENERAL PURPOSE

Another great iron from Scope. Rugged and reliable it's rated at 20 watts which makes it ideal as a general purpose iron for around the home, workshop, etc. Plugs straight into the mains and it's fitted with air cooled handle to make work more comfortable. Tips and elements are easy to replace so maintenance is a breeze.
Cat T-1620

Just $29.95



BARGAIN DESOLDERING BULB



A must for the workshop or toolbox! Easy to use and makes repair or alterations much easier. Superb quality at a great low price.
Cat T-2581

Just $5.95

HIGH QUALITY SCREWDRIVERS

When you need tools you can depend on...here's the way to go. High quality screwdrivers with heavy duty handles and made from Chrome-Vanadium steel for longer life. Superbly engineered they're ideal for tradesman and handyman alike.

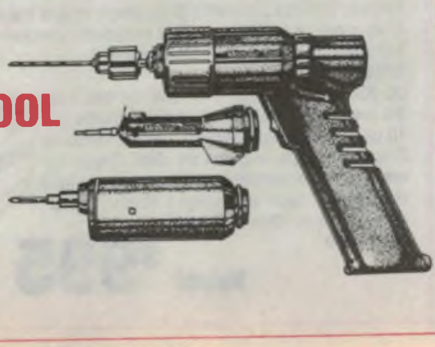
Size	Cat No.	Price
4 x 100mm Flat	T-6100	$7.95
6 x 150mm Flat	T-6105	$9.95
8 x 220mm Flat	T-6110	$15.95
3 x 150mm Flat	T-6115	$9.95
75mm Phillips	T-6120	$7.95
100mm Phillips	T-6125	$9.95

Ideal For Site Work!

3-IN-1 MODULAR TOOL

- It's a DRILL
- It's a SCREWDRIVER
- It's a SOLDERING IRON
- It's RECHARGEABLE

Cat T-5712



Just $99

DICK SMITH ELECTRONICS

NEW

Cat Q-1314 **$499.95**

With Period Counter!

GHZ DIGITAL FREQUENCY METER

Talk about 'classy'! This has to be at the top of your list for workshop equipment. For the first time a truly intelligent frequency counter - PLUS a period counter - for hundreds of dollars less than meters that don't come close for accuracy or quality.

Superbly constructed, with a range of unique features that are nothing less than astounding. It actually measures subsonic frequencies in fractions of a second with amazing accuracy. Measures right across the range from 0.1Hz to 1GHz. Check out these specifications....

INPUT CHARACTERISTICS CH.A (0.1Hz-100MHz) — Frequency Range: DC couple 0.1Hz to 80MHz, AC couple 30Hz to 80MHz. Sensitivity: 15mVrms 0.1Hz to 50MHz, 25mVrms 50MHz to 80MHz.
Coupling: AC/DC. Filter: Low Pass(100KHz, -3dB). Input Impedance: 1Mohm//40PF. Attenuator: X1, X20. Trig Mode: Auto or Manual. Period Range: 10nS to > 10S.

INPUT CHARACTERISTICS CH.B (50MHz-1GHz) — Frequency Range: 50MHz to 1GHz. Sensitivity: 20mV to 650MHz, 55mV to 1GHz. Coupling: AC only. Input Impedance: 50 ohms. Max. Input: 3Vrms. Resolution: At least five digits at minimum gate time. Resolution depends on setting gate time control.

TIMEBASE — Frequency: 10MHz. Aging Rate: <1PPM/Month. Coefficient: <10PPM, 0 C - 40 C, Accuracy: <50PPM. Line Var.: <0.1PPM for line voltage +/- 10%. Gate Time: Continuously Variable from 60mS to 10S or 1 period of input signal, whichever is longer.

High Performance - Low Cost!

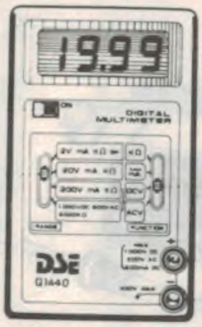
DIGITAL MULTIMETER

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

- 15 ranges to 1000VDC, 500VAC, 200mA (AC/DC), 2M ohms
- Diode & Transistor check.

Cat Q-1440

Bargain! $49.95



Digital & Bargraph!

3.5 DIGIT MULTIMETER

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

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

$179

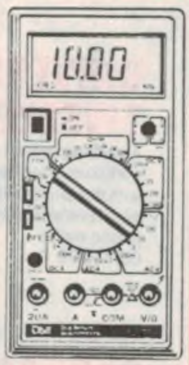
Ideal For Sparks!

AUTO RANGING DMM

All the features an electrician needs. With a huge 21mm LCD display, pushbutton switches for mode and function selection, full range of measurements including AC/DC volts & Amps, resistance, diode, continuity and frequency. Features audible continuity test, auto ranging on DC, over range indicator, data hold, etc, etc. Plus it's shock resistant and fully sealed against water and dust.

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

$129



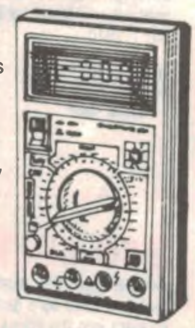
It's Got The Lot!

4.5 DIGIT MULTIMETER

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

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

$199



Includes Battery Check!

3.5 DIGIT WITH TR DIODE & CONTINUITY

A bright change for the toolbox! Includes all the usual ranges, current to 10A and resistance to 200megs... Plus a continuity checker with a fast 100ms response time, a diode and transistor checker & battery checker (it tests under actual load conditions). Takes a single 9V battery (and tells you if it's low) and comes complete with a flip down handle that doubles as a stand.

RANGES:
DCV: 0.2, 2, 20, 200, 1000V. CV: 0.2, 2, 20, 200, 650V. DC: 200uA, 2, 20, 200mA, 10A. AC: 200uA, 2, 20, 200mA, 10A. Resistance: 200, 2k, 20k, 200k, 2M, 20M, 200M. Transistor Check: Hfe. Diode Check: 1mA, 3.2V. Continuity: Buzzer. Battery Checks: 1.5V(@ 200mA), 9V(@ 6mA).
Cat Q-1445

Save $5 $79.95

Unbelievable Features and Value!

20MHz DUAL TRACE CRO

It's just astounding at the price! The DSE Dual Trace CRO with inbuilt component checker has features you'd be lucky to find on models which cost much more. It's a professional quality dual trace with outstanding performance, an economical price...and looks to match!

Features 20MHz bandwidth (-3dB), single or dual trace modes, dual trace in chopped or alt. mode, 2 probe sets, inbuilt component checker - for capacitor, inductors, transistors, diodes, zeners, etc, and more!

SPECIFICATIONS:
DC-20MHz (-3dB), with < 17.5ms rise time and 3% overshoot. Deflection: 5mV/div to 5V/div in 10 calibrated steps. Accuracy: +/-3%. Timebase: 0.1us/div to 2/div in calibrated steps. Triggering modes: peak or normal from either/both channels or external. Trigger sensitivity: 0.5V/div. Sweep delay: 0.1us to 10ms in 6 steps.
Cat Q-1260

Value! $995

DICK SMITH ELECTRONICS

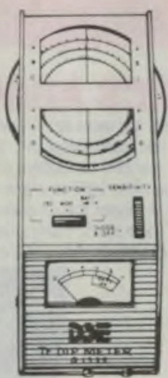
Value Plus!

ECONOMY TRANSISTOR DIP METER

No physical connection is required (it works on inductive or capacitive coupling) so a dipper is ideal for working on live RF circuits. It's mechanically and electrically stable, has colored coded coils, headphone connection and it's battery operated. Plus, it comes at a great low price!

Frequency Range: 1.5 to 250MHz.
Crystal Oscillator: 1.5MHz.
Modulation: Approx. 2kHz sine wave. Nominal accuracy 7%
Cat Q-1335

ONLY $139



A Must For The Toolbox!

RESISTANCE SUBSTITUTION WHEEL

Extremely handy and conveniently sized! With large, easy to read value selection so working is less of a chore. You can select values from 5 ohms to 1M ohm in 36 steps using the most common divisions. Comes complete with insulated leads and crocodile clips for easy connection. Cat Q-1410

Just $17.95

DIGITAL LUX METER

Perfect for photographers, video users, laboratories... anywhere there's a need to measure light quickly and accurately. Measures up to 50,000 LUX over three range selections. It's battery operated (gives 150-200 hours continuous use), has low battery indicator, 13mm display and auto zero. Bargain priced as well!
Cat Q-1400

$129

ALL THE LATEST KITS!

NEW IMPROVED LIGHT CHASER

Our new Light Chaser is low in cost, easy to build, incredibly flexible and it's designed with safety in mind. With 6 chasing patterns, 8 speeds, an enhanced front-panel monitor display and the ability to run lamps to a total of 2400 watts. It's been designed as a 'dedicated' chaser for the ultimate in safety. This also allows many more functions without getting into complex construction techniques. Comes complete (full form), right down to the last bolt!
Cat K-3161

$99

2 Channel, 7 Day

SPRINKLER TIMER

Design your own garden sprinkler system for about half the cost of commercial units! The Sprinkler Timer allows you to control up to 14 sectors (2 x 7). With the aid of any standard Distributor Tap and only one or two solenoid valves you can have the healthiest garden in the street. Mains-powered, the kit comes with case, pre-punched front panel, panel label and all components.
Cat K-3588

DISTRIBUTOR TAPS & SOLENOIDS NOT SUPPLIED

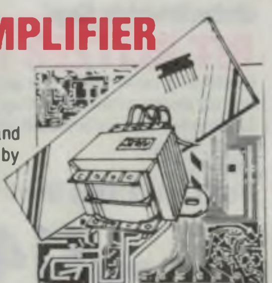
$99

Playmaster...

30 WATT STEREO AMPLIFIER

The very latest in the highly successful Playmaster series. A 30/30 watt stereo amplifier that's easy to build, low in cost, provides all the essential features and offers excellent performance and superb noise and distortion specifications. Construction is made easy by mounting virtually all parts, including heatsinks, on one large PCB. Short form kit comes with 2 x TDA 1514 IC's, front and rear panels, transformer, PCB and instructions.
Cat K-5100

$99



PORTABLE AM STEREO RADIO

Small, lightweight, incredibly easy to tune and superb stereo sound! The Wide Band AM Stereo Radio is easy to build and requires no fancy tools or equipment. Comes complete with case, economy stereo headphones, pre-punched front panel and all components. All you do is put it together, add 2 AA batteries and you're away!
Cat K-5200

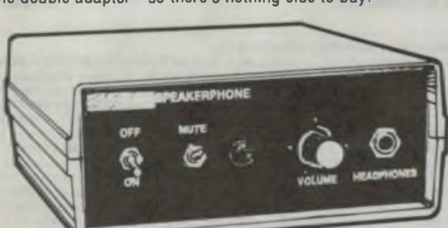
$79.95

Your Phone Can Be A...

HANDS-FREE SPEAKER-PHONE

Here's a way to add Hands-Free Speaker-Phone capabilities to your existing phone...without spending a fortune. There's even a phones jack which is great if a family member is a little hard of hearing. Comes complete with case, phone cable and plug, PLUS a telephone double adaptor - so there's nothing else to buy.
Cat K-3100

Only $89.95



Incredibly Small!

FM WIRELESS MICROPHONE

The FM Wireless Microphone is small enough to be inserted into a matchbox, can be tuned to operate at around 90MHz (On your FM receiver), it's incredibly stable with extremely sensitive circuitry and relatively easy to build. It's fantastic! Comes as a short form kit with components and PCB. Also includes batteries.
Cat K-5006

$16.95

DICK SMITH ELECTRONICS

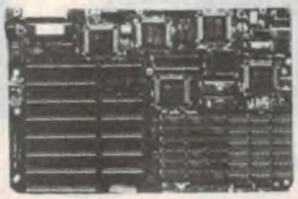
BEST SERVICE - BEST RANGE - BEST DEALS!

IBM AT COMPATIBLE 80286 MOTHERBOARD

Speed, power and versatility are yours with our 12MHz motherboard. You can build your own system or upgrade the old one. DRAM not included.

LOOK....

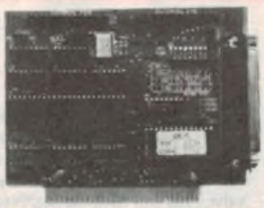
- Expandable up to 4Mb
- Selectable 8/12MHz operation
- Six 16-Bit and Two 8-Bit expansion slots.
- Selectable RAM speed - 80 or 100 nanosecond
- Selectable from 0 wait states on read operations (with 80 nanosecond RAM)
- Socketed for 80287 Co-processor
- Performance - 13.7 using Norton S.I.
- Battery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



Cat X-1002

Save $100 New Low Price $399

CONTROLS FOUR DISK DRIVES



Allows you to install two internal and two external disk drives. 360K, 720K, 1.2Mb & 1.44Mb drives. Includes cables for internal drives and connection for external drives. Cat X-2024

Just $119

A FAX IN YOUR COMPUTER

A smart space & time-saving idea! The Fax card simply slots into your PC and for a fraction of the cost of a separate fax machine, you get all the advantages. Comes complete with software. It runs as a resident program so it's always ready to receive a message. With memory for 200 fax numbers, automatic dial - in fact you can program it to dial out at any time when the phone charges are lowest - and more. A great device!
Cat X-3302

Limited Stocks $699

Available in Sydney stores or through Mail Order only.

Saves Disks And Time!

VIDEO TAPE HARD DRIVE BACK-UP

Back-up your hard drive on video tape - there'll be no more worries about lost information. Allows you to store about 1meg of information per minute of tape - think of the disks you'll save! Comes with card and software. The card just slots into your PC and allows connection of video cables to most standard video recorders. You can even program it to save automatically. It's a fantastic idea!
Cat X-3840

Limited Stocks $399

RS-232 MULTILINK ADAPTOR

A complete in-line tester/adaptor which makes complex and time consuming Serial connections a breeze! Comes fitted with 25 pin male connector and 25 pin female connector. With jumper pads and wires, 24 in-line switches and 8 bicolour LED's for line monitoring.
Cat X-2654

$49.95

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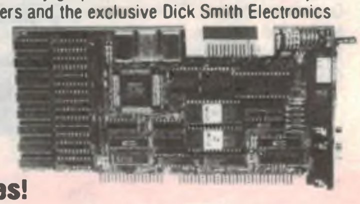
More colours, higher resolution and more options with our VGA Graphics Adaptor! Perfect for AutoCAD, games, text, paint programs, graphics, charts, desktop publishing... the lot! Fits into any IBM compatible (XT or AT) and comes with 256K RAM (expandable to 512K). Includes utilities which allow emulation of EGA, Hercules and CGA. All standard IBM VGA modes are supported plus 640 x 400 (256 colours) and 800 X 600 (16 colours). There are so many graphics modes available there's just no room to list them all! Comes with drivers and the exclusive Dick Smith Electronics 55 page manual.



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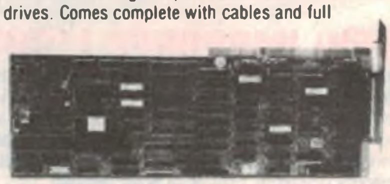

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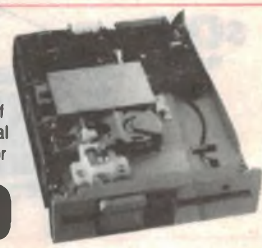

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74 SERIES TTL

Type No.	Description	Cat No	Price Ea	Price 10 up
7490	Decade Counter	Z-5210	$1.65	$1.60
74121	Monostable Multivibrator	Z-5260	$1.65	$1.60

74LS SERIES TTL

Type No	Description	Cat No	Price Ea	Price 10 up
74LS00	Quad 2 input NAND gate	Z-4900	.75	.70
74LS01	Quad 2 input NAND gate, o/collector	Z-4901	.75	.70
74LS02	Quad 2 input NOR gate	Z-4902	.75	.70
74LS04	Hex inverter	Z-4904	.75	.70
74LS05	Hex inverter, open collector	Z-4905	.85	.80
74LS08	Quad 2 input AND gate	Z-4908	.95	.90
74LS10	Triple 3 input NAND gate	Z-4910	.85	.80
74LS11	Triple 3 input and gate	Z-4912	.85	.80
74LS13	DL 4in NAND Schmitt trigger	Z-4913	.85	.80
74LS14	Hex Schmitt trigger	Z-4914	.95	.90
74LS20	Dual 4 input NAND gate	Z-4920	.95	.90
74LS21	Dual 4 input positive AND gate	Z-4924	$1.55	$1.50
74LS27	Triple 3 input NOR gate	Z-4927	.95	.90
74LS30	8 input NAND gate	Z-4930	1.05	1.00
74LS31	Delay line	Z-4931	$1.05	$1.00
74LS32	Quad 2 input OR gate	Z-4932	.95	.90
74LS37	Quad NAND buffer	Z-4937	.95	.90
74LS47	7 segment dec buffer	Z-4947	$1.65	$1.60
74LS54	2 say AND or inv	Z-4954	.95	.90
74LS73	Dual J-K flip flop	Z-4973	$1.25	$1.20
74LS74	Dual D-type edge trig. flip flop	Z-4974	$1.15	$1.10
74LS75	Quad bistable latch	Z-4975	$1.55	$1.50
74LS83	4 bit full binary array	Z-4983	$2.25	$2.20
74LS85	4 bit magnitude comparator	Z-4985	$1.45	$1.40
74LS86	Quad 2 input EXCLUSIVE-OR gate	Z-4986	$1.25	$1.20
74LS90	Decade counter	Z-4990	$1.45	$1.40
74LS95	4 bit L-R shift register	Z-4995	$1.50	$1.45
74LS109	Dual JK flip flop	Z-5109	$1.25	$1.20
74LS123	Dual monostable multivibrator	Z-5310	$1.65	$1.60
74LS132	Quad 2 input NAND Schmitt Trigger	Z-5283	$1.95	$1.90
74LS138	ONE OF EIGHT Decoder Multiplexer	Z-5284	$1.85	$1.80
74LS139	ONE OF EIGHT Decoder multiplexer	Z-5285	$1.55	$1.50
74LS153	Dual 4 input multiplexer	Z-5286	$1.35	$1.30
74LS157	Quad 2 input multiplexer	Z-5287	$1.75	$1.70
74LS165	Par Load Shift Register	Z-5288	$2.50	$2.45
74LS174	Hex D-type flip flop	Z-5290	$1.40	$1.35
74LS175	Quad D flip flop	Z-5291	$1.50	$1.45
74LS190	Up/down decade counter	Z-4999	$2.35	$2.30
74LS192	Sync dec up/down ctr	Z-5192	$1.65	$1.60
74LS193	Bin sync up/down ctr	Z-5193	$2.25	$2.20
74LS196	Decade counter	Z-5196	$2.95	$2.90
74LS221	Dual mono multivibrators (S/trigger)	Z-5296	$2.25	$2.20
74LS240	Octal buffer/line driver	Z-5298	$2.45	$2.40
74LS241	Octal buffer/line driver	Z-5293	$2.85	$2.80
74LS244	Octal buffer/line driver	Z-5294	$2.75	$2.70
74LS245	Octal bus transceiver	Z-5299	$2.75	$2.70
74LS367	Hex bus driver & 3 stage o/p	Z-5292	$1.15	$1.10
74LS373	Octal 3 stage latch	Z-5295	$2.45	$2.40
74LS374	Octal D-type flip flop	Z-5297	$2.45	$2.40

74C/4000 SERIES CMOS

Type No	Description	Cat No	Price Ea	Price 10 up
74C00	Quad 2 input NAND gate	Z-5410	$1.55	$1.50
74C14	Hex Schmitt trigger	Z-5413	$1.50	$1.45
74C926	4 decade counter 7 seg output	Z-5414	$15.95	$14.95
4001	Quad 2 input NOR gate	Z-5601	.80	.75
4002	Dual 4 input NOR gate	Z-5602	.80	.75
4007	Dual comp pair with inverter	Z-5607	.95	.90
4009	Hex inverter buffer/lever shift	Z-5609	$1.35	$1.25
4011	Quad 2 input NAND	Z-5611	.75	.70
4013	Dual D edge triggered flip flop	Z-5613	.95	.90
4015	Dual 4 bit shift register	Z-5615	$1.55	$1.50
4016	Quad analog switch	Z-5616	$1.45	$1.30
4017	Decade counter/divider	Z-5617	$1.45	$1.30
4019	Quad AND/OR select gate	Z-5619	$1.75	$1.65
4020	14 bit binary counter	Z-5620	$1.75	$1.65
4022	Divide by 8 counter	Z-5622	$1.85	$1.75
4023	Triple 3 input NAND gate	Z-5623	$1.05	0.95
4024	7 stage ripple counter	Z-5624	$1.25	$1.15
4025	Triple 3 input NOR gate	Z-5625	.95	.85
4026	Decade counter/7 segment divider	Z-5626	$3.95	$3.75
4027	Dual J-K flip flop	Z-5627	$1.15	.95
4028	BCD to decimal decoder	Z-5628	$1.65	$1.55
4029	Preset up/down binary decade counter	Z-5629	$1.95	$1.85
4030	Quad EXCLUSIVE OR gate	Z-5630	.95	.80
4040	12 stage ripple counter	Z-5640	$1.75	$1.65
4044	Quad R/S flip-flop	Z-5644	$1.75	$1.65
4046	Phase-locked loop	Z-5646	$2.20	$2.10
4047	Monostable/Astable multivibrator	Z-5647	$2.50	$2.40
4049	Hex inverter/buffer	Z-5649	$1.15	$1.05
4050	Hex non inverting buffer	Z-5650	$1.15	$1.05
4051	8 channel analog multiplexer	Z-5651	$1.75	$1.65
4066	Quad analog switch	Z-5666	$1.15	$1.05
4069	HEX inverter	Z-5669	.80	.75
4071	Quad 2 input OR gate	Z-5671	.90	.85
4081	Quad 2 input buffered AND gate	Z-5681	.85	.80
4082	Dual 4 input AND gate	Z-5682	.90	.85
4093	Quad 2 input NAND Schmitt trigger	Z-5693	$1.40	$1.30
40194	4 bit bi-direct shift register	Z-5694	$3.95	$3.80
4511	BCD/7 segment decoder/driver/latch	Z-5730	$2.45	$2.30
4616	Presettable up/down counter	Z-5738	$2.95	$2.80
4518	Dual BCD up counter	Z-5740	$2.15	$2.00
4520	Dual binary up counter	Z-5742	$1.85	$1.85
4526	4 bit programmable down counter	Z-5744	$2.15	$2.00
4528	Dual Monostable Multivibrator	Z-5748	$1.95	$1.85
45026/41342	Security Encoder	Z-5425	$9.95	$9.45
45028/41344	Security Decoder	Z-5430	$9.95	$9.45

74HC CMOS

Type No	Description	Cat No	Price Ea	Price 10 up
74HC00	Quad 2 input NAND gate	Z-5800	.95	.85
74HC02	Quad 2 input NOR gate	Z-5802	.95	.85
74HC04	Hex inverter	Z-5804	.95	.85
74HC08	Quad 2 input AND gate	Z-5808	.95	.85
74HC11N	Triple 3 input	Z-5811	.95	.85
74HC14	Hex Schmitt-Trigger	Z-5814	$1.50	$1.40
74HC27	Dual J-K flip-flop	Z-5827	.95	.85
74HC30	8 input NAND gate	Z-5830	.95	.85
74HC32	Quad 2 input OR gate	Z-5832	.95	.85
74HC74	Dual D-type edge triggered flip-flop	Z-5874	$1.10	$1.00
74HC76	Dual J-K master/slave flip-flop	Z-5876	$1.45	$1.35
74HC85	4 bit magnitude comparator	Z-5885	$2.25	$2.15
74HC86	Quad 2 input EXCLUSIVE OR gate	Z-5886	$1.25	$1.15
74HC123	Dual re-triggerable monostable	Z-5910	$2.90	$2.70
74HC138	Expandable 3/8 decoder	Z-5915	$1.25	$1.15
74HC139	1 of 8 decoder/multiplexer	Z-5920	$1.55	$1.45
74HC157	Quad 2 input multiplexer	Z-5925	$1.95	$1.85
74HC165	Par load 8 bit shift register	Z-5930	$2.25	$2.05
74HC174	Hex D-type flip-flop	Z-5935	$2.25	$2.15
74HC221	Dual mono multivibrators (S/trigger)	Z-5940	$4.25	$4.05
74HC240	Octal Buffer/Line Driver	Z-5945	.95	.85
74HC244	Octal buffer/line driver	Z-5950	$2.45	$2.35
74HC245	Octal bus transceiver	Z-5955	$3.50	$3.30
74HC367	Hex bus driver & 3 state o/p	Z-5960	$1.95	$1.85

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Silicon Valley NEWSLETTER

Intel plans US$400 million Irish campus

Fearing it may be shut out of the critical European market after 1992, Intel of Santa Clara has announced plans to build a US$400 million computer and chip manufacturing facility on a 55-acre lot in Leixlip, County Kildare near Dublin.

Included in the project, which will take 10 years to complete, are a state-of-the-art wafer fab, and a research and development laboratory.

In the first phase of the project, which will get underway immediately, Intel will build a 150,000-square-foot facility for the manufacturing of desktop computers aimed at the European market. Intel hopes the facility will be on line by the end of 1990.

Next, Intel will build two large semiconductor facilities, including a state-of-the-art wafer fab and an assembly and testing centre. In all, the complex will total 500,000 square feet and employ more than 2000 people.

Intel officials conceded the move is clearly aimed at protecting Intel's thriving business in the European semiconductor market, which generates more than US$700 million in annual sales.

Apple, Sun, Compaq reject US Memories

Just after US Memories president Sanford Kane reported on his DRAM startup's progress at the Semiconductor Industry Association's annual forecast conference, Apple Computer, in a surprise announcement, bluntly rejected the overtures to become a member of the consortium.

According to a spokeswoman for Apple, the company "has decided not to invest in US Memories at this time." She added that Apple already had adequate DRAM supply arrangements with a number of major vendors from Japan, the US and Europe.

The Apple announcement was followed by statements from Sun Microsystems and Compaq Computer, two other potential key members for the DRAM joint venture, that while they remain interested in US Memories, they have decided not to invest in the company for the time being.

The rejections came as a potential blow to US Memories' chances of attracting sufficient additional investors to meet its financial backing objectives.

Kane reported that his firm was in the process of negotiating with as many as 45 firms, 17 of which have expressed a strong interest in backing US Memories financially in return for a guaranteed supply of memory chips. US Memories is requiring members to invest between US$5 and $50 million, and commit themselves to buying up between 1 and 5% of the company's future DRAM output.

Kane was clearly upset about the untimely Apple announcement, which he said has left him "disappointed and frustrated."

Zenith sells computer division

Zenith Electronics, in a surprise announcement, said it has agreed to sell its thriving personal computer business to France's Groupe Bull for US$635 million.

According to Zenith chairman and president Jerry Pearlman, the company currently finds itself involved in two of the most competitive industries around, consumer electronics and personal computers. While the company has been doing relatively well in both markets, Pearlman said that; "We are a highly leveraged company in very tough businesses. That is a tough position in order to be competitve. We couldn't do either business justice."

The sale of the computer unit, Zenith Data Systems, surprised market analysts since it has been outperforming the company's consumer electronics division. Last year, Zenith Data Systems had sales of US$1.4 billion, compared to US$1.1 billion for the consumer electronics group.

Pearlman, however, said that his company, the last surviving US-based television manufacturer, is envisioning major market opportunities in the television market of the 1990s, particularly in the area of HDTV. The large windfall from the sale of the computer group will provide the company with considerable funds to invest in new television technology development.

According to some analysts, however, Zenith was more or less forced into selling its most valuable asset. The company, which has been operating in the red during the past couple of quarters, has been suffering from a heavy corporate debt. It had been trying for some time to find a buyer for the consumer electronics group. But most US corporations continue to find the television market too risky.

Also, the company's dubious status as the last remaining US television vendor probably scared away foreign buyers. Philips of the Netherlands, Samsung and Lucky Goldstar, both from Korea, reportedly made offers for Zenith's television group. The offers, however, were rejected for being too low.

Quake disrupts Valley operations

Business was anything but usual at most of the valley's high-tech companies in the aftermath of the worst earthquake to strike the valley since the one of 1906.

Disruption of business was reported at most of the major and mid-size electronics firms. Many, including IBM, Apple Computer and Hewlett-Packard shut their doors altogether in order to check for damage to their facilities and to allow workers to take care of their families and damage to their own property.

At most of the valley's semiconductor companies, workers that did show up were turned back, in order to give engineers a chance to check the highly complex chemical delivery systems that feed the wafer fabs. Some observers said it is somewhat of a miracle that none of the hundreds of wafer fabs in the area experienced significant damage to their chemical delivery systems, many of which carry some of the most poisonous and toxic gases known.

Only IBM reported that a broken main water line at its huge General Products division in South San Jose had flooded many of the buildings at the

Grid Systems of Fremont, California has just released the GridPad, a 'laptop' or handheld MS-DOS portable PC which recognises human printing – made on its LCD screen using a stylus. Here a highway patrolman uses it to take down a motorist's details.

complex. The quake, centred less than 10 miles from the IBM facility, knocked out all of the company's computers and 'idled' more than 9000 workers. IBM said it took several days before operations could resume at the facilities, which produce IBM's mainframe disk drives.

By far the hardest hit of any of the valley's 5000 electronics firms appeared to be Seagate Technology. While structural damage to the company's facilities were relatively minor, the company found itself completely shut off from the rest of the world and expected to be unable to resume operations for several weeks, if not months.

Seagate is located in the small 'Scotts Valley' between San Jose and Santa Cruz and was almost at the epicentre of the quake. Highway 17 which runs through the valley and connects the two larger cities, suffered severe structural damage, with several stretches of road between Scotts Valley and Santa Cruz having collapsed. On the other side, towards San Jose, rock slides covered sections of the road and in many locations the road surface split open or buckled. In some places there were cracks more than three feet wide and more than 20 feet deep into the ground.

Three days after the quake, power and telephone services were not yet restored to the Scotts Valley area.

The quake will also have a significant impact on the operation of the many semiconductor companies in Silicon Valley. Most plants operate around the clock. But throughout the valley major chip plants were idle following the quake, with most equipment shutting off automatically when the trembler hit to prevent poisonous gases escaping from busted pipelines.

National Semiconductor, Siliconix, Cypress Semiconductor and others all told workers to stay home while emergency crews checked for damage to the structures and piping systems. National reported it had suffered damage to the pipes of a de-ionisation water treatment installation.

Even if the quake left most fab structures intact, chip firms still faced huge headaches in getting their production started back up. This is because the quake knocked most of the highly sensitive wafer alignment systems out of their carefully set positions. Recalibrating these systems is a time consuming task that will likely disrupt wafer production for some time. Fortunately, the quake hit at a time when most chip makers were looking for ways to slow down their output, as demand for many components had slowed down.

Bush proposes 3Gbps data 'superhighway'

The Bush Administration has announced the most ambitious plan in more than two decades to help America's high technology industries and improve the country's overall base of technological know-how.

In all, Bush has asked Congress to provide some US$1.7 billion in funds to finance the project, which will include building a country-wide 'data 'superhighway'' that will link more than 1000 private, government, and educational research centres and will be capable of transmitting data at the rate of 3 billion bits per second.

Supporters for the data network said it would move the US an important step closer to a distant goal of bringing high-speed, high-capacity data wires into every home and business. Such connections could deliver a variety of sophisticated new services, including high-definition television, full-motion video telephones and many advanced computer data services.

The Bush proposal envisions a systems that will deploy radical new transmission technologies, that will be able to increase the rate of data transfer by a factor of 1000 from the current level. The system would be able to handle the equivalent of some 50,000 pages of scientific data per second.

Currently most US scientific laboratories and government research facilities are linked on the so-called 'Internet' network, which links some 500,000 researchers in 60,000 facilities around the US. But the system which can send data at the rate of only about 50 pages of information per second, has become oversubscribed and too slow for most advanced scientific data exchange.

Under the Bush plan, the current Internet will initially be expanded and improved to handle data at the rate of about 45 million bits per second. Beyond that the plan calls for the creation of a new network that will be operational in about 10 years and capable of transferring data at the blistering rate of 3 billion bits per second.

The Serviceman

Titanic struggles - with a Titan!

Every now and again you come across a servicing job that takes on all of the characteristics of a nightmare. When you've found and fixed the nominal fault, others start appearing and the job rapidly becomes bigger and bigger. It happened to me quite recently, with a CTV carrying the unfamiliar 'Titan' brand name...

A few months ago I commented on having had a run of Philips CTV's in my workshop, several of which ended up as stories in these pages.

Now the same thing has happened with various Sharp models, and for weeks there seems to have been nothing else in my workshop. Even when I open a new Philips I'm likely to find it's really a Sharp, so these two brands have dominated my life for months!

This month's story began with what I thought was an entirely new brand of set on the television market. The cabinet back was branded 'Titan' – one I'd never heard of. But then reading further revealed that the set was made by Sharp, so Titan was obviously someone's house brand and I was stuck with yet another Sharp!

Trouble was, the Titan model number, TS-2011, bore no resemblance to Sharp model numbers and it was left to me to find out which Sharp was the closest to the chassis in the Titan.

I browsed through my Sharp circuits and manuals and came up with a CX-2033 as being the most likely model. A check with a colleague more familiar with Sharp than I am confirmed my selection, and also revealed the origins of the Titan.

It seems that the set was made for a discount house that flourished in Sydney a few years ago. They used their own model numbering system, and nobody seems to have ever done a cross reference from one brand to the other. Now that the discount house is out of business, there's no-one about to help confirm the accuracy of a technician's assumptions.

Now back to the main story!

The set came in with the complaint that it occasionally cut out. "Just stopped dead!" the customer said. But next day it was going again. He couldn't understand it, and he had never heard of an 'intermittent'. Some people have all the luck!

Well, not quite *all* the luck, because there was a little left over for me when I switched the set on. It ran for 30 seconds then stopped and nothing I could do would restart it.

A bit of judicious poking and prodding showed that the power supply was delivering volts to the line output stage, but the output was not making use of them. In fact, there was no voltage on the collector of the line output transistor.

The fault turned out to be caused by the curious mounting of the output transistor. It wasn't bolted to the heatsink, in the usual way of these things. Instead, it used a kind of plastic stud to clamp the whole transistor/heatsink assembly together, with the collector contact being made by no more than the pressure of the clamp.

It was this clamp that was loose, and causing occasional failure of the line output stage. So my first job was to rebuild the assembly to allow a more permanent contact.

This took some little time as I had to find suitable nuts, bolts and washers, and plastic spacers to replace the studs which I was removing. Eventually, I had the transistor remounted in a more traditional manner and I was ready for the smoke test.

Fortunately, there was no smoke when I switched on, but that was the only good fortune that day. As the switch clicked over, there was a 'plink' from inside the set, and the mains fuse went open with a bright flash.

The only thing that can kill a mains fuse is a shorted diode in the bridge, or a dead short on the output of the bridge. In this case it was the latter, a dead short in the IX0308CE switchmode power supply IC. (An easy way to check this IC is to measure the resistance between pins 10 and 14 – low resistance means a useless chip!)

I was not at all familiar with the 2033 chassis, so while I awaited delivery of the new chip, I enquired around among my colleagues to see if anyone could throw light on why the original one went U/S. Their answers were not at all reassuring.

It seems that the IX0308CE is very touchy and is easily destroyed. It's likely that in this set, the intermittent open circuit connection to the line output transistor had been spiking the power chip, and it chose to drop its bundle just as I eliminated the source of trouble. I have all the luck!

I learned that Sharp had issued a modification note intended to help protect the chip. Independant technicians have worked out yet other mods that help further to protect the IC. In all, I finished up with six pages of material about this particular device and its idiosyncrasies.

The gist of all these notes is that the chip runs quite hot and it's this heat that affects other nearby components, particularly two electros and two diodes. The device eventually fails when these associated components break down as a result of the hot environment.

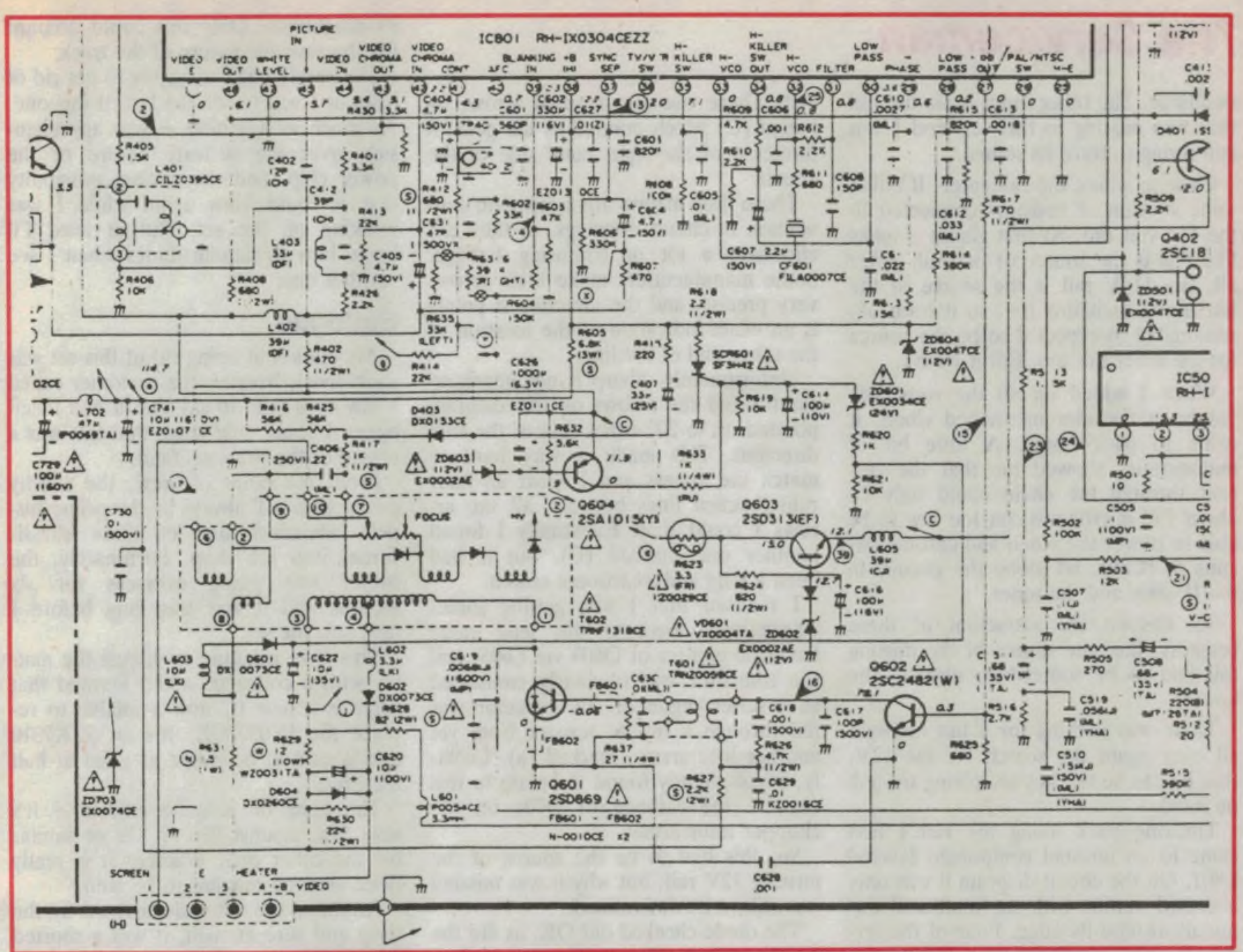
Most of the modifications concern repositioning these components on the underside of the board and this should be done to every set, even if the chip has not failed.

One source even suggested removing the chopper heatsink, painting it flat black to improve its thermal efficiency, then remounting it with new heatsink compound. This treatment causes the IC to run cooler, with consequently less stress on surrounding components. Fitting a larger heatsink is an even better suggestion.

By the time the new chip arrived, I had as much information as I needed to restore the set to full operation. Or so I thought...

After fitting the new IC and doing all the mods, I screwed up my courage and switched on. After all the dire warnings I had heard, I would not have been surprised if the new device had blown instantly. But it didn't – in fact nothing happened.

The only sign at all was a faint rustle of EHT in the tube. There was no light



Part of the Sharp/Titan schematic – the best copy we could get. IC801 is just visible at the top, with Q603 just 'south east' of the centre. The fault turned out to have a surprising cause!

on the screen, nor any audio from the speaker.

My next problem was to turn the chassis upside down so that I could get to the various parts of the circuit with my scope. This proved to be almost as hard a job as the actual repair itself.

This set, and many others like it, has one small circuit board in the bottom of the cabinet, one small board behind the control panel, and one picture tube. The small parts count leaves vast amounts of space inside the cabinet, and one might expect it to be a snip to manoeuvre the boards into position for easy service.

Not so. The manufacturers seem to have deliberately reduced the lead lengths to prevent such manipulation. I found I had to remove the tube base board, then unplug the speaker, power and degaussing leads before I could upend the main board. Then I had to reconnect everything, before I could do any testing.

A set of extension leads would have been handy, but weren't available and would not be economical unless I was to service a lot of these sets. I've said many times that designers should be made to work in service jobs before being allowed to design anything. It would stop a lot of these sorts of problems.

Once the board was upside down and working, I was able to confirm that the line stage was indeed working. The 114V rail was normal, as were the 12V rails to the horizontal oscillator and audio chips. What *wasn't* normal was the 12V rail to the picture IF strip and the tuner.

This chassis has power rails derived from two distinct sources. One is on the chopper transformer and the other on the line output transformer. And until the circuit diagram is studied closely, it's not apparent just where each rail comes from or goes to.

In this exercise I started at the tuner and traced the 12V rail backwards towards its source. This led me on a merry chase, because the source isn't there at all. It's over on the other side of the diagram. (We would have to print the whole circuit diagram to make any sense of this rail and I don't think the Editor would give us two whole pages just for this story. Sorry about that!)

In the diagram the rail from the tuner goes around the IF chip then appears to go back to the top of the diagram and over to the top of the video-cum-chroma-cum-sync separator-cum-vertical-cum-horizontal IC, IC801.

I say 'appears' to go back to the top of the diagram because this is really only a branch of the rail, not the rail itself, as you will find when you read on.

This IC801 is an LSI device that does almost everything in this set, and is unusual in that it has two quite separate 12V inputs. One comes from the 114V rail via R405 and powers the horizontal oscillator. The other input is via the rail that was missing in this set, and I was still trying to trace its source.

Close to where the rail enters IC801 it joins a chain of resistors connected to the 114 volt rail. At first glance it looks like this is the source of the rail. After all, the 114V rail is the source of the horizontal oscillator B+, so it's not unreasonable to expect it to be the source for the other rail too. But it wasn't.

When I added up all the resistance values in the aforementioned chain, it came to 644k ohms. A little bit of mathematics showed me that the current through the chain could only be about 150 microamps, far too low to be able to power the video and chroma circuits in IC801, let alone the circuits in the IF strip and the tuner.

So, despite the attraction of these resistors, the true source of the missing rail had to be somewhere else on the board.

There was nothing for it but to begin all over again the search for the 12V, that had to be the key to solving the job on hand.

Tracking back along the rail I first came to an unusual component labeled L801. On the circuit diagram it was only a dotted outline with six numbered terminals around its edge. Four of the terminals were associated with IC801, one went to ground, and the sixth was tied to the missing 12V rail.

The diagram gave no inkling of what the component was or did, and it was quite possible that there was a short in it that was causing my trouble. So out it came.

The component was a white plastic box rather like an up-ended chroma delay line. Inside the box was a small circuit board carrying one transistor and a few passive components. What it is or what it does I have no idea. But it had no shorts and was not faulty in any apparent way.

Tracking further back along the rail I came to a branch that I hadn't noticed earlier. What's more, I didn't notice a branch on the branch, and spent some time trying to relate the 12V rail to a dead end at the video input in IC801. (I said before that chip did everything, and this is another confusing example of its multifarious proclivities!)

When I did notice the second branch, things began to look up. This branch ended at the emitter of Q604, which is associated with a crowbar protection circuit. There was also a small arrow, labelled (C) which pointed in the general direction of the right hand side of the circuit.

These little arrows are a common convention in circuit drawings, as they can eliminate a lot of confusing lineage. Some manufacturers make their arrows very precise, and the direction it points is an exact indication of the location of the other end of the line.

Unfortunately, Sharp is not nearly so careful and the arrows on this diagram pointed up to 20° either side of the true direction. This made it very hard to match the arrows and I spent an hour ruling pencil lines between all the arrows I could find. Eventually I found another one marked (C), but it had been a long and wearisome search.

I realised that I was getting somewhere now, because this lead came from the emitter of Q603 via L605, and the transistor was obviously connected as a series regulator. Its collector was fed through a fusible resistor from yet another litte arrow, marked (a). Luckily, I had already found the mate to this one, at the cathode of D704 on the chopper transformer.

So, this had to be the source of the missing 12V rail, but why it was missing was still to be determined.

The diode checked out OK, as did the fusible resistor. There was a full 18V on the collector of Q603 instead of the specified 15 volts, and on its emitter was the expected 12 volts. L605 also had 12 volts at each end, yet the short rail connected to L605 had no voltage at its remote end.

Now, read that last sentence again, because that is what I did! L605 had voltage on each end, yet the track connected to the output end of L605 lost all its volts along 3mm of copper!

I bridged L605 to the next solder pad along the track and the set came to life. Yet I could see absolutely no trace of a break in the copper. In fact, I scraped the solder resist off the track and found it more like a resistor than a track. It had 12 volts at one end, 6 volts in the middle, and nothing at the other end!

I removed all the solder and resist from the pad and track, and even then could not be sure that there was something wrong with the copper. But the set would not work reliably until I bridged the whole 3mm track.

I can only assume that it was not continuous copper, but was made up of countless tiny pads each barely touching its neighbour. Only this could account for the resistive nature of the track.

I've rarely been so happy to get rid of a set as I was to see the last of this one. As much as anything, it was apprehension over the delicate nature of the power chip, and the distinct possibility that it could blow again while I was working on the set. But at least I'll know how to handle things when I see another one.

Epilogue

My elation at being rid of this set was short lived, because the customer called a few days later to say that it had failed again. I could only guess that this was a repeat of the previous fault.

From my point of view, the touchy power chip will always be the prime suspect whenever one of these chassis comes into the shop. Fortunately, the owner was going overseas for six months and it was this long before I next saw the set.

This gave me time to discuss the matter with a colleague and I learned that there is a new IC now available to replace the IX0308CE. It's an STK7310 and is said to be 'twice as good at half the price'.

The price bit is quite correct – it's only $18, against $36 or $39 or similar for the other one. Whether it is really twice as good remains to be seen.

Anyway, the set duly arrived in the shop and sure enough, it was a shorted IX0308CE. It was only seven months since the new IC was fitted, and the customer had been out of the country for six of the seven! Needless to say, the customer really stamped his foot when I reported the matter to him.

He didn't calm down until I explained that there would be no further labour charges – this was still part of the same job for which he had already paid. I would only charge him for the new chip and any other parts that might be necessary.

(Customers always expect some sort of warranty from servicemen, but they are usually surprised when they get their warranty without having to fight for it. It really takes the wind out of their sails!)

I duly fitted one of the new STK chips and switched on. Apart from a slight squeak from the line stage, there was nothing. It seemed as though I was right back to square one.

Now alert to 12V rail problems, I went straight to L605 and found no sign of the 12V. Neither was there any voltage on the emitter of Q603. However, there was 21V on the collector, so it was apparent that the transistor was not turned on.

I checked the 820-ohm base resistor and the two diodes in series to ground. There was nothing wrong with any of them, and I found about 12V on the resistor/diode junction! But the resistor/diode junction was also the base of the transistor, where there was no voltage! So what was going on?

In fact, the transistor base pin was at one end of a 2mm track with the resistor/diode junction at the other end. Believe it or not, that tiny track was open circuit, in a manner similar to the coil track mentioned earlier.

The copper showed every sign of being continuous, but was in fact open circuit. All I had to do was to bend the resistor pigtail in the other direction and solder it to the transistor base pin. It was long enough to bridge the gap and provided a complete cure.

I hope I'll never see this set again, but then, I wonder? With two faulty tracks on the board already, what guarantee is there that no other tracks will fail. Could it be an intermittent track that killed both the original and the replacement IX0308CE's?

This set has turned into a real monster and I'm stuck with it. Roll on, retiring age! It can't come soon enough for me while this villainous Titan is still around.

See you again next month, (if the Titan doesn't come back)!

Fault of the Month

Thorn 8503 (AWA 'G' chassis)

SYMPTOM: No sound or picture. A plain white raster can be produced if 'Video Bias' VR201 is turned up, but there is no sign of a picture and only a soft hiss from the speaker. The tuner will not run a test set, nor will the faulty set process an IF signal from an external generator.

CURE: Check voltage on pin 3 of plug FD. If this is under 1 volt, replace Q102 (2SC710) the first video amplifier. The transistor was OK on static test, but shorted base/emitter under load. This removed an important bias voltage from the video IF and tuner.

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

Construction Project:

VK Powermate 25

Here is the highest power 13.8V DC supply we have described to date. Featuring a 25 amp continuous current rating, with a peak capacity of 35 amps, it it capable of running transmitters and amplifiers in the 100-150W class. It is fully protected with both foldback current limiting and an over-voltage crowbar circuit.

by MARK CHEESEMAN

The need for a reliable source of DC power in any amateur shack has been around for as long as amateurs have been transmitting radio waves into the ether. When vacuum tubes were universally used in transmitter finals, this supply needed to produce anything up to a few thousand volts, depending on output power, with current ratings of typically much less than one amp. This formed the plate supply to the output 'bottles', and in the case of integrated transceivers, was incorporated into the rig itself.

The advent of cheap semiconductors for RF amplification resulted in radically different power supply requirements. Instead of the potentially lethal voltage required by valve finals, solid-state output devices require a much lower voltage DC supply, with a corresponding increase in current requirements. While some transceivers did (and still do) incorporate this DC supply into the main cabinet, it is more common these days to make the DC supply an external entity.

The advantages of this are pretty apparent. The rig can be built into a more compact enclosure, and the heat dissipation is also greatly reduced. By choosing a supply voltage of 13.8V, and taking advantage of the smaller enclosure made possible by the omission of the internal power supply, the rig could be used 'mobile', even in today's smaller Japanese cars.

Another advantage which may not be immediately obvious is that with an external supply, the one power source can be used to power several rigs simultaneously, on the assumption that generally only one is being used to transmit at any one time – the receive current drain being much less than that on transmit.

Design aspects

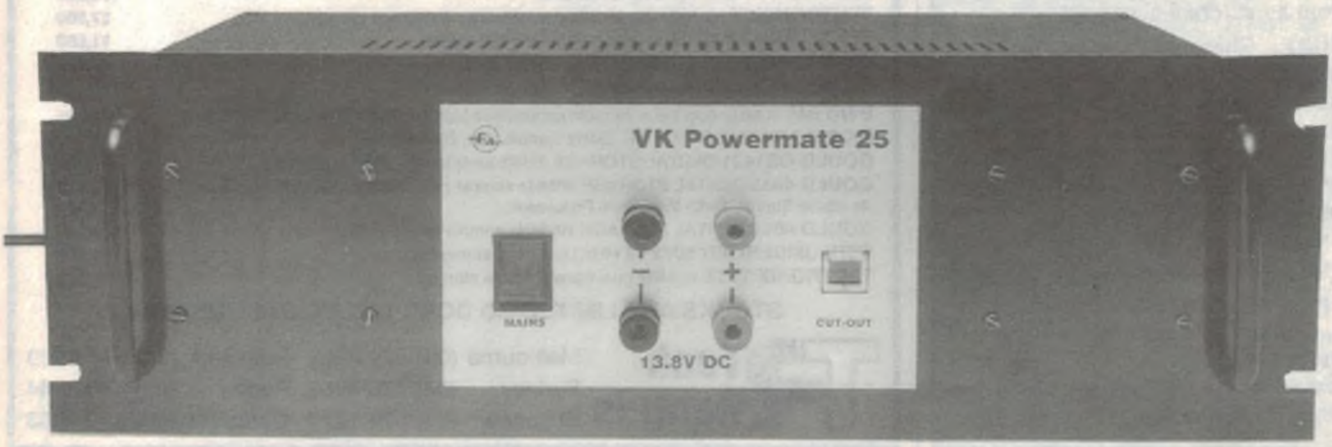
There are several ways in which the AC mains may be converted into the required DC potential. One technique is to use a switching power supply, of the kind commonly used as computer power supplies. While such supplies are very efficient, they tend to have a rather noisy output, requiring a fair amount of filtering to reduce the noise to acceptable levels for powering sensitive receivers, such as those encountered in amateur communications.

The other significant problem, which rears its ugly head all too often in projects designed to be constructed by readers of *EA*, is that of parts availability. Switching power supplies require the use of special high-frequency transformers, which are difficult (read expensive) to source in small quantities.

One variation on the switching supply is the switching regulator. This makes use of a conventional transformer, rectifier and filter, and uses switching techniques to convert the unregulated DC supply to the desired voltage. This still has the problem of output noise, and the more one tries to reduce this noise, the more the efficiency tends to suffer.

This brings us back to the tried-and-true linear series regulator configuration, as used in many power supply projects which we have published over the years. While their efficiency is nothing to write home about, linear regulators do have a very clean output, so as not to swamp that weak QRP signal from the other side of the globe.

Electronics Australia's most popular 13.8V power supply has no doubt been the VK Powermate, first described in May 1978, and updated twice, most re-



cently in October 1988. It provided a steady 13.8V at up to 5A, or more if two output transistors were used.

More recently, the VK Powermaster supplied a continuous 14A, with a peak capability of about 25A. However, a typical 100W transmitter or amplifier required around 20A on transmit, and if high duty-cycle modes such as FSK or FM are being used, this current can be drawn from the supply for a considerable period of time, causing overheating of the power transformer.

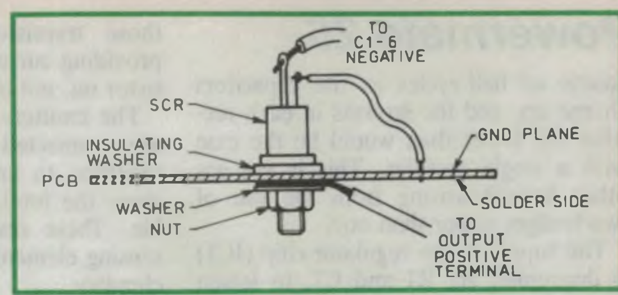
The new VK Powermate 25, as the name implies, is capable of supplying 25 amps on a continuous basis, with a peak capacity of 35A. This is more than enough to supply an active transmitter and a couple of other rigs on receive.

In common with all previous Powermate designs, the Powermate 25 is based around the LM723 regulator. This chip provides a temperature-compensated voltage reference, error amplifier and current limiting circuitry in a single package. A minimum of external components are required to build a complete power supply.

The mains input to the supply passes through a 3A slow-blow fuse (FS1), and then through a double-pole illuminated switch to the primaries of the two transformers. A slow-blow fuse is necessary to stop the initial inrush current of the capacitor bank from blowing the fuse.

Two transformers are used to provide the necessary current capacity at a reasonable cost. We found that a custom-made transformer of the required capacity would cost more than the two off-the-shelf items added together!

Mounting details for the SCR used as an over-voltage crowbar. As it only conducts briefly in the event of a fault, it is mounted directly on the PCB as shown.



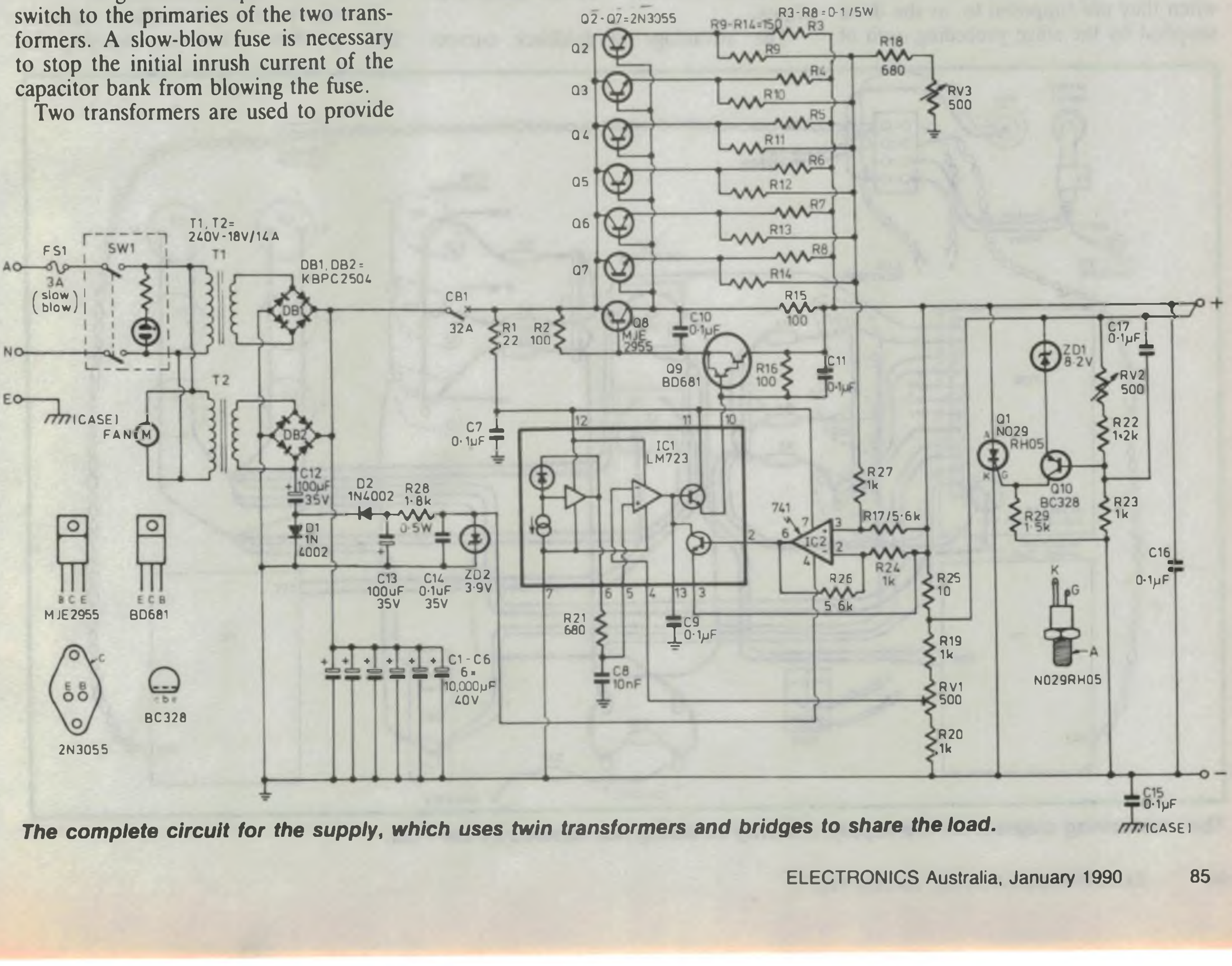
The resulting low voltage AC is rectified by two 25 amp bridges, one for each transformer. The use of two bridges rather than one is done for two reasons. One is to prevent a circulating current resulting from slight differences in the two transformers, which would waste current capacity.

The other reason is that each bridge only has to carry half the total current, reducing stresses in these components. Indeed, we managed to destroy a single 35A bridge early in the development of the project, although it was only carrying an average current of 25 amps at the time.

In practice, the current-sharing scheme works quite well, with the two transformers and bridges sharing the total current within a few percent.

Six 10,000uF (10mF) electrolytic capacitors serve to filter the raw DC from the rectifiers, so that the regulator does not drop out (lose regulation) between voltage peaks. Such a capacitance presents a very low impedance to the transformers and bridges when the supply is initially switched on. In fact, depending upon the exact time in the half-cycle that the mains switch is closed, the initial peak value of this current can easily reach several hundred amperes!

This current settles down within a



The complete circuit for the supply, which uses twin transformers and bridges to share the load.

couple of half-cycles as the capacitors charge up, and the stresses in each rectifier are lower than would be the case with a single rectifier. This is yet another benefit arising from the use of two bridges rather than one.

The supply to the regulator chip (IC1) is decoupled via R1 and C7, to lessen the chances of a feedback loop appearing through the supply, which could result in instability. The internal reference voltage is connected to the non-inverting input of the error amplifier via R21, with C8 ensuring a low impedance at high frequencies.

The inverting input of this amplifier is derived from the output of the supply, via a resistive voltage divider formed by R19, RV1 and R20. The output of the error amplifier drives a transistor (also internal to the IC), which in turn provides base current to Q9, a BD681 darlington. This transistor then controls the base current of Q8, an MJE2955. This long chain of command enables the 723 to drive the bases of the output transistors (Q2-7).

Resistors R2, R15 and R16 ensure that their respective transistors turn off when they are supposed to, as the drive supplied by the stage preceding each of those transistors is only capable of providing current to turn the next transistor on, not off.

The emitters of the output transistors are connected together via 0.1 ohm resistors, to ensure that the transistors share the total current as well as possible. These resistors also serve as the sensing elements for the current limiting circuitry.

The operation of the current limiting circuitry used in this supply is known as *foldback* limiting, because under short-circuit conditions, the output current drops back to a level well *below* the maximum current capacity of the power supply under normal operating conditions.

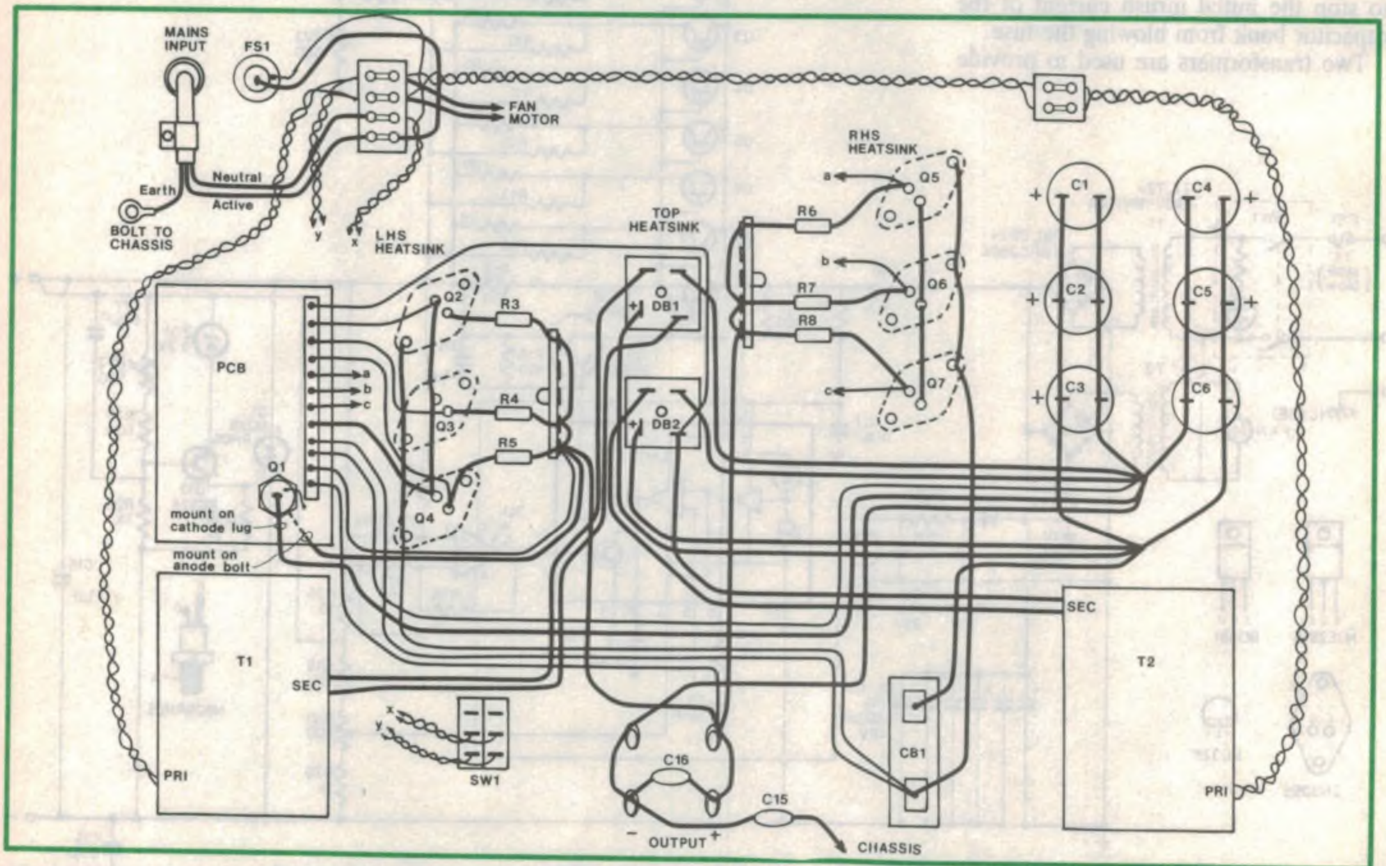
The reason for this is that, under short-circuit conditions, the full unregulated supply voltage appears across the output devices, and if the current is limited only to the maximum current capacity of the supply, the power dissipation in the output transistors would fall outside their safe operating area, resulting in their premature demise. With foldback current limiting, the short-circuit current drops to about 5 amps, so that the dissipation in the output transistors is contained within acceptable limits.

The advantage of foldback current limiting over other forms of protection such as an over current cut-out is that, once the overload condition is rectified, the supply returns to normal operation without further intervention on the part of the operator.

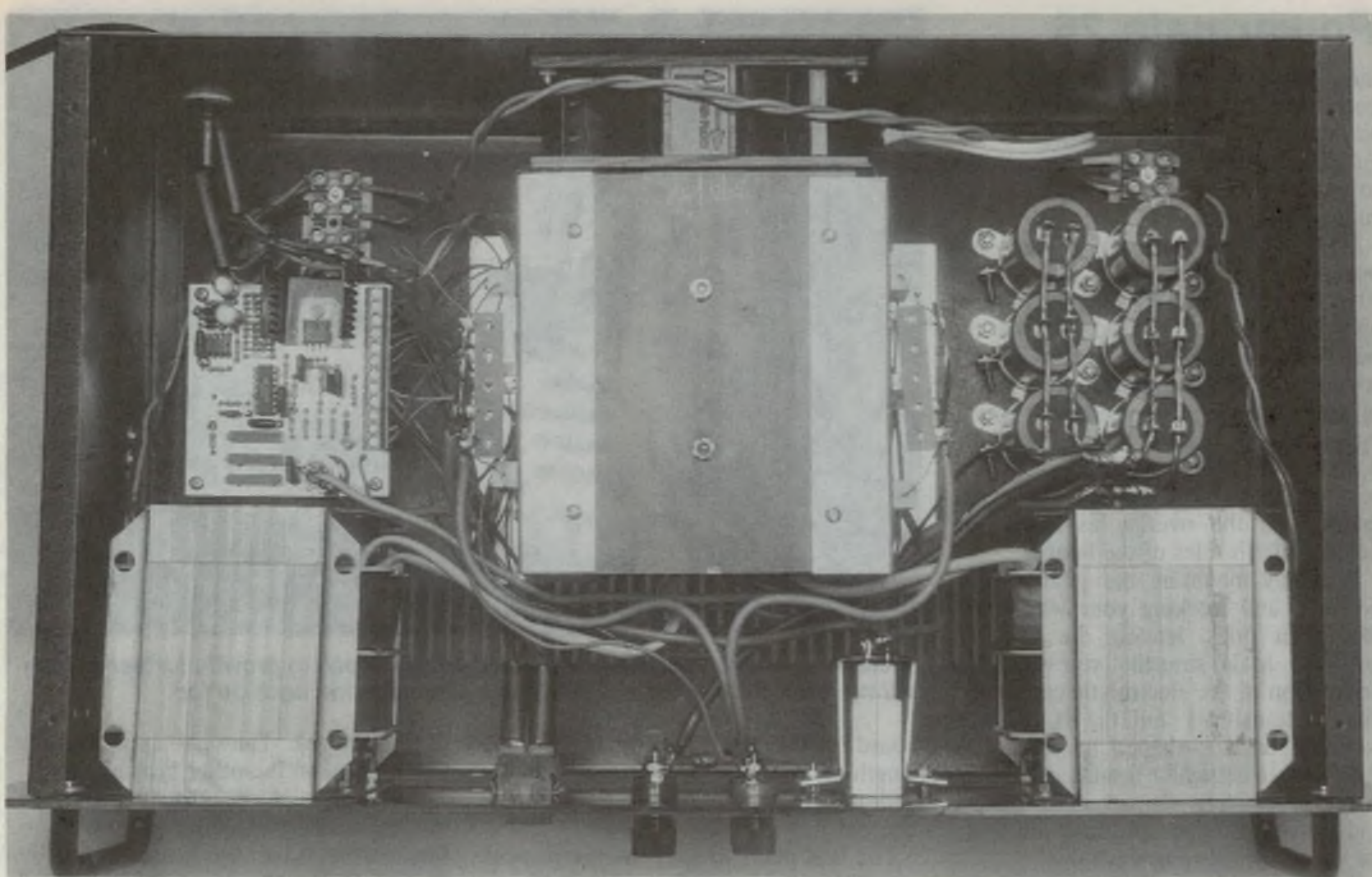
Resistors R9-14 effectively sum the individual voltage drops across the current equalising resistors, thus ensuring that the current limiting circuitry's effectiveness is not compromised by the failure of a single output transistor. IC2 serves to increase the sensitivity of the current limiting transistor in the regulator IC1 (the one with its base connected to pin 2). If this were not done, the best that could be achieved would be a short-circuit current of about 25 amps.

In the unlikely event of the output voltage rising above a pre-set limit, the load is protected from damage by a 'crow-bar' circuit, comprising Q1, Q10 and associated components. The output voltage is connected to a voltage divider, formed by RV2/R22 and R23. Zener diode ZD1 provides a reference voltage, and when the voltage across RV2 and R22 exceeds the Zener voltage by about 0.6 to 0.7 volts, the transistor turns on, triggering the SCR (Q1) into conduction – which short-circuits the output.

At this point, the foldback current limiting will come into play, limiting the



The main wiring diagram for the supply, showing all wiring not handled by the PCB.



An overall shot inside the case, showing the central heatsink tunnel and fan assembly.

short-circuit current to around 1.5 to 2 amps. In this case, the 'crowbar' can be re-set by switching the circuit breaker off and then back on. If the over-voltage condition arises due to one of the output transistors going short-circuit, a high current will flow, tripping the circuit breaker again.

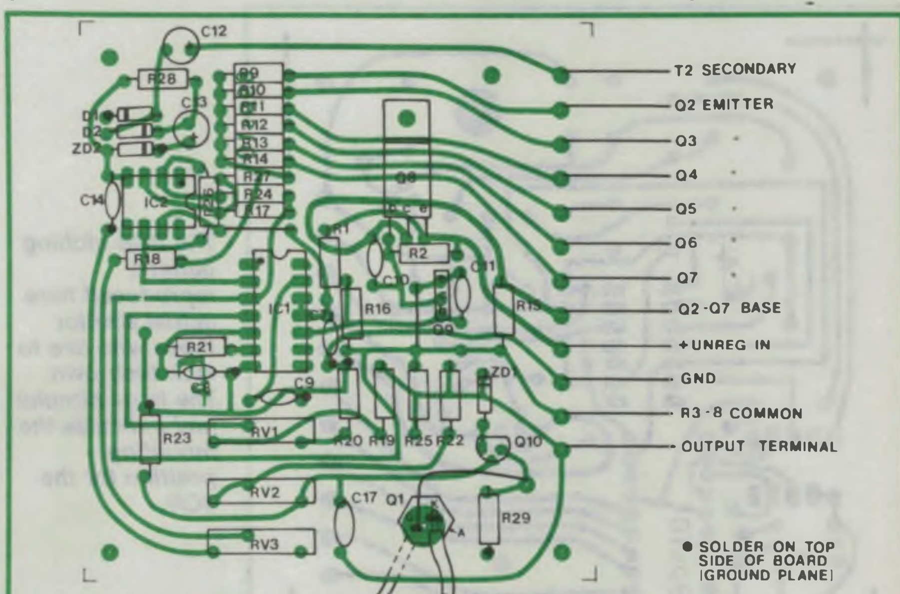
D1, D2, C12 and C13 derive a low current negative supply rail from one of the transformers, for the current limiting op-amp (IC2). This is required because the output of the op-amp cannot swing very close to its negative supply rail. Under short-circuit conditions, the positive output terminal is at ground potential, and when the short is removed, the op-amp cannot swing low enough to turn the limiting transistor in IC1 off, so that the supply will not recover, but will stay in the shut-down condition. With the small negative supply rail to the op-amp, it has proper control over the transistor, so that the foldback limiting works as it should.

Construction

The prototype was built into a 3-unit rack mounting cabinet. The two power transformers are bolted to the front panel of the box, one in each corner, with the mains switch, circuit breaker and output terminals accommodated between them. The six output transistors and the rectifier bridges are bolted to three heatsinks, which are assembled to form a tunnel, running from the back of the box towards the front.

A 120mm fan is mounted on the rear panel, to force air through the tunnel. The air then exits the box through the ventilation holes in the top and bottom panels.

Most of the smaller components are accommodated on a double-sided printed-circuit board, coded 89ps10. Although the artwork printed elsewhere in



Use this overlay diagram to guide you in wiring up the PC board.

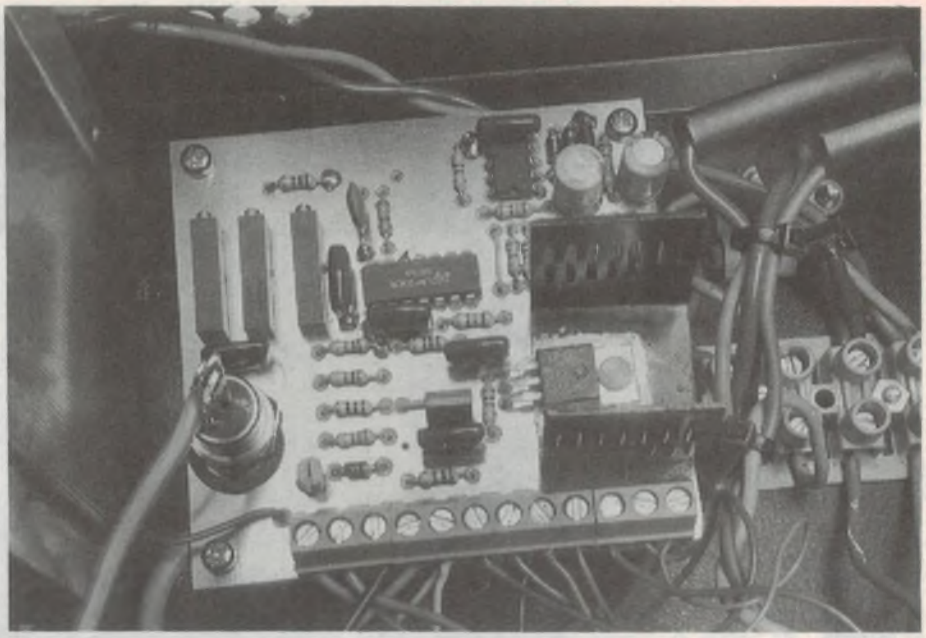
Powermate 25

this article implies only a single-sided board, the top side of the board is used as a ground plane, to provide a safeguard against RF energy – which tends to find its way into everything in a typical amateur shack.

If you are constructing your own board, the top layer is not etched at all (it should be covered fully with resist when etching the other side). When the board has been etched and drilled, the copper around the holes on the top side of the board should be removed with a large drill, so that the component pins do not touch the ground plane. The exceptions are those holes which are marked on the overlay as being soldered on both sides of the board.

Begin by mounting the smaller components, and working your way up to the larger ones, leaving the two ICs until last. Make sure that you watch the orientation of the electrolytic capacitors, diodes, transistors and the ICs. Q8 is mounted on a U-shaped heatsink, and should be electrically insulated from it. An appropriately shaped mica washer and a nylon bolt are probably the easiest way in which to achieve this.

We used a 12 way PCB-mounting terminal strip to bring all external connections to the board, although this may be considered optional, with the wires being soldered directly to the board. PCB pins are not recommended, as it is too easy to get shorts to the ground plane. Leave the SCR (Q1) off the board for the moment, although a small length of wire should be attached to the pad to which the gate will ultimately connect.



A close-up of the assembled PCB inside the supply, to provide further help in wiring it up. Note that the board has a ground plane layer on top.

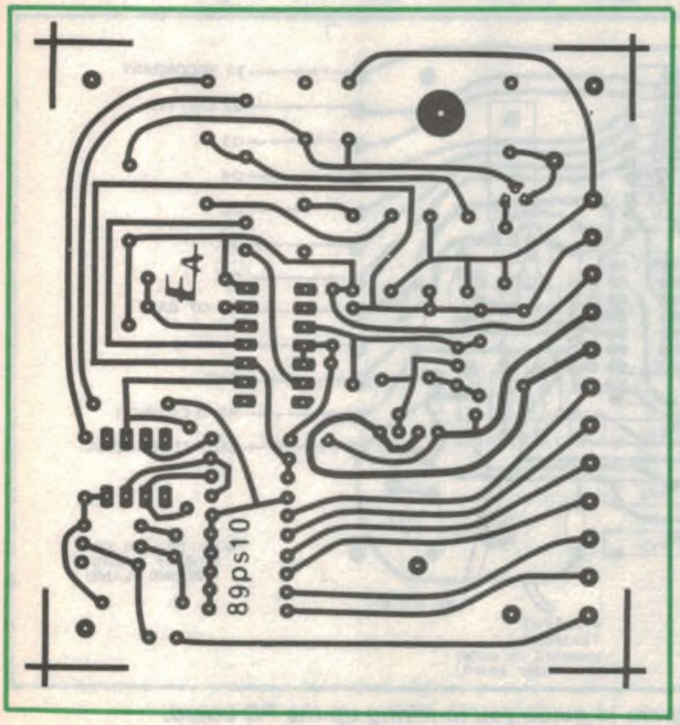
The best place to start the mechanical assembly of the power supply is to assemble the heatsink tunnel. Three 'fan' cross-section heatsinks 135mm long were used on the prototype, two for the output transistors, while the third cools the rectifier bridges. Drill the transistor heatsinks so that the three transistors on each are equally spaced along the length of the heatsink. The same applies to the two bridges on the other heatsink.

However, before actually mounting the semiconductors on the heatsinks, arrangements to bolt the heatsinks together, and to the bottom of the box, need to be made. We used four 135mm lengths of 25 x 25mm angle aluminium. One of these is to mount each of the transistor heatsinks vertically on the bottom of the box, and the other two attach the rectifier heatsink to the other two, forming the top of the tunnel.

Two tag strips are also attached to the tunnel, one on each side, above the central transistor on each of the vertical heatsinks, and the holes for these should be drilled at this point also. Now bolt the transistors to their heatsinks, making use of insulating washers and liberal amounts of heatsink compound. Heatsink compound should also be applied to the two rectifiers, but as they are isolated from their cases, insulating washers are not necessary here.

Now the tunnel may be put together – not forgetting to mount the aforementioned tagstrips at the same time. Before putting the tunnel assembly aside, a 0.1 ohm 5W resistor should be soldered between the emitter of each of the transistors and one of the tags on the adjacent tag strip (not the centre one, though!). Using a multimeter on its ohms range, check that all of the transistors are indeed isolated from the heatsinks.

The rear panel is home for three components – the mains input cable, the associated fuse, and the cooling fan.



The PCB etching pattern, reproduced here actual size for those who like to etch their own. The large circular pad indicates the mounting position for the SCR.

The holes for the first two should be drilled in the lower right-hand corner (when looking from the outer side of the panel), allowing adequate clearance around them for safety and ease of assembly. The fan is mounted so as to line up with the ultimate location of the heatsink tunnel, and should be tackled next.

A good template for the fan mounting holes is the finger guard which is supplied with it. The bottom edge of the fan should just rest on the bottom of the box, and it should be centered in the left-right axis. Once this is completed, the fuse and fan may be fitted in place. Also insert a rubber grommet in the hole intended for the power cord.

The front panel should be tackled next. The two power transformers are mounted as close to the front corners of the box as possible, and are mounted centrally between the top and bottom edges of the panels. We used 4BA cheese head screws, spray-painted black before mounting, to secure the transformers to the panel.

Before finally mounting the transformers, the holes for the rest of the components on the front panel should be cut. A photocopy of the front panel artwork is useful here, taped so that it lies in the centre of the panel, both vertically and horizontally. Two holes need to be drilled, one each side of the circuit breaker cut-out, and countersunk to accommodate 6BA screws.

Once this is completed, two countersunk screws should be inserted in the holes and held in place with tightly secured nuts. Finally, the stick-on front panel may be put in its final position, and the holes in it cut out with a sharp art knife.

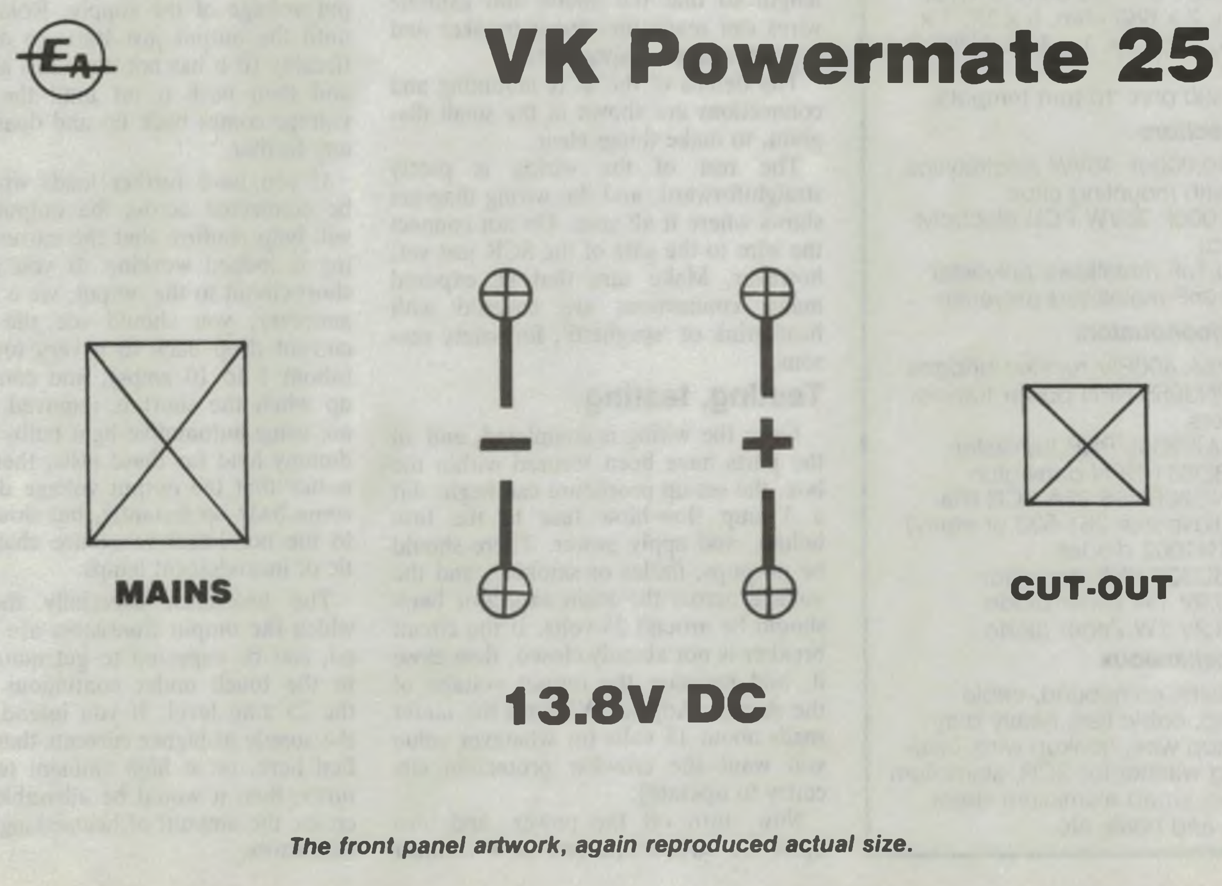
The power switch simply snaps into its hole, secured by moulded-in 'fingers' on each side. The circuit breaker, however, is a little more difficult, as it is not designed for mounting in this way. We fashioned an aluminium 'U' bracket to hold the breaker against the front panel, using the two screws mounted earlier on. Wrap a bit of insulating tape around the bracket to prevent it shorting against the terminals of the breaker.

Now mount the two transformers, so that the secondary connections emerge from the edge closest to where the heatsink tunnel will be located. Before assembling the box, holes should be drilled into the bottom panel, using the internal photographs as a guide, to support the six capacitors, the PCB, the two terminal blocks and the mains cable clamp. Try to separate the mains components from the PCB as much as possible. Also drill the mounting holes for the heatsink tunnel, so that it is as close to the fan as possible, without actually touching it.

Now, the side panels may be attached to the front panel (at the same time, securing the handles to the box), followed by the rear and bottom panels. The stand-off insulators for the PCB may be put in place at this point too. Temporarily mount the board on top of these, and mark out three holes in the side panel to allow easy adjustment of the trimpots later on. Make sure that you remove the board before drilling, just in case the drill bit 'grabs' on the way in.

Wiring

There is a fair amount of wiring in the power supply, which should be tackled next. We used $2.5mm^2$ (16 amp) building wire for the high current connections. The transformers have just



The front panel artwork, again reproduced actual size.

Powermate 25

enough cable length to reach the rectifiers, and the cables are already terminated in spade connectors, ready to push onto the AC terminals of the bridges.

The six capacitors are mounted in the rear right-hand corner of the box, and connected in parallel with bared 2.5mm^2 wire, so that the common connections for the bank of capacitors are between the two front-most capacitors. Heavy wire is then used to connect the appropriate terminals of the capacitors to the two bridges, before the heatsink tunnel is finally secured in place.

Two lengths of heavy wire should also be attached to the SCR, as it is mounted on the PCB. The anode (bolt end) of the SCR is connected by simply wrapping the bared end of the wire around the bolt (under the PCB) before the nut is tightened. Make sure that the strands of wire do not touch any tracks on the board though. Leave enough length so that the anode and cathode wires can reach the circuit breaker and capacitor bank, respectively.

The details of the SCR mounting and connections are shown in the small diagram, to make things clear.

The rest of the wiring is pretty straightforward, and the wiring diagram shows where it all goes. Do not connect the wire to the gate of the SCR just yet, however. Make sure that all exposed mains connections are covered with heatshrink or 'spaghetti', for safety reasons.

PARTS LIST

1 PCB, 80 x 75mm, coded 89ps10
1 3 unit rack mount box (DSE H-2481 or equiv)
2 18V/14A transformers (DSE M-2010 or equiv)
1 32A circuit breaker (GEC 'Super Switch' or equiv)
1 DPDT illuminated rocker switch
1 4-way mains terminal block
1 2-way mains terminal block
1 3AG fuseholder and 3A slow-blow fuse
1 120mm cooling fan
4 Heavy duty binding posts (2 red, 2 black)
1 Mains cord and plug
3 135mm lengths of 'fan' cross-section heatsink

Resistors

All 1/4W 5% unless noted:
6 x 0.1 ohm 5W, 1 x 10 ohm, 1 x 22 ohm, 3 x 100 ohm, 6 x 150 ohm, 2 x 680 ohm, 5 x 1k, 1 x 1.2k, 1 x 1.5k, 1 x 1.8k 1/2W, 2 x 5.6k
3 500 ohm 10-turn trimpots

Capacitors

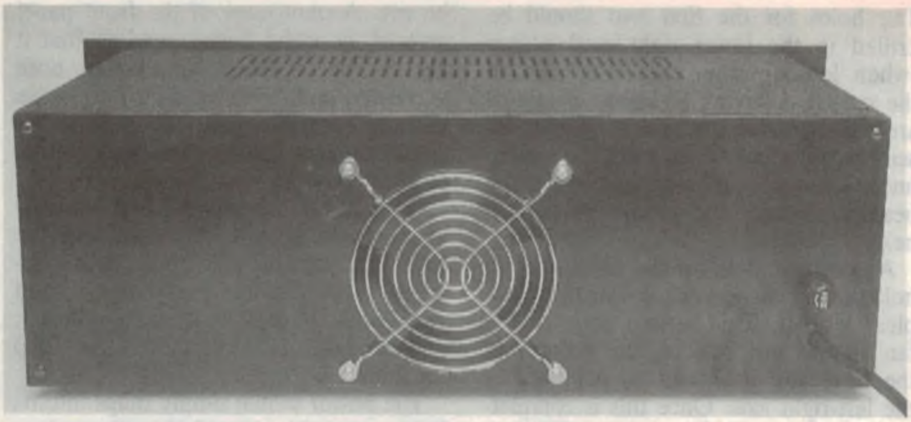
6 10,000uF 40VW electrolytics with mounting clips
2 100uF 35VW PCB electrolytics
8 0.1uF metallised polyester
1 10nF metallised polyester

Semiconductors

2 25A 400PIV rectifier bridges
6 2N3055 NPN power transistors
1 MJE2955 PNP transistor
1 BD681 NPN darlington
1 NO29RH05 25A SCR (Radiospares 261-520 or equiv)
2 1N4002 diodes
1 BC328 PNP transistor
1 3.9V 1W Zener diode
1 8.2V 1W Zener diode

Miscellaneous

Heatsink compound, cable clamp, cable ties, heavy duty hookup wire, hookup wire, insulating washer for SCR, aluminium angle, scrap aluminium sheet, nuts and bolts, etc.



The rear of the supply, with the cooling fan grill in the centre and the mains cord entry at lower right.

Testing, testing

Once the wiring is completed, and all the parts have been secured within the box, the set-up procedure can begin. Fit a 3 amp slow-blow fuse to the fuse holder, and apply power. There should be no pops, fizzles or smoking, and the voltage across the main capacitor bank should be around 25 volts. If the circuit breaker is not already closed, then close it, and measure the output voltage of the supply. Adjust RV1 until the meter reads about 15 volts (or whatever value you want the crowbar protection circuitry to operate).

Now, turn off the power, and also open the circuit breaker. Now connect the gate of the SCR to the appropriate pad on the PCB, and rotate RV2 fully counterclockwise. Re-apply power, close the breaker, and slowly rotate RV2 clockwise, until the voltmeter reading drops. Now back off RV1 a few turns, and reset the breaker. Finally adjust RV1 for the desired 13.8 volts output.

The setting of the current limiting requires the availability of a load which will draw a suitably large current (about 35 amps) from the supply. A high current ammeter is also useful, although if the impedance of the load is known, the current can easily be calculated.

Connect the load to the output terminals of the supply, and observe the output voltage of the supply. Rotate RV3 until the output just starts to drop noticeably (if it has not done this already), and then back it off until the output voltage comes back up and doesn't rise any further.

If you have further loads which can be connected across the output, these will help confirm that the current limiting is indeed working. If you apply a short-circuit to the output, via a suitable ammeter, you should see the output current drop back to a very low value (about 5 to 10 amps), and come back up when the short is removed. If you are using automotive light bulbs as your dummy load for these tests, then you'll notice that the output voltage does not come back up instantly, but slowly, due to the non-linear resistance characteristic of incandescent lamps.

The heatsinks, especially those on which the output transistors are mounted, can be expected to get quite warm to the touch under continuous use at the 25 amp level. If you intend to run the supply at higher currents than specified here, or at high ambient temperatures, then it would be advisable to increase the amount of heatsinking on the transistors.

Powermate, Chaser, Sprinkler kits from DSE

Having just read through Mark Cheeseman's description of our husky new VK Powermate 25 power supply, you're probably wondering where you might be able to buy a kit of parts for the design. You need wonder no longer – Dick Smith Electronics has advised that it has prepared kits not just for this supply, but also for the 2-metre FM transmitter in the November issue. It's also currently offering handy little video/audio modulator modules, at a bargain price.

To provide greater flexibility and quite possibly save some builders money, the DSE kit for the VK Powermate 25 supply is not complete down to the last nut and bolt – which would force you to buy everything, even if you already have some of the parts. Rather it is of the 'short form' variety, although not quite as basic as other short-form kits.

In this case, what the kit provides is virtually everything but the two power transformers and rack-type metal box. So if you have a suitable case, and one or two suitable transformers, you'll be able to use these and save quite a lot. You'll also have the option of building up the supply with only one transformer, if you don't need the full 25 amps output capacity at present...

The catalog number of the new kit is K-3210, and it includes the PCB and all minor components, cooling fan, rectifier bridges, regulator transistors, reservoir capacitors, extruded heatsinks, switches and terminals. And the price for this 'short form' kit is only $249.

If you do need to buy a case, DSE can of course provide the same one that Mark Cheeseman used in the prototype supply: the H-2481, priced at $55.95. They can also provide the original transformers used – the M-2010 – priced at $69.95 each.

This means that even if you do need to buy both the case and two transformers, to make up a complete 25A supply from scratch, you'll be up for less than $450 total. This seems very reasonable indeed, when you consider that a commercial 25A supply costs around $700.

FM Tx kit

DSE has also produced a kit for Dewald de Lange's simple 2-metre FM transmitter, described in last month's issue. This project only consisted of a pair of PCB modules, you may recall, with the case and power supply being left for the constructor to provide. So even though DSE has produced a complete kit for the project, this is also in effect a 'short form' kit, by default.

The K-6010 kit includes both PCB's, all transistors and IC's, and all minor components – including trimmers, coil winding wire, a clip-on heatsink for the output transistor and a crystal. It is available for only $59.50, which should bring the project into almost everyone's price range.

Light chaser

Needless to say, DSE has also produced a kit for its own Light Chaser project design, as published in the November issue. And this is very much a full kit, complete down to the last nut, bolt and cable tie.

As with virtually all of the DSE kits this one comes with a comprehensive instruction manual. However in this case the manual is particularly thorough.Because DSE's kit people felt that some constructors might not be able to wire the unit up easily and safely, using our original photographs and text as a guide, they went to the trouble of preparing an additional and very clear overall wiring diagram.

This should allow even beginners to wire up both the signal and mains wiring with complete confidence – a point worth noting.

The catalog number of the DSE Light Chaser kit is K-3161, by the way, and it sells for $99.

Sprinkler timer

While we're talking about DSE kits, the company has also sent us a sample of the kit they've produced based on Tony Agius's Timer/Controller for Garden Sprinklers, as described in our October issue.

Actually, after borrowing the original prototype, DSE felt the project could be developed somewhat further, to make it even more attractive. As a result they spent a considerable amount of effort in redesigning both the circuit and the PCB, ending up with a design that is both simpler and more reliable than the original.

The revised version has only eight ICs in place of the original 10, and the new PCB is rather less crowded and easier to wire up. The instruction manual plied with the kit gives full details of the revised design, including a new PCB and wiring diagram.

We've examined a wired example of the revised design, and also given it a basic checkout. It looks to be a very nice job, and works very reliably indeed. So intending constructors can tackle the project with greater confidence than before, thanks to DSE's efforts.

The Sprinkler Timer kit has the catalog number K-3588, and is priced at $99. It is for the complete controller, but doesn't include the solenoids or distributor taps.

VHF modulator

Finally, DSE has also advised that it has acquired good stocks of a very handy little VHF modulator unit, for video and audio, which it is offering at a bargain price until stocks are sold.

The K-6043 module is made by the well-known Astec firm, and measures only 70 x 42 x 22mm overall. It has four lugs on the base for mounting on a PCB, with signal and supply inputs via four flying leads at one end. An RCA-type socket on one side is used for the RF output.

Operating from any DC supply voltage between 6V and 15V, the module takes standard composite video (approx 0.6V p-p) and audio (5V p-p max) and produces normal negatively modulated vision and FM intercarrier sound carriers on either of Australian VHF channels 0 or 1. Channel selection is done via a 'channel select' DC control input.

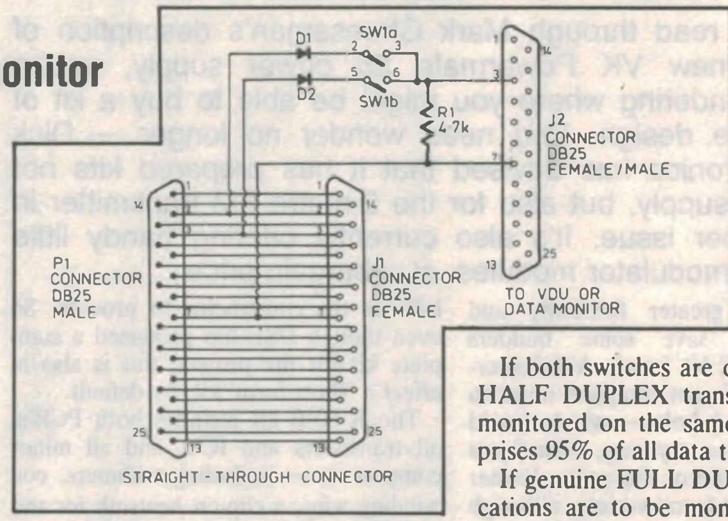
The K-6043 provides a full vestigial sideband filter for the vision carrier, plus accurate pre-tuning of the sound subcarrier at 5.5MHz. It is also designed for colour signals, having a chroma/sound beat product of 55dB typical. Vision carrier output level for Vmod = 2.0V (sync tips) is 14mV minimum into 75 ohms.

In short, it's suitable for just about any application where video and audio must be modulated to produce a VHF signal on channel 0 or 1. And the price? Just $9.95, complete with data sheet. You might need to be quick, though – at this price, they probably won't last long.

Circuit & Design Ideas

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

Low cost RS-232 data monitor



Have you ever wanted to monitor RS-232 data communications on a dumb VDU, or record data communication directly to disk? This circuit allows you to construct the necessary hardware interface for less than $5.00.

All RS-232 communications occur on pins 2 and 3 of a DB25 plug or socket, and here pins 2 and 3 of J1/P1 are selectively mixed via switches SW1A/B and diodes D1, D2 into a single data line of J2. This data line is connected to the RXD pin of your monitor VDU or computer (normally either pin 2 or pin 3). The attached drawing is correct if an IBM PC is used. The circuit is designed to monitor either pin 2 or pin 3 or both pins if simplex communications are monitored. (Only one pin at a time is active).

RS-232 signals are OFF if between –3 and –25 volts and ON if between +3 and +25 volts. Most terminals generate voltages which are typically +10 volts. The actual changeover point is around +0.6 volts. This circuit relies on that fact, as it 'OR's' either/both data pins into a single resistor R1. The monitor thus sees only 0-10 volt data transitions.

If both switches are on, SIMPLEX or HALF DUPLEX transmissions can be monitored on the same pin. This comprises 95% of all data transmissions.

If genuine FULL DUPLEX communications are to be monitored then only one switch can be ON, as monitor data will be corrupted if both lines are active at the same time.

P1 and J1 are a male and female DB25 plug and socket, which are placed back to back and soldered together on all 25 pins, to form a straight-through connector. Diodes D1 and D2 anodes are connected to pins 2 and 3 respectively. Switches SW1A and SW1B are 2 sections of dual in line switches, which you should be able to find in your junk box. I cut down a 4-switch unit to reduce its physical size.

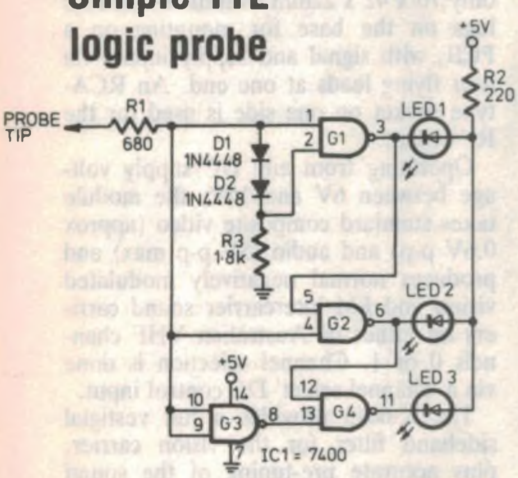
To use the monitor, disconnect the DB25 connector from the equipment you require to monitor, connect the monitor straight-through connector into the equipment and reconnect. Select the required channel with switch SW1A/SW2A (normally both ON) and ensure P2 pin is connected to your monitor terminal's RXD pin. Note some terminals also need DSR (pin 6) and CD (pin 8) also active, before they will display. See your terminal's manual for strapping details to allow data on RXD to be displayed.

Configure your terminal to the same baud-rate and parity as the communications are going to use, and plug J2 into the terminal.

I have used the above data monitor to capture ASCII data to disk for later analysis, using an IBM PC clone running Crosstalk to capture data to disk. It has been invaluable for capturing that random data pattern which causes the system to crash.

Peter D.Kay,
Glen Waverley, Vic **$30**

Simple TTL logic probe



This simple TTL logic probe is capable of displaying all three possible logic levels. It uses a single low-cost 7400 quad NAND gate, plus a handful of other parts.

The main level decision is made by gate 1, using diodes D1 and D2 together with resistor R3 to make the gate's pin 2 input follow pin 1, but about 1.2V lower. If the input logic level is above 2.3V (i.e., logic 'HIGH'), both inputs will be lifted high enough for G1 to operate, pulling its output down to logic low and causing LED1 to glow. At the same time, the logic low applied to pin 5 of G2 prevents it from operating, even though pin 4 is high.

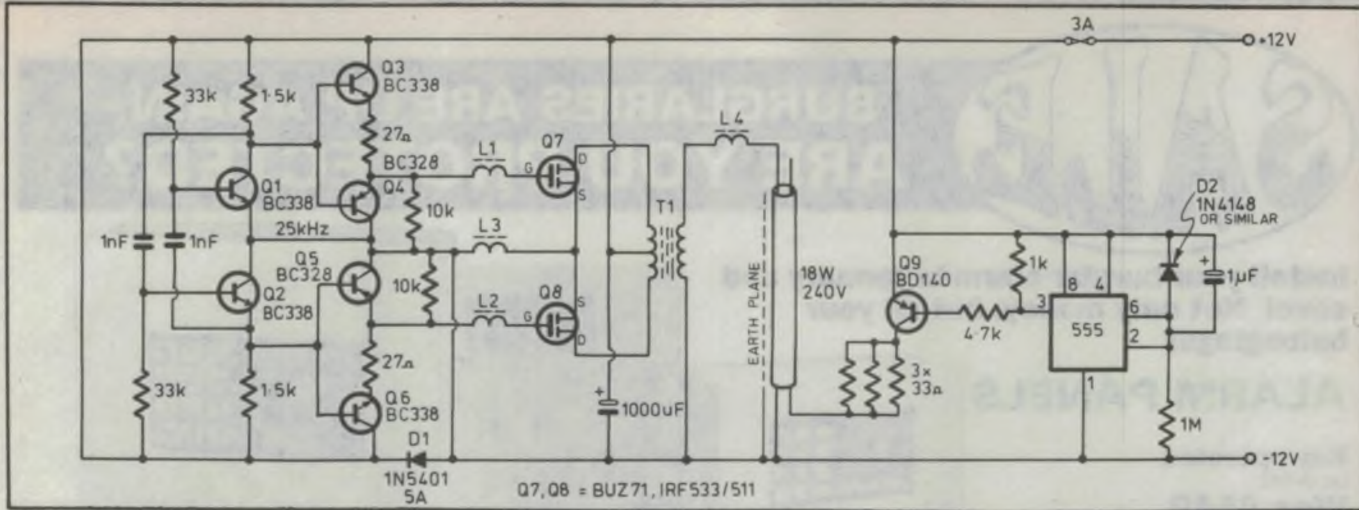
In this situation G3, connected as an inverter, will also operate. However this produces an output low at pin 13 of G4, preventing this gate from operating. Hence both LED2 and LED3 remain dark.

Similarly if the input logic level is lower than 0.8V (i.e., logic 'LOW'), G1 and G2 will both remain inoperative with their outputs high. However G3 will now also not operate, and will produce a logic high at pin 13 of G4. As pin 12 will also be high, G4 thus operates and LED3 glows.

For input levels above 0.8V but below 2.3V, G1 will not operate because pin 2 will be below the switching threshold. As a result, pin 5 of G2 will be high, while pin 4 will also be high enough for G2 to operate – causing LED2 to glow. G3 will also operate, pulling down pin 13 of G4. So G4 will be held off, ensuring that only LED2 glows.

Due to chip tolerances, the values of resistors R1 and R3 may need to be adjusted for correct setting of the switching thresholds.

Michal Cedrych,
Morphett Vale, SA **$35**



12V/240V inverter for an 18W fluorescent

I developed this small inverter to power an 18W fluorescent lamp in a remote shed, on my property.

Q1 and Q2 are connected in an astable multivibrator configuration, running at 25kHz. Each side drives complementary buffer pairs Q3/Q4 and Q5/Q6, and these in turn drive the power MOSFETs Q7 and Q8, switching current to the step-up transformer T1.

Q9 and the 555 timer IC are for starting. When power is first applied, the output of the 555 (pin 3) goes low for one second, turning on Q9 and passing current through the lower lamp heater. Along with the earth plane near the lamp, this is sufficient to get it going.

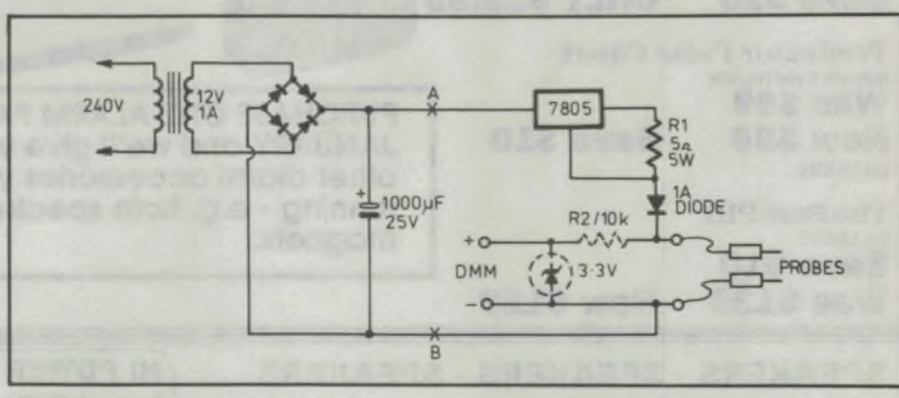
Inductors L1 and L2 are suppressor chokes formed by fitting ferrite beads on the gate leads of Q7 and Q8. Similarly L3 is a small inductor (2 turns of 19 B&S enamelled wire on a TV balun core) to control switching spikes. Inductor L4 in the transformer secondary circuit is used to adjust loading, and hence battery current. It consists of 80 turns of 24 B&S enamelled wire on an FX2240 pot core, with paper washers used to adjust the air gap and loading for a battery current of 2A.

Transformer T1 is wound on a Siemens EC52 core. The primary consists of two windings of 30 turns in 19 B&S, wound bifilar in two layers. The secondary is 550 turns of 24 B&S, wound in 11 layers over the primary. As the voltage spikes on L4 and the top of the secondary reach 700V, some care needs to be taken with secondary insulation – and also isolating the secondary circuit from the rest of the electronics.

Crowbar diode D1 is only for protection against reverse polarity input, and could be left out if the circuit is permanently wired. Note that Q7 and Q8 must be mounted on heatsinks.

Bill Jolly,
Nambucca Heads, NSW **$50**

Milli-ohm DMM adaptor



Recently, while installing a ham antenna, I needed to test the earth connection to ensure it was a suitably low resistance. So I reached for my trusty 3-1/2 digit DMM. Shock horror! It could only measure to 0.1 ohm, and even that had digital dither.

I realised that I would be able to measure lower resistances on the voltage range of the meter – which is more accurate, anyway – by pushing increased current through the system. Since the lowest DC voltage range is 199.9mV full scale, a current of 1 amp would convert this range into one reading directly in milli-ohms.

The circuit shown is basically a transformer and rectifier, to produce unregulated low voltage, followed by a 7805 5-volt regulator IC connected as a constant-current source. The current level of 1 amp is set by resistor R1, whose value of 5 ohms gives a drop of 5V at 1A.

Note that R1 needs to be rated for at least 5 watts of dissipation. Similarly the 7805 should be mounted on a good heatsink, as it too will have significant dissipation.

The optional 10k resistor R2 and 3.3V zener diode are to limit the voltage applied to the DMM, for meters without overload protection.

The circuit can be powered from a 12V car battery if required, by connecting this at A and B instead of the transformer and rectifier.

Finally, note that the resistance of the test probes will register on the DMM, as these are effectively in series with the unknown resistance being measured.

David Angus,
Berry, NSW **$35**

Dreamed up a great circuit or design idea?

If you've developed an interesting circuit or idea, why not share it with other readers? Obviously we also pay for those we publish. Just draw out the circuit, jot down some notes and send it all to Jim Rowe, Electronics Australia, PO Box 227, Waterloo 2017.

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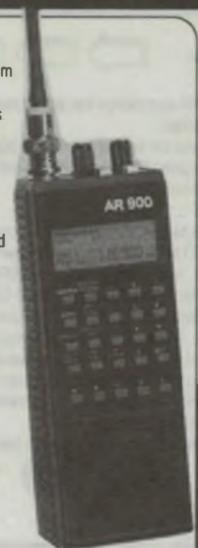
Channels:	20
Scan Speed Channels Per Second - 13	
Search Increments:	5, 10, 12.5kHz, Lo, Hi, VHF, 12.5kHz UHF 25kHz 830 - 950MHz
Power Requirements:	6V DC @ 60mA (squelched)
Antenna Connector:	BNC
Display Type:	LCD



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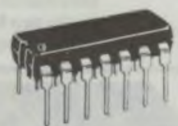

TTL COOKBOOK

Don Lancaster - 335 pages.
A complete guide to the understanding and use of Transistor Logic (TTL) integrated circuits - the basics of TTL are given, what it is, how to power it and so on. Also contains a catalogue of TTL devices, giving physical and electrical specs.

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Better Features. The Pro Series I not only kills the 5000 for perfomace, it has great features. For example, it has a chassis plug IEC 320 style mains inlet and a switched chassis IEC 240V socket to power other mains equipment. It also features signal clipping LED's on the cast front panel. This keeps in mind the highly likely professional applications for this amp.

Simpler to Build. You would think that this new amp would be harder to build than the straight forward 5000. Not so! The Pro Series I, infact, is far easier to build and actually has less signal distorting components than the 5000.

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As usual, the Jaycar kit comes with every conceivable part - nothing else to buy - and Jaycar quality as a bonus!

Cat. KA-1725 **$599**

NEW

Specifications: Playmaster Pro Series I

Power output (per channel, with both channels driven)	
Continuous:	140W RMS into 8 ohms
	200W RMS into 4 ohms
IHF pulse power:	190W RMS into 8 ohms
	320W RMS into 4 ohms
Harmonic distortion	0.005% at 100W RMS into 8 ohms
	0.007% at 140W RMS into 8 ohms
	0.008% at 200W RMS into 4 ohms
Intermodulation distortion	0.004% at 100W RMS into 8 ohms
	(4:1 ratio of 50Hz and 7kHz)
Frequency response	10Hz to 100kHz (-3dB points)
Signal to Noise	More than 100dB below rated output (unweighted)
Sensitivity	0.83V RMS for 100W into 8 ohms
Input impedance	Approx 33k ohms
Output slew rate	More than 60V/us
Damping factor	Greater than 50
Overload indicator	Activated if output distortion exceeds 0.05%

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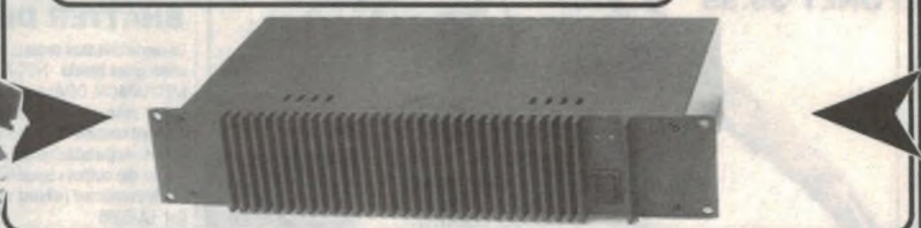

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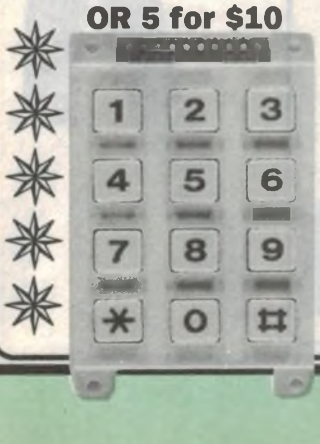

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Construction project:

New high performance stereo power amplifier - 2

In this second article describing the Playmaster Pro Series One, we deal with the amplifier's construction and set-up procedure, and include a few practical hints for installation.

by ROB EVANS

During the development of this project, we placed considerable emphasis on more than just the performance of the amplifier. The ease of construction and adjustment are vitally important, if a constructor's version is to offer the impressive capabilities of our prototypes.

To this end, the new design uses one single-sided PCB per channel, a minimum of interwiring and no fussy specialised components. Also, the set-up procedure is simplicity in itself, with only one trimpot to be adjusted for each channel. However, before diving headlong into the amplifier's construction, there are a few general points to discuss.

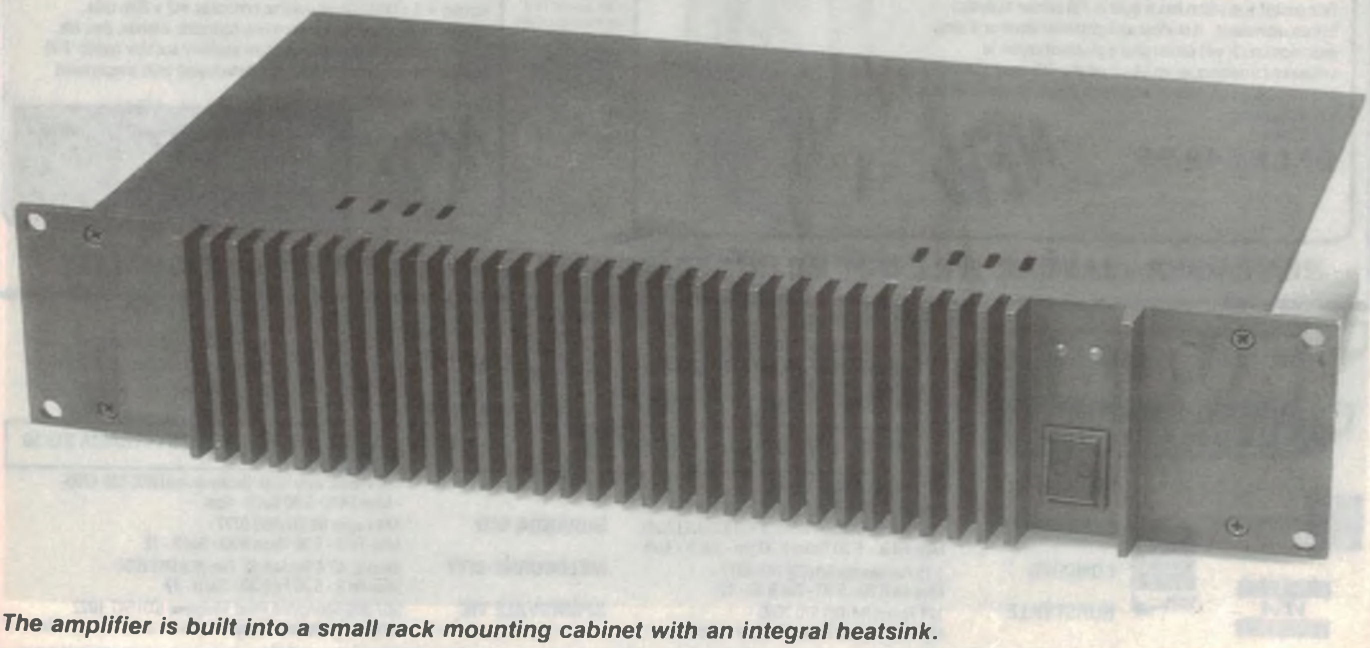
Safety and earthing

At the risk of boring experienced readers, we cannot stress the safety aspect too strongly. As with any project using the 240V mains for a power source (as opposed to plug-packs or batteries), take particular care to cover and insulate any exposed mains wiring, and ensure that the equipment's chassis is well connected to the mains earth. Also note that the amplifier's supply rails have a total voltage of around 140V, which can also be dangerous in the right (that is, wrong) circumstances.

While the amplifier's chassis *must* be tied to the mains earth, the internal circuitry could be left 'floating' with no direct connection between the 0V (common) line and the cabinet – as featured in many designs. In this situation, the amp's internals are earthed via the shielding braid of the signal cables to the preamplifier's earth connection. However, this constitutes a potential safety hazard.

Although it may seem unlikely, the relevant scenario involves an insulation breakdown within the amplifier's power transformer, where its 240V primary winding comes into electrical contact with the lower voltage secondary winding. The amplifier's circuitry (including the 0V line) will then attempt to rise towards mains potential.

Now, if the signal source is directly referenced to the mains earth (as is often the case), the interconnecting lead will appear as a short circuit to the amp's newly acquired mains potential. Naturally, the cable's shield will attempt to carry the heavy current and either

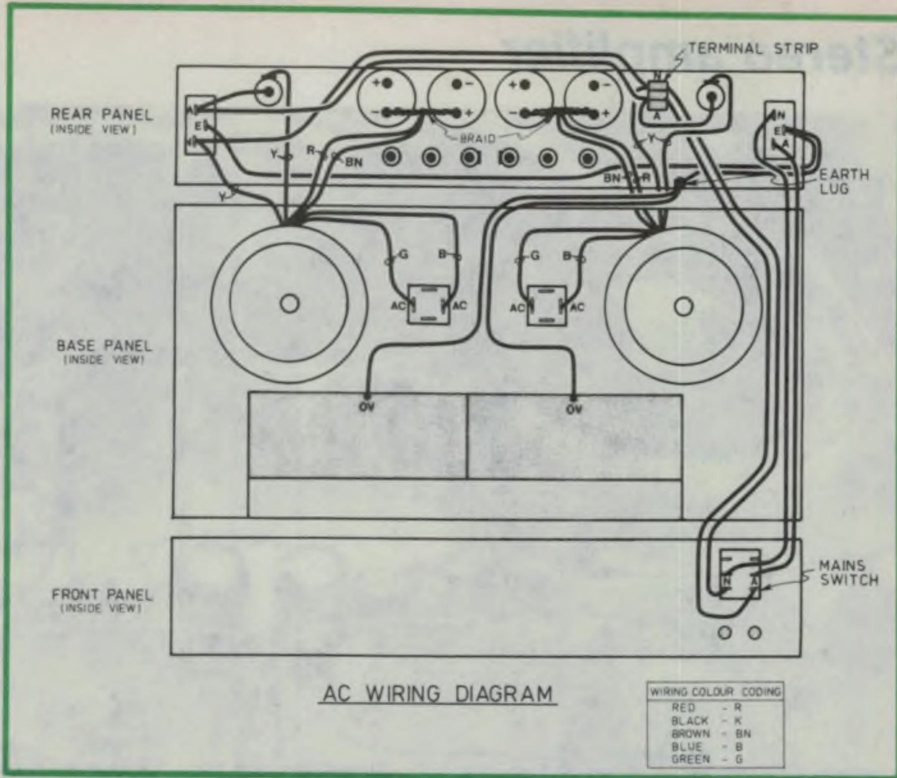


The amplifier is built into a small rack mounting cabinet with an integral heatsink.

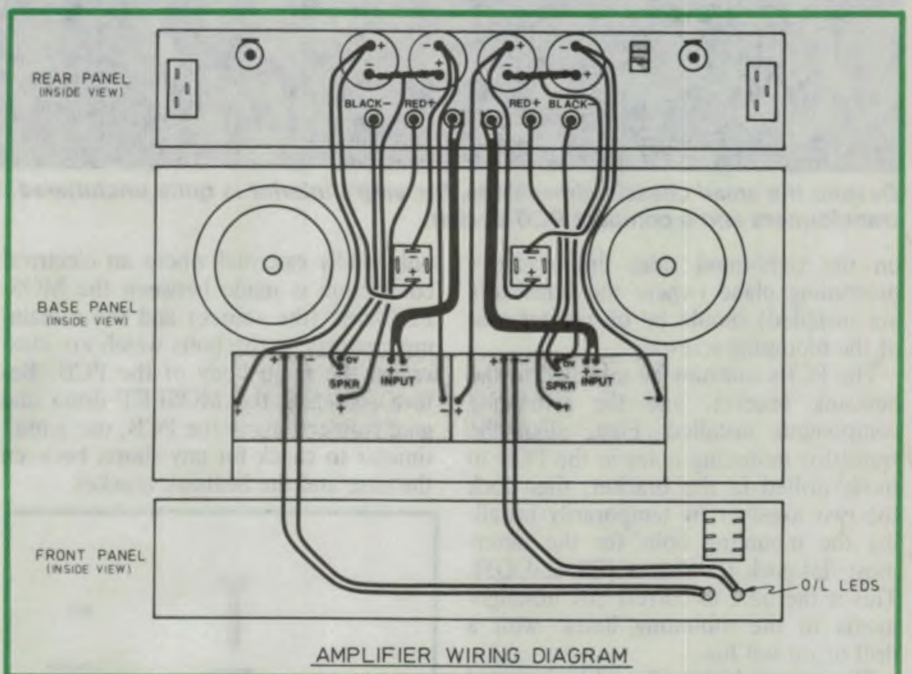
burn out, or survive long enough for the amplifier's mains fuse to fail. A burnt out cable would allow the amp's circuit to rise to the full voltage, which is then exposed at the rear terminals. Further to this, the signal source may *not* be earthed to the mains, allowing its circuitry, connectors and (possibly) chassis to be forced up to a lethal potential.

The solution of course is to connect the amplifier's 0V line directly to the mains earth. However, while this satisfies the safety aspect of amplifier earthing, the hoary old problem of earth loops may appear. This tends to happen when the circuitry of both the power amp *and* preamp are directly earthed to the mains, causing a double earth path to exist via the signal leads and mains earth. This will often induce a noticeable (and unacceptable) level of hum and noise at the amplifier's input, which is ultimately reproduced by the loudspeakers.

So if we must float one piece of equipment to break the earth loop, the preamp must be the logical candidate. By imagining the reversed situation of a transformer failure within the preamp, we would expect the interconnecting leads to easily outlast the mains fuse – which would be of a much lower rating than a power amp's mains fuse. Also, the preamp's transformer (if correctly chosen) has a far easier life, and is less likely to fail. Of course, the preamp's chassis would still be directly connected to the mains earth.



Above: The connections for mains wiring, transformer leads and chassis earth lug, shown separately for clarity.



The wiring diagram for the PCB and power supply interconnections. Note that in both of the above diagrams, the view is from inside the unit.

Construction

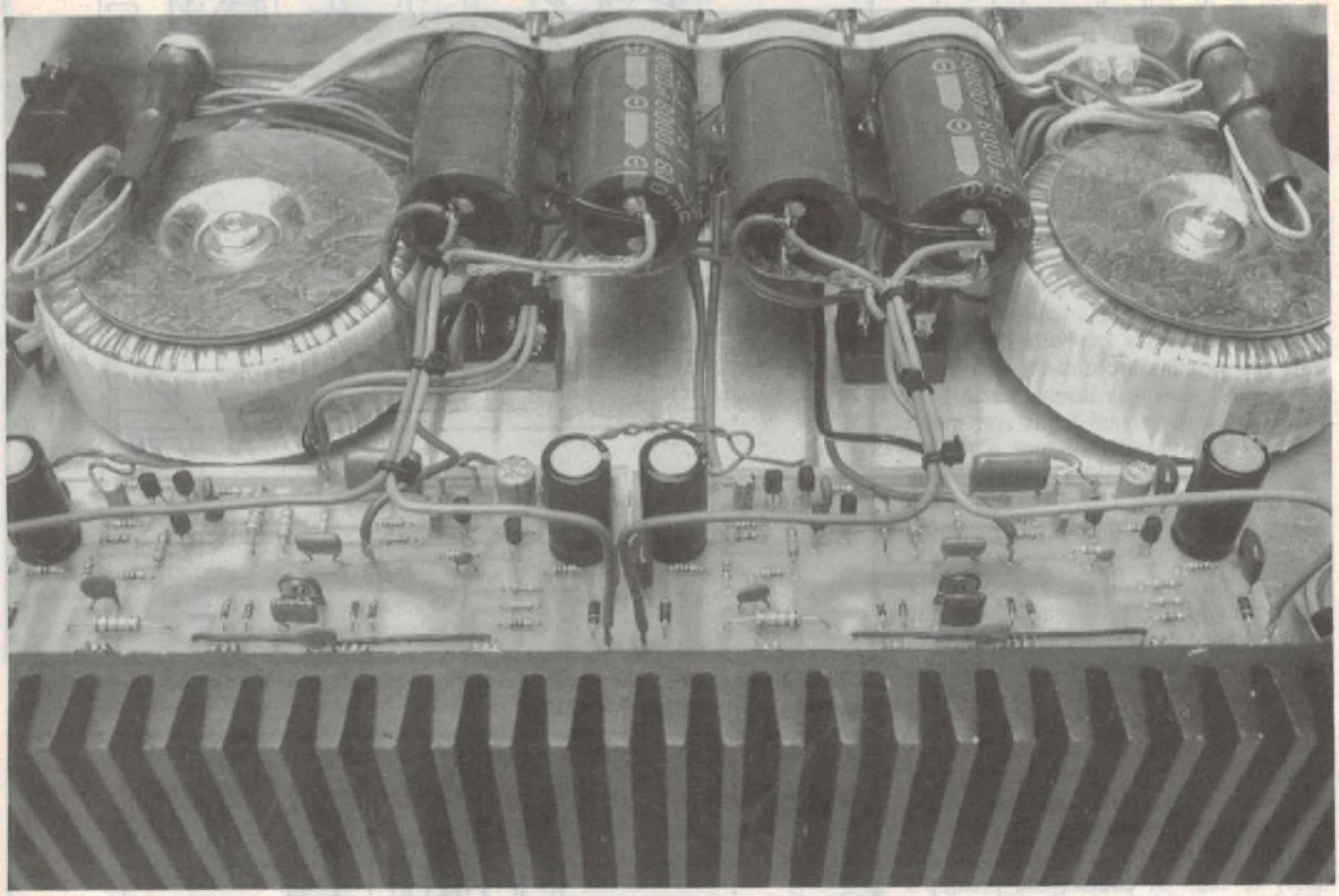
Having exorcised the safety problems, we can now move on with the construction, which happily, is quite straightforward. This is broadly divided into two tasks – mounting the components on the PCBs (coded 89ma11, with dimensions of 155 x 100mm), and assembling the power supply and associated wiring.

First, install the components on the PCB with the exception of the those which will be bolted to the heatsink (Q5 to Q12), or mounted on the copper side of the board (R14 to R21, and C9 to C11). As usual, work through from the lower profile parts through to the larger components, taking particular care with the orientation of any polarised devices – their connections are clearly identified on the component overlay.

Mount any higher powered resistors (R4, R11 and R22) slightly proud of the PCB, to assist their cooling. Don't forget to fit the wire link as depicted in the overlay – this must be of insulated wire, so as to avoid contact with adjacent component legs. Also note that C10 has a value of 470pF, rather than 390pF as shown in the circuit diagram published last month.

Make certain that you have correctly identified the 12V zener diodes ZD1 and ZD2, since they may look very similar to the small signal diodes D1 and D2. If there is any doubt, test all four components for reverse breakdown using a zener tester, or a power supply (greater than 12V), series isolating resistor (say 1k) and multimeter.

Next, bolt the right-angled bracket to the main heatsink assembly (the cabinet's front panel) with liberal amounts of heatsink compound applied to both mating surfaces. If the heatsink is lying on its face with the mains switch cut-out



Despite the small chassis dimensions, the amp's interior is quite uncluttered. This is mainly due to the use of toroidal transformers and a compact PCB design.

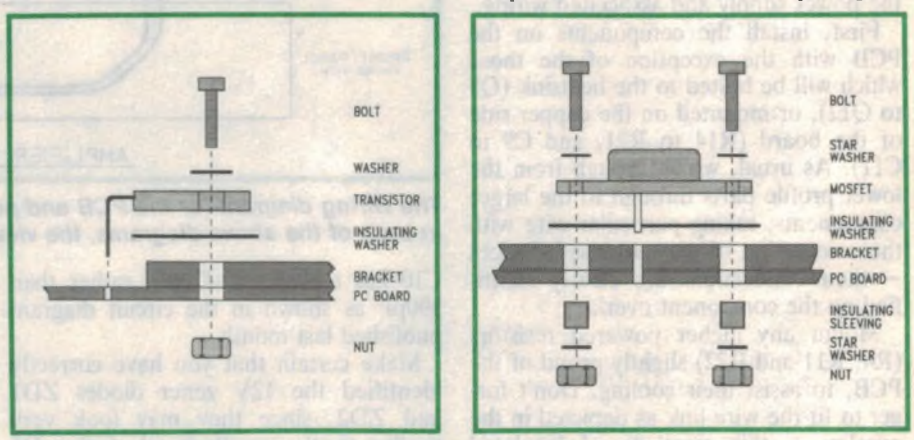
on the right-hand side, the bracket's protruding plane (where the transistors are installed) should be on the far side of the mounting screws.

The PCBs can now be attached to the heatsink bracket, and the remaining components installed. First, align the transistor mounting holes in the PCB to those drilled in the bracket, then lock the two together by temporarily installing the mounting bolts for the outermost flat-pack transistors (Q7 and Q5). This is the time to correct any misalignments in the mounting holes, with a drill or rat-tail file.

The output devices should be installed as shown in the accompanying diagram, with generous amounts of heatsink compound applied to both the MOSFET and the bracket mounting surfaces. The insulating sleeving for the mounting bolts should be cut to a length which is slightly greater than the heatsink bracket's thickness, and installed in the bolt holes when the MOSFET and insulating washer are in place.

While the diagram shows both bolts with 'star' or locking washers, they are only really essential where an electrical connection is made between the MOSFET case (the source) and the remaining circuitry – the bolts which are closest to the main body of the PCB. Before soldering the MOSFET drain and gate connections to the PCB, use a multimeter to check for any shorts between the case and the heatsink bracket.

The TO-126 package transistors (Q5 to Q8) are similarly bolted to the heatsink via insulating washers and thermal compound, however the mounting bolts do not require locking washers or sleeving. Note that the MOSFET insulating washers may have to be trimmed at the edge facing the TO-126 devices, or their respective washers will overlap, degrad-



Mounting details for the TO-126 (left) and T03 (right) power transistors. The mounting surfaces should be coated with heatsink compound, and the mica washers trimmed to size.

ing the thermal path. The easiest method here is to run an art knife along the edge of the (mounted) MOSFET, and bend the washer's protruding section up and down along the scored line, until the piece breaks off.

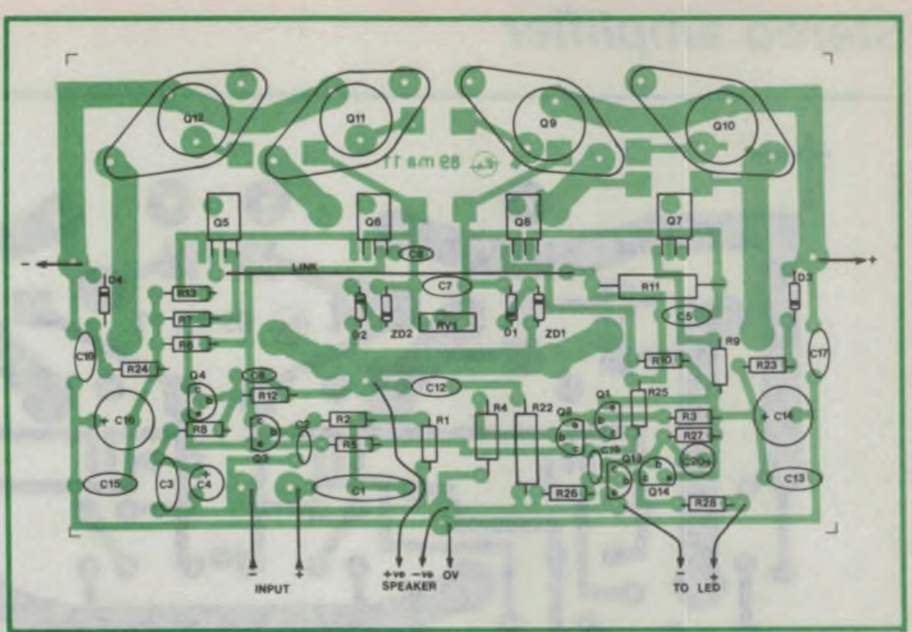
The TO-126 washers may be trimmed to the size of the transistor's body, before they are installed. The legs of each MJE340/350 should be bent at right angles so that the bolt hole and the PCB connections are correctly aligned, then the package bolted to the heatsink and the legs soldered in place – naturally, the body's metal surface (collector) must face the heatsink. Double check that you haven't confused the positions of the NPN and PNP transistors (the MJE340's and MJE350's respectively), and that their collectors are electrically isolated from the heatsink.

Now you are ready for the final PCB components, which mount directly on the copper side of the board. If the PCB tracks are not already solder plated and your iron has sufficient heating capacity, we would recommend presoldering the tracks which are to handle high currents. These are the wide tracks on the board which couple the power supply rails to the MOSFET drains, and the source connections to the output via the 5W source resistors. Avoid the use of prolonged heat in this procedure, since the PCB will become discolored or even damaged.

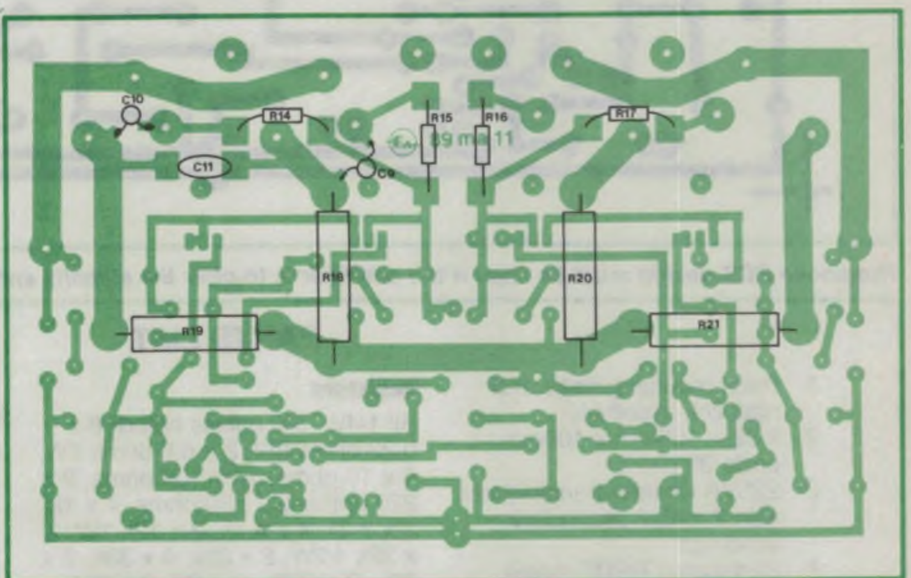
The four 5W resistors (R18 to R21) should be positioned as shown in the overlay, but with a few millimetres of air-space between their bodies and the PCB. The four gate resistors (R14 to R17) and compensation capacitors (C9 to C11) may then soldered in place – shape the leads so that they cannot come into contact with any other tracks or the mounting bolts. Also, avoid overheating the capacitors, since the two small ceramic devices in particular (C9 and C10) are easily damaged.

Now that the PCB is completed, take a moment to check your work against the component overlay. Take particular note of the orientation of any polarised components – for example, the direction of both the diodes and electrolytic capacitors are easily transposed.

The final construction stages involve the chassis, power supply and its associated wiring. First, assemble the case (including the front panel and PCB assembly), and mount the remaining hardware and components, with the exception of the four 8000uF 75V filter capacitors – if they are installed now, the bridge rectifier (and its wiring) would be inaccessible. Also, the earthing lug and its associated wires should be securely attached to a chassis bolt (as shown), before the transformers are installed.



Above: The component overlay for the non-copper side of the PCB. Take care not to confuse the two types of TO-126 transistors.

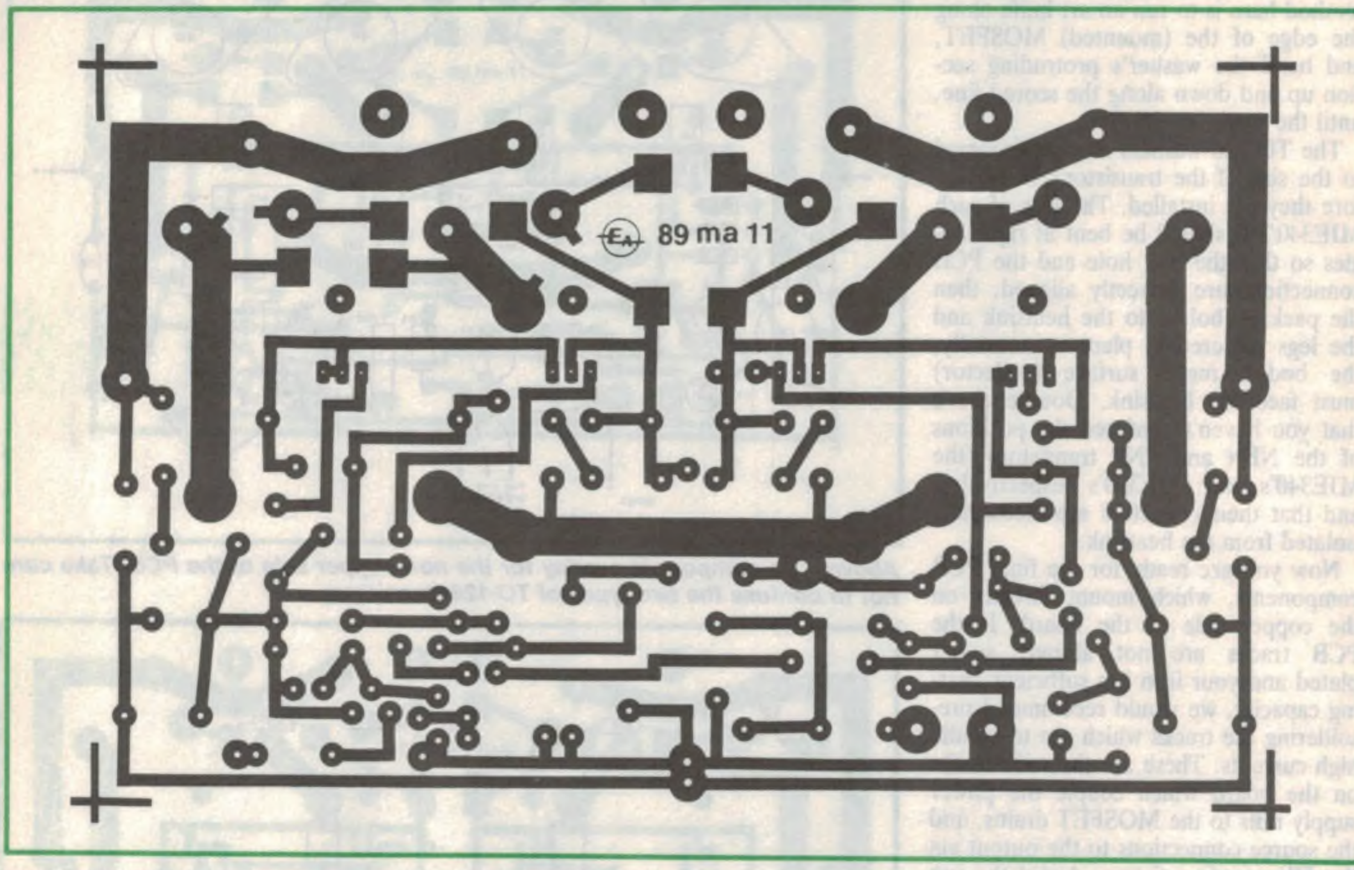


The component overlay for the copper side of the PCB. Don't overheat the small ceramic compensation capacitors C9 (330pF) and C10 (470pF).

The input and output connectors are arranged in the cabinet's rear panel as depicted in the wiring diagram. Note that the RCA sockets should be insulated from the panel by the addition of plastic sockets and fibre washers – the plastic sockets will need to be trimmed to match the thickness of the rear panel.

When mounting the two mains transformers, don't overtighten the locating bolts or the cabinet's bottom panel will be distorted – the supplied rubber washers will hold each transformer quite firmly with only a moderate tension on its mounting bolt. Also, make sure that the point where the flying-leads exit the transformer's body is facing towards the rear panel.

Once all of the various parts are installed (still with the exception of the filter capacitors), the wiring between the PCB and the chassis mounted components may be completed. If you are not using PCB stakes, remove the front panel/PCB assembly from the case, and attach suitable lengths of cable to the various pad connections on the board. Of course, the input leads should be shielded, and the power supply and speaker connections made with heavy



The above PCB design must be used if the amplifier is to offer the stability and high performance of the prototype.

PARTS LIST

- 1 Rack mounting case and heatsink assembly
- 2 PCBs, 155mm x 100mm, code 89ma11
- 2 225VA toroidal transformers, with 2 x 45V secondary windings
- 1 Illuminated DPDT mains rocker switch
- 1 Panel mount IEC plug (male) with protective cover
- 1 Panel mount IEC socket (female) with protective cover
- 1 IEC protective cover for mains switch
- 1 IEC mains power lead
- 2 3AG panel mount fuse holders
- 2 2A slow-blow 3AG fuses
- 1 Length of mains rated terminal strip

1 x solder lug; 4 x rubber feet; 4 x binding posts, 2 red and 2 black; 2 x panel-mount RCA sockets and insulators (5/16″ plastic sockets and 1/4″ fibre washers)

Resistors

All 1/4W, 5% unless noted: 8 x 0.22 ohms 5W, 2 x 6.8 ohms 1W, 4 x 10 ohms, 10 x 100 ohms, 8 x 220 ohms, 2 x 680 ohms, 4 x 1k, 2 x 3.3k, 4 x 4.7k, 2 x 12k 1W, 2 x 22k 1/2W, 2 x 22k, 4 x 33k, 2 x 82k, 2 x 330k, 2 x 1M, 2 x 200 ohm miniature vertical trimpots

Capacitors

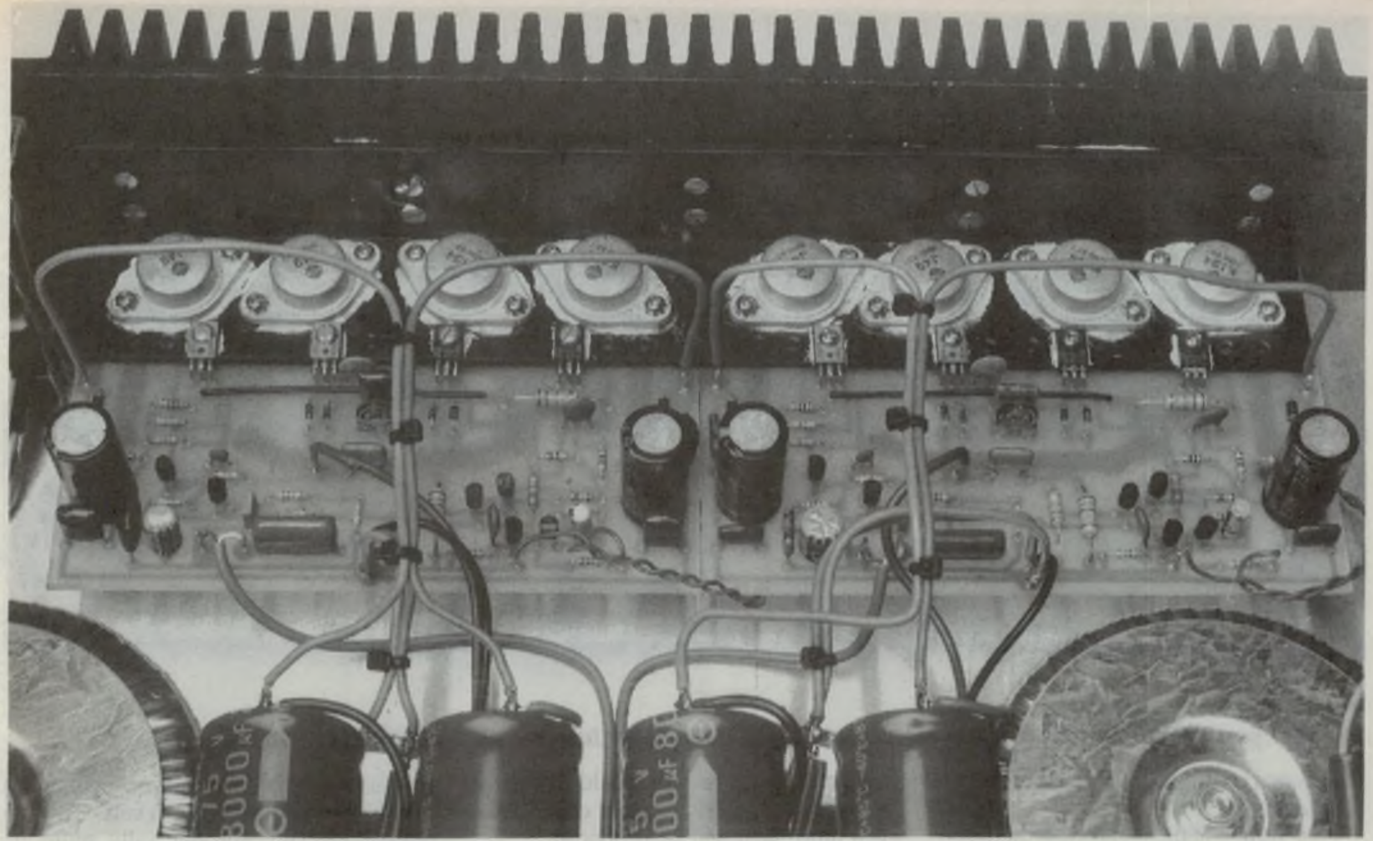
- 2 10pF ceramic
- 2 18pF 100V ceramic
- 2 330pF ceramic
- 2 470pF ceramic
- 2 1nF metallised polyester
- 4 10nF metallised polyester
- 2 22nF metallised polyester
- 12 0.1uF metallised polyester
- 2 0.22uF metallised polyester
- 2 0.47uF metallised polyester
- 2 1uF 63VW PCB electrolytic
- 2 47uF 16VW PCB electrolytic
- 4 100uF 100VW PCB electrolytic
- 4 000uF 75VW chassis mount electrolytic

Semiconductors

- 10 BC556 PNP transistors
- 2 BC546 NPN transistors
- 4 MJE350 PNP transistors and insulating kits
- 4 MJE340 NPN transistors and insulating kits
- 4 2SK134 power MOSFETs and insulating kits
- 4 2SJ49 power MOSFETs and insulating kits
- 2 25A diode bridges, 2504 or similar
- 4 1N4002 diodes
- 4 1N914 diodes
- 4 12V 400mW zener diodes
- 2 5mm red or yellow LEDs

Miscellaneous

Nuts and bolts, washers, tinned copper braid, (very) heavy duty hookup wire, light duty hookup wire, shielded audio cable, cable ties, heatsink compound, heat-shrink tubing for fuse holders.



Another internal view of the Pro Series One. The power supply leads should be run using heavy duty wire – the unusual routing arrangement provided a slight improvement in the final distortion figures.

duty cable. Don't forget to connect the overload LEDs, which only require light duty hookup wire.

When the input/output sockets have been terminated, connect the transformer leads to the bridge rectifiers (as shown in the wiring diagram) and attach short lengths of heavy duty wire to the rectifier's '+' and '–' lugs. These cables will connect to the filter capacitors, which may now be installed.

The capacitor mounting brackets will fit neatly into the rear panel in only one direction – with the harness (and locking bolt) facing down, towards the input/output sockets. Since the locking harness will be inaccessible, the capacitors should be correctly aligned within their brackets, before they are installed. For the appropriate orientations, see the wiring diagram.

Then fit lengths of braid between the capacitor terminals as shown, and solder the transformer wires, common (0V) line and chassis earth to the braids' centre point. The power supply leads between the capacitors and the PCB may be shaped and tied together, as shown on the prototype – note that the leads are held at a considerable distance above the plane of the PCB. This method provided a slight reduction in the prototype's output distortion (around 0.001%), and appears to reduce the interference effects created by the large pulse currents flowing in the supply leads.

The 240V wiring of the Pro Series One is a little more complex than other kit amplifiers, due to the use of dual transformers and IEC mains connectors. Follow the wiring diagram carefully, and take particular care not to transpose the active and neutral wires in their path between the IEC plug and IEC socket. The lead carrying the 240V supply from one side of the amp to the other should run along the top of the filter capacitors, rather than underneath near the input leads.

It is vitally important that any exposed 240V connections are well covered with a sturdy insulating material. In the prototype version we covered the two fuseholders with heatshrink tubing, and the IEC connectors and mains switch with close fitting plastic boots. These boots were supplied with the panel mounting IEC connectors.

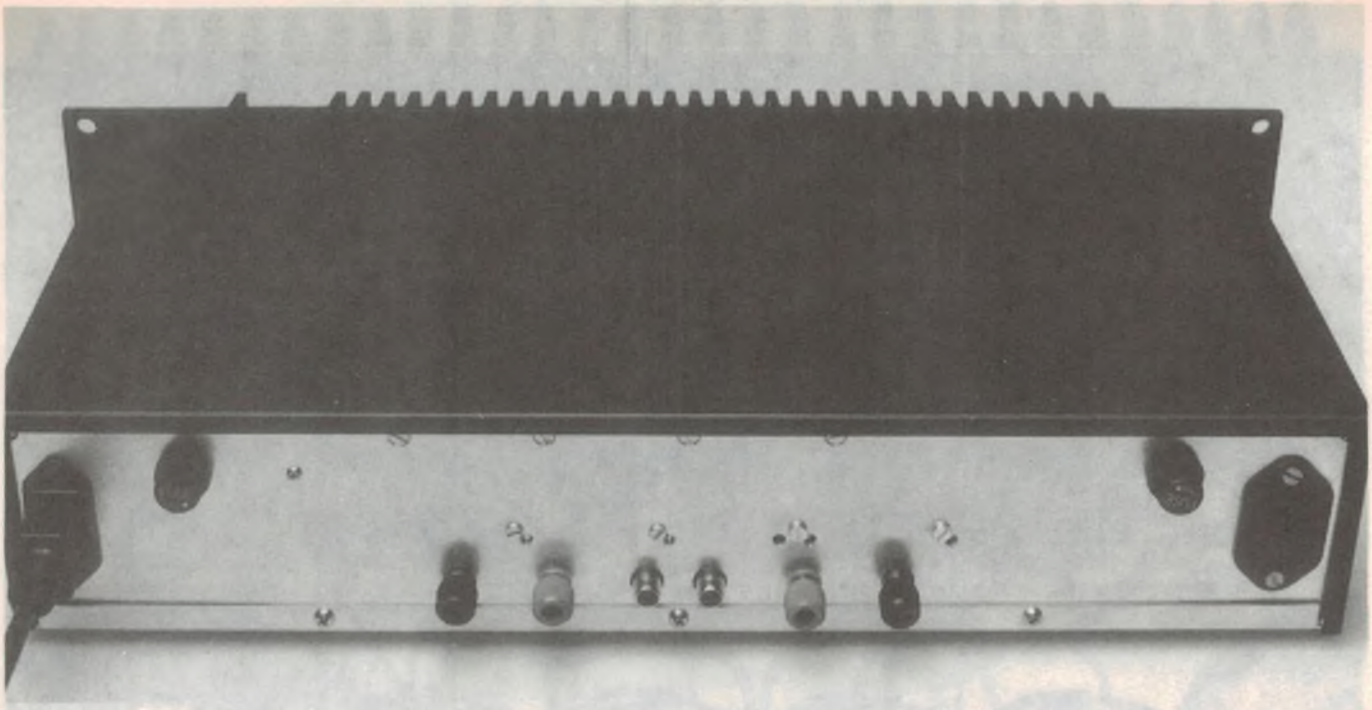
Finally, tidy up your wiring and double check for the correct connections, then attach a set of rubber feet to the bottom panel. Position one pair of feet close to the transformer mounting bolts, and the other near the front panel at the extreme edges of the case.

Powering up

Before applying power to the unit, install 10 ohm resistors in series with each supply rail, and rotate RV1 fully anticlockwise. Visually check this position on the trimpot since it may not have an end-stop, allowing the wiper to slip past the minimum resistance point to a maximum setting – or in practice, the maximum quiescent current!

Then install the fuse for only one channel, and apply mains power. If the 10 ohm resistors go up in smoke, turn the unit off and thoroughly re-check your work. However if all is well (naturally!), check the power supply rail voltages and the amp's output voltage – these should be close to +/–69 volts, and 0V (+/–30mV) respectively. By the way, in the circuit diagram published last month, the collector of Q6 should have been labeled with a voltage of –0.3V rather than (+)0.3V.

To set the amplifier's quiescent current, monitor the voltage across one of the 10 ohm resistors and adjust RV1 for a reading of 0.8 volts. Once you are happy with the setting, turn the amp off and install the other fuse – then turn the unit back on and repeat the entire procedure for the other channel. Check the quiescent current of both channels over a period of about ten minutes and



The rear panel features neat IEC connectors and a separate mains fuse for each channel.

if necessary, readjust RV1 for the correct reading.

This adjustment is far less sensitive (or critical) than the equivalent setting on a bipolar amp, and will increase by a significant amount as the amp warms up. However once each MOSFET reaches an idling current of around 100mA (say after the amp has delivered a substantial level of power), the NTC effect will come into play, causing the output stages to thermally self-stabilise. Nevertheless, if you feel that the general (idling) temperature of the heatsink is too high, back off the quiescent current adjustment (RV1) by a small amount – but note that this will slightly compromise the distortion figures.

Installation & use

While the noise and distortion components generated by this power amplifier are almost immeasurable, the signal source (preamplifier, etc) could easily compromise the end result. In short, the matching preamp should offer a similar performance level (or better) to that of the main amplifier – fortunately we have such a preamp under development in our labs. Stay tuned to *Electronics Australia* for this new project, which will form the next part in our Pro Series of audio components.

The first point to watch when installing the present amplifier is ventilation. The heatsink/front panel can generate a surprising amount of heat if the amp is working hard, and must have an unrestricted airflow. As you would expect, if the amplifier is driving four ohm loads, even more heat will be produced.

This design is mainly directed at a high quality hifi environment, where the loudspeakers have a nominal impedance of 8 ohms and the signal source has the usual dynamic qualities (that is, music produced by CDs, records etc). If however, the amp is to be used in a more rigorous environment, such as studio monitoring or even sound reinforcement (PA) applications, extra cooling may be required. This is the only real limitation for such uses, since the amp is extremely rugged and takes four ohm loads in its stride. In fact on our test bench, we regularly ran the amp up to full power into two ohm loads!

Another problem encountered when installing preamp/power amp combinations is the tendency for hum to be induced in the preamp, when it is stacked on top of the power amp. This is due to the presence of the large field generated by the power amp's heavy duty mains transformer(s), which may effect some of the more sensitive preamp circuits. However this is less likely to be a problem with our new power amp design, since we've used toroidal transformers which produce far less interference than conventional types.

Next on the compatibility adgenda is the clicks and thumps which may be produced by the loudspeakers, when the system's 240V supply is turned on or off. These transient signals are mainly produced by the preamp circuitry, as its various internal capacitors charge to their nominal voltage levels. If the preamp *doesn't* automatically mute its output for a few seconds after power is applied, the power amp should not be activated at the same time – so in this situation, wait a few seconds before you switch it on.

Due to its symmetrical circuit design, the power amp itself will come to life quite smoothly, with just a slight wobble from the speaker cones. However if you have a preamp with the muting function, and significant clicks are still heard from the loudspeakers, try fitting a 0.1uF capacitor with a 240V AC rating across the mains supply (active to neutral) at the terminal strip. Don't forget to cover its legs with protective sleeving.

As a final point, those purists who would like an even lower distortion figure may wish to raise the quiescent current to around double the recommended figure – a setting of about 2 volts across the 10 ohm resistors. While this eliminates the last minute traces of crossover distortion, the amp will run at a considerably higher idling temperature. However if you can hear the difference, your ears are far more finely tuned than ours! In any case, the amplifier will certainly sound a little better after an initial warm-up period.

That's all we have space for in this issue. Next month we will present a comprehensive faultfinding guide for the Pro Series One, and a general discussion of faultfinding in audio amplifiers.

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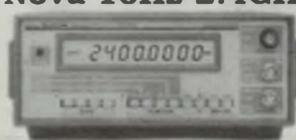

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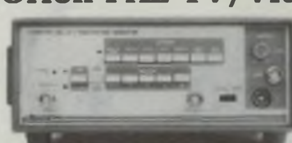

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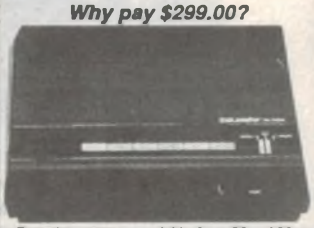

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M 3065	30 + 30
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M 3080	45 + 45

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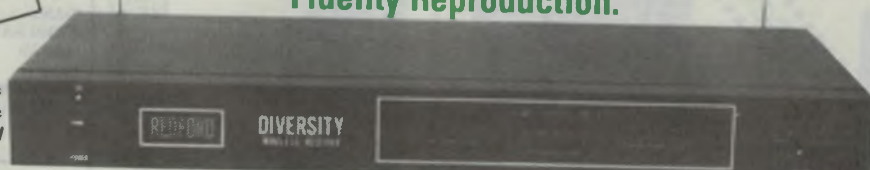

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Please Note: *4 different operating frequencies are available (you will need to specifically nominate a desired frequency only if the equipment is being used in proximity with other Redford systems on the 200MHz band. Please specify if you have preference.*

Freq. available: 202.1MHz, 202.4MHz, 202.5MHz and 203.7MHz

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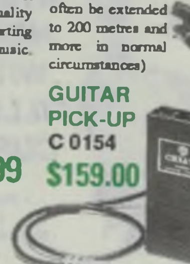

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C 0160
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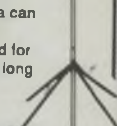

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VALUE

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Specifications: ● **Raintight**, outdoor, all weather operation ● **Operation Time:** Adjustable 1-20 mins ● **Sensitivity:** Adjustable 20' - 50, 30 beams ● **Aimable** to desired direction with 2 ball joints ● **Switching Capability:** 500W max. incandescent ● **Operation Modes:** OFF, AUTO, TEST, MANUAL, ON.

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See EA April/May 89

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Perfect for workvan, toolbox or work bench.

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(See Silicon chip Oct 88)

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EA June 1989

VALUE

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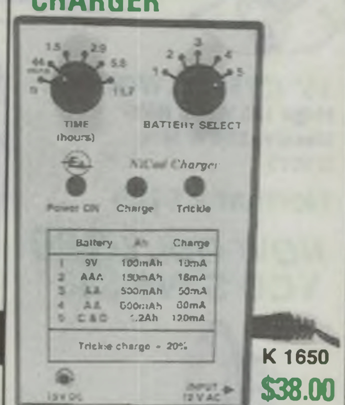

Battery	Ah	Charge
1 9V	100mAh	10mA
2 AAA	150mAh	18mA
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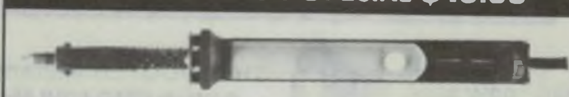

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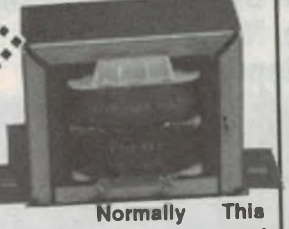

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M 2852	12.6V	CT	300mA	$7.65	$6.95
M 2853	12.6V	CT	500mA	$8.95	$8.45
M 2855	30V	CT	150mA	$6.95	$6.50
M 2154	0,12,15,18V at		1Amp	$12.50	$11.50
M 2156	6,9,12,15V at		2Amps	$17.95	$16.50
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(See Silicon Chip July '89)

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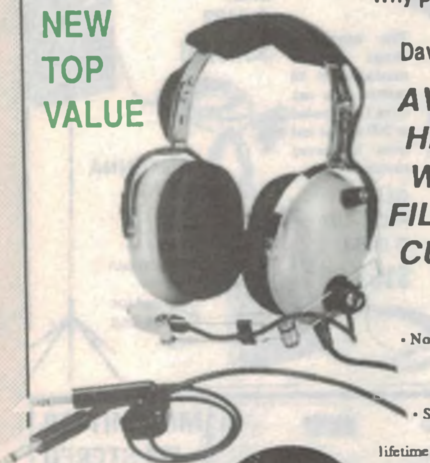

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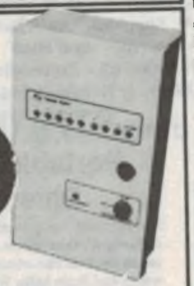

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Features: ● Alarm has 8 separate input circuits - 8 sectors can be monitored independently ● Each input circuit is provided with an indicator LED and a sector ON/OFF switch. ● Individual sector isolation allows the user to be in some areas of the premises while others remain protected, eg Inside OFF, Ouside ON. ● Inputs accept both normally closed and normally open sensors. ● Two inputs provided with an entry delay (between 10-75 seconds). ● Internal trip warning buzzer - alerts owner/occupant of pending alarm operation - great for the "forgetful" amongst us. This buzzer is presettable between 5 and 55 seconds prior to alarm. ● Unique circuit detects automatically when either N/O or N/C loops are either open circuit or dead short, eg someone is trying to bridge reed switches etc. ● Switched output can be used to send a silent alarm through an auto-dialler circuit or similar.

(See EA Jan/Feb'85 or our 1989 Catalogue for full features)

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Construction Project:

Simple FM receiver for the 6m band

Here's part 1 of another project designed to encourage home construction of amateur radio equipment. Construction details will follow next month.

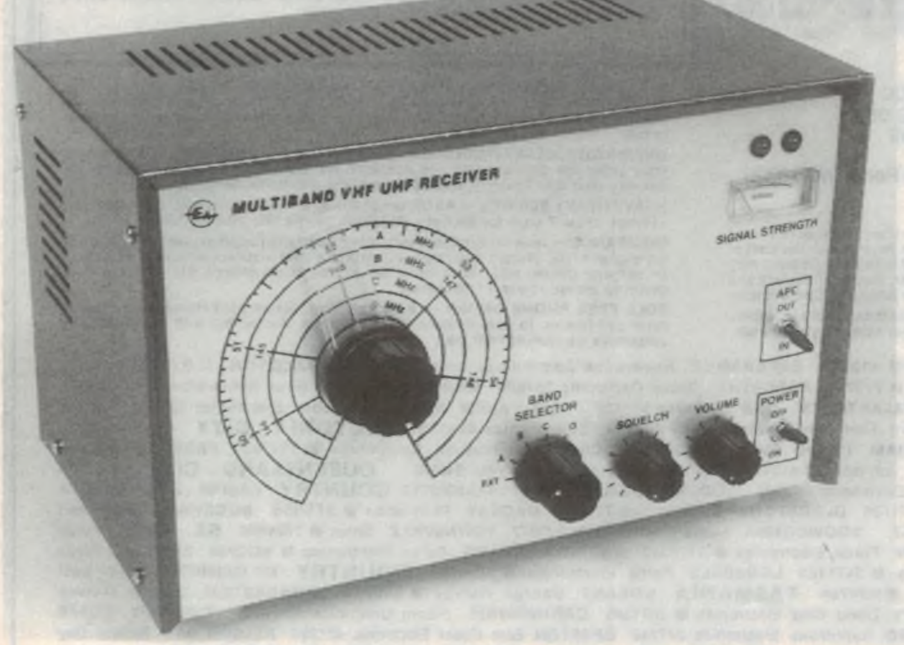
Listen to amateur radio on the 50 to 54MHz band, with this very simple unit. Most of the receiver functions are performed by a single IC, the new MC3363. This project will also form a basic 'tunable IF' receiver module for future converters, to cover other amateur bands.

by DEWALD DE LANGE

Integrated circuits that fulfill the IF (intermediate frequency) and demodulation functions of a receiver have been around for many years. More recently a number of manufacturers have produced devices that directly accept RF signals in excess of 100MHz. This signal is internally mixed down to one or two IF stages before detection of the audio information.

If you buy a small portable AM/FM radio these days, it quite possibly contains only one semiconductor component. With only a small number of external components added, the final product can be very compact. Hence the proliferation of radios that are built into some pocket size format, or into headphones.

Some of these ICs are only suitable for narrowband FM (deviation less than +/–5kHz), as opposed to the broadband FM used for broadcasting (deviation equal to +/–75kHz). It is one of the former devices that we will be using for this amateur radio receiver.



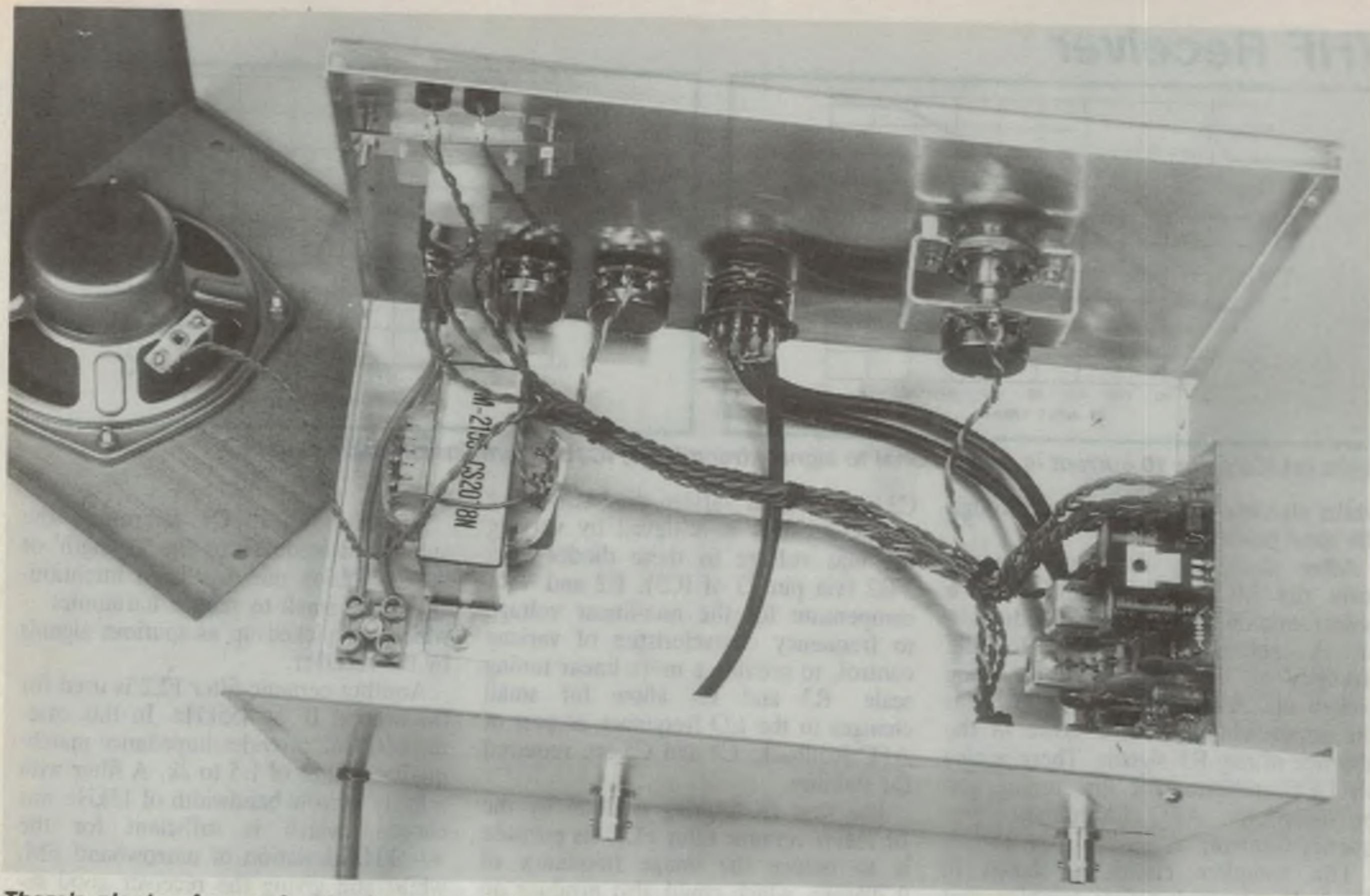
We are referring to the MC3362/3/4 series of ICs from Motorola. These are complete dual conversion superheterodyne FM receivers.

Starting with the MC3362, it has two mixers, two IF amplifiers, two local oscillators (LO) – the first one with varicap tuning – limiting, a detector and signal strength indicator. The MC3364, in addition to these functions, offers audio muting. To the MC3363 is added an RF pre-amplifier.

These ICs are intended for cordless telephones, CB radio and other narrowband communication applications. The specifications give an input frequency limit of 200MHz, with higher frequencies possible if driven by an external local oscillator. We therefore thought it very suitable as an amateur radio receiver, starting with the 50 to 54MHz band.

Although the MC3363 offers the largest number of functions, it is unfortunately only available as a surface mounting device. Eventually we may all have to work in this small format, but it is unlikely that the home constructor will be prepared for it at this stage. We therefore decided to use the MC3362, which is available in the 'old' DIP (Dual In-line Package) format.

This construction project forms part of an ongoing series of basic modules for newcomers to amateur radio. Using this receiver as a tunable IF, in future articles we will be looking at frequency converters, to cover the other amateur



There's plenty of room inside the case of the receiver, to fit in converter boards for additional bands. The speaker mounts in the lid of the case, as you can see.

bands. This will include a converter that can be used as a receiver for the 2m FM transmitter, published earlier.

Circuit operation

The block diagram in Fig.1 gives an overview of the complete receiver. A separate low-noise RF pre-amplifier is used for increased sensitivity. The bulk of the other receiver functions are performed by the MC3362, shown enclosed by a dotted line.

The first local oscillator (LO) is tuned to the difference between the received frequency and the first IF of 10.7MHz. For example, with a 50MHz input signal, the first LO frequency would be 39-.3MHz. The second LO frequency is fixed at 10.245MHz, being the difference between the first IF and the second IF of 455kHz.

To keep the circuit as simple and cheap as possible, we opted for the older style manual tuning, rather than synthesizing the first LO frequency. The manual control does at least give a more direct 'feel' for what is on the air,

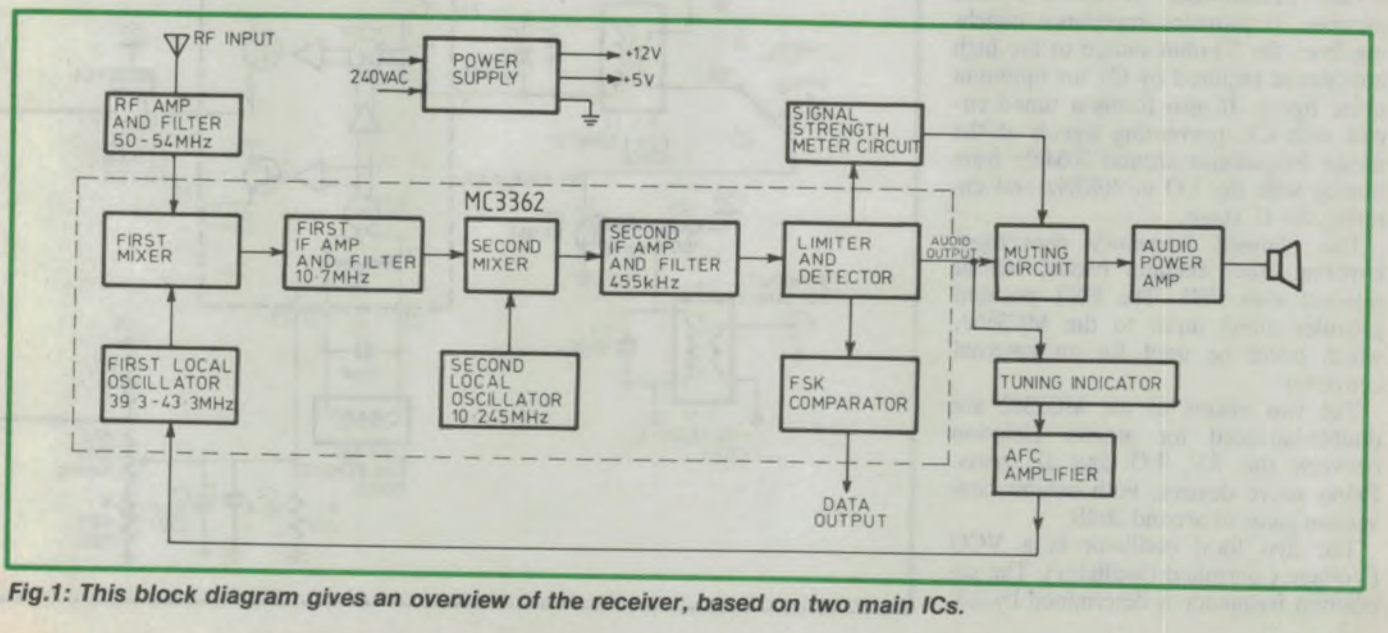


Fig.1: This block diagram gives an overview of the receiver, based on two main ICs.

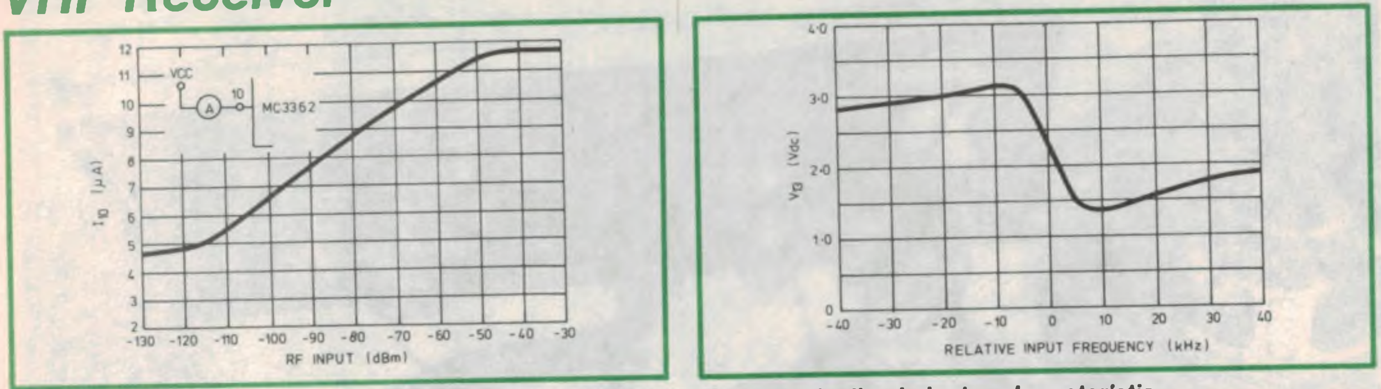


Fig.3: (a) IC3's pin 10 current is proportional to signal strength; (b) IC3's discriminator characteristic.

whilst also making a quick scan through the band possible.

After detection, the audio output from the MC3362 is amplified by a power amplifier for driving a loudspeaker. A metering circuit indicates the strength of the signal that is being picked up. A muting circuit allows for the suppression of audio noise in the absence of any RF signals. There is also an LED indicator for fine tuning and provision for AFC (Automatic Frequency Control).

The complete circuit is shown in Fig.2. It may look rather complex, but the circuitry outside the MC3362 is actually quite simple. Although the internal operation of the IC may not be of importance to the constructor, we included the schematic details for a better understanding of the overall receiver operation.

The RF signal from an antenna is firstly amplified by Q1. The MOSFET BF981 is used for this purpose because of its low noise figure, typically around 0.7dB. Transformer L1 serves a dual purpose. It provides impedance matching from the 50 ohm source to the high impedance required by Q1 for optimum noise figure. It also forms a tuned circuit with C1, preventing signals at the image frequencies around 30MHz from mixing with the LO at 40MHz and entering the IF stage.

The planned frequency converters, covering other amateur bands, will be selected with SW1. The EXT position provides direct input to the MC3362, which could be used for an external converter.

The two mixers of the MC3362 are double-balanced for greater isolation between the RF, LO and IF ports. Being active devices, both exhibit conversion gains of around 20dB.

The first local oscillator is a VCO (Voltage Controlled Oscillator). The oscillation frequency is determined by L3, C3 and internal varicap diodes. Tuning of the receiver is achieved by varying the bias voltage to these diodes with VR2 (via pin 23 of IC3). R2 and VR1 compensate for the non-linear voltage to frequency characteristics of varicap control, to provide a more linear tuning scale. R3 and R4 allow for small changes to the LO frequency as part of AFC feedback. C4 and C5 are required for stability.

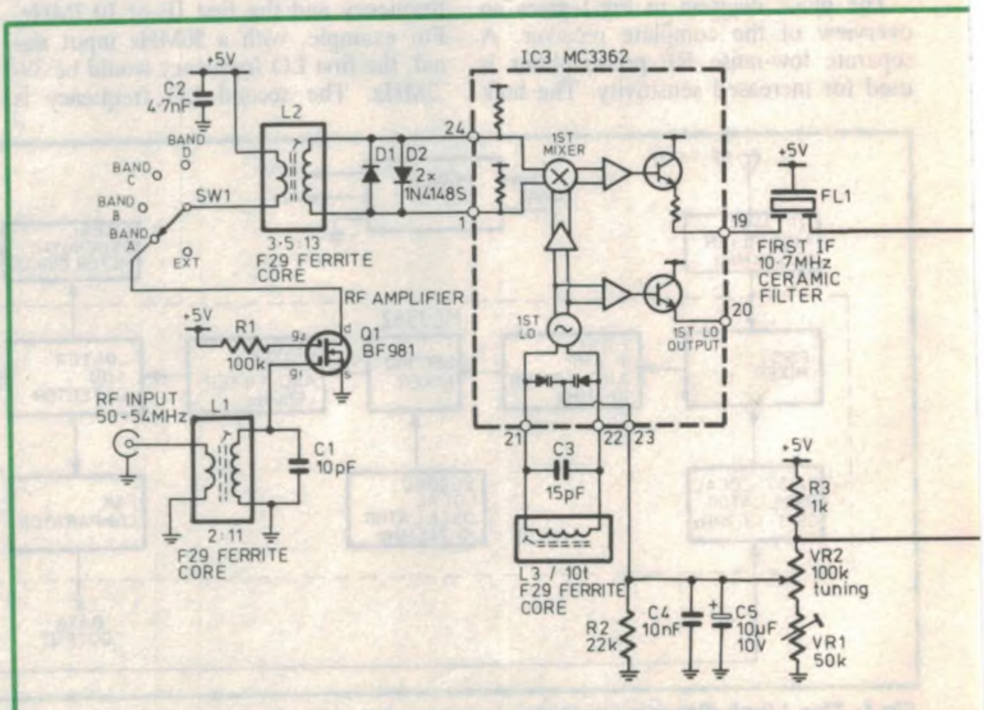
The first IF filtering is done by the 10.7MHz ceramic filter FL1. Its purpose is to reduce the image frequency of 9.79MHz, which could also produce an IF of 455kHz, when mixed with the second LO at 10.245MHz. The MC3362 provides the correct source and load impedances for a 330 ohm ceramic filter.

The second LO frequency is set to 10.245MHz by crystal X1 and the associated capacitors C6 and C7 at pins 3 and 4 of IC3.

The ratio C6 to C7 determines the amount of feedback or the 'strength' of the oscillation and has been intentionally made small to reduce harmonics – which are picked up as spurious signals by the receiver.

Another ceramic filter FL2 is used for the second IF at 455kHz. In this case, the MC3362 provides impedance matching for a filter of 1.5 to 2k. A filter with a fairly narrow bandwidth of 15kHz was chosen, which is sufficient for the +/–5kHz deviation of narrowband FM, whilst still giving the receiver good selectivity.

C8 and C9 at pins 8 and 9 of IC3 provides decoupling for the limiter circuit. The tuned circuit at pin 12, formed by L4, VC1, C11 and R6 is part of the quadrature detector of the MC3362 operating at 455kHz. R6 determines the



peak separation of the detector, or the frequency bandwidth over which detection takes place, as indicated by Fig.3(b). The 68k value is an optimum for a peak FM deviation of +/–5kHz.

The current sunk at pin 10 of the MC3362 is proportional to the amount of 'clipping' taking place in the limiter stages and is therefor an indication of signal strength – see Fig.3(a). This diagram is of course off-set by the gain of our RF preamp. The voltage across R5 is amplified by IC4a to drive the signal strength meter M1. The zero position of the meter is set with VR3.

Audio muting is provided with IC4b, which compares the output of IC4a with the level of VR4, the squelch control. If VR4 is set to below the output voltage of IC4b, the output of IC4c swings towards the +12V supply and D4 becomes reverse biased, breaking the audio signal path between the MC3362 and the power amplifier IC5. With the output of IC4b near ground level, diode D3 is reverse biased and the audio signal passes uninterrupted. C12 slows down the rate at which muting takes place.

The detected audio output of the MC3362 at pin 13 passes through a 5kHz low pass filter consisting of R16 and C14 before attenuation by the volume control pot VR5 and power amplification by IC5.

It can be seen from Fig.3(b) that the FM detector (or discriminator) has to operate around the centre of its range or the detected audio signal will be clipped on one side. This means the receiver must be tuned to the exact centre frequency of the incoming signal. Provision is therefore made for monitoring of the detector's operating level. The average signal on pin 13 is obtained by R10 and C13 and amplified by IC4d. When the output at pin 13 is at the correct level of 2.25V, the output of IC4d is at 6V and both LED1 and LED2 are driven equally strongly.

The output of IC4d is further amplified by IC4c and used to automatically adjust the first local oscillator and so keep the FM discriminator in the centre of its range. This AFC (Automatic Fre-

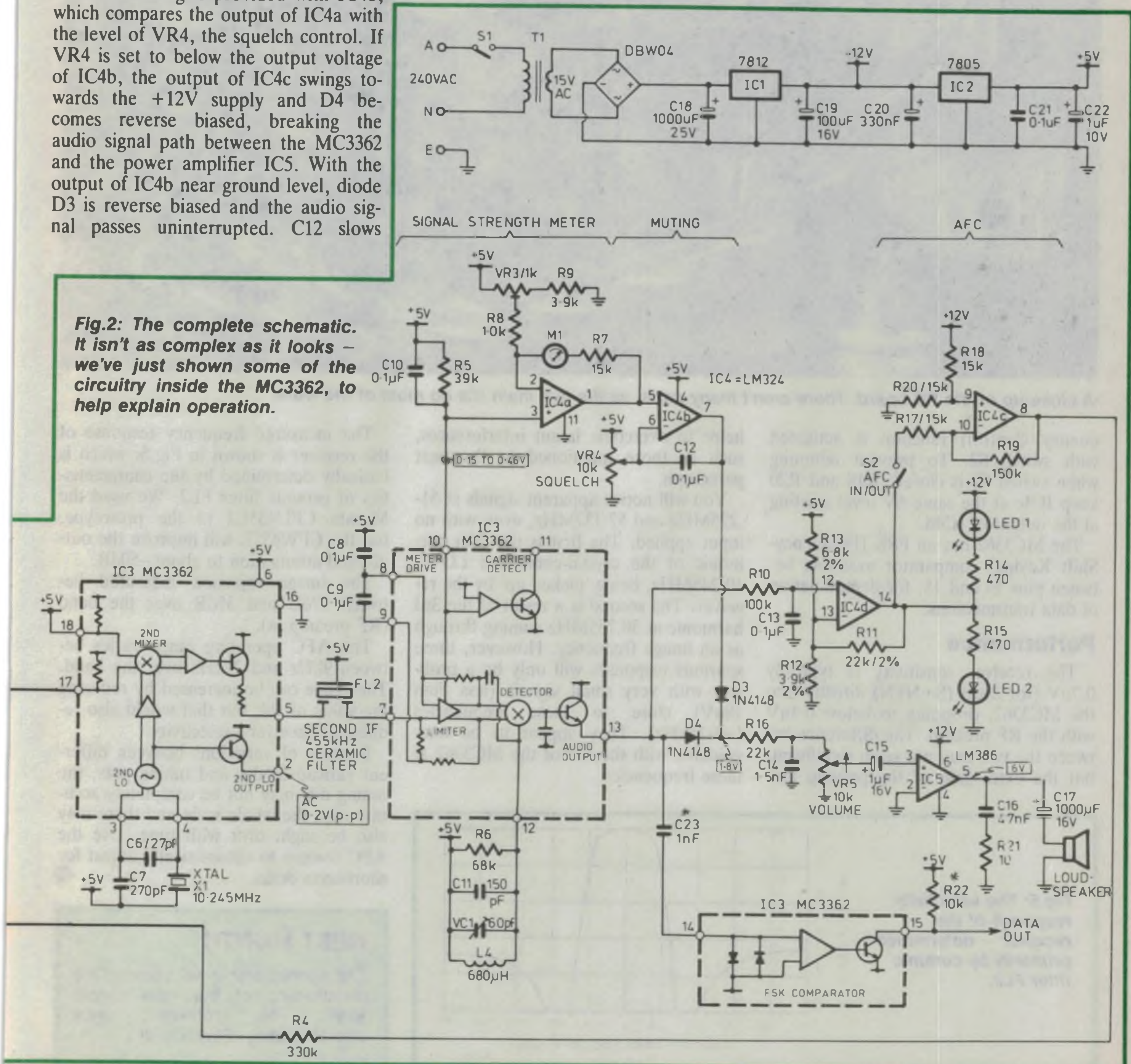
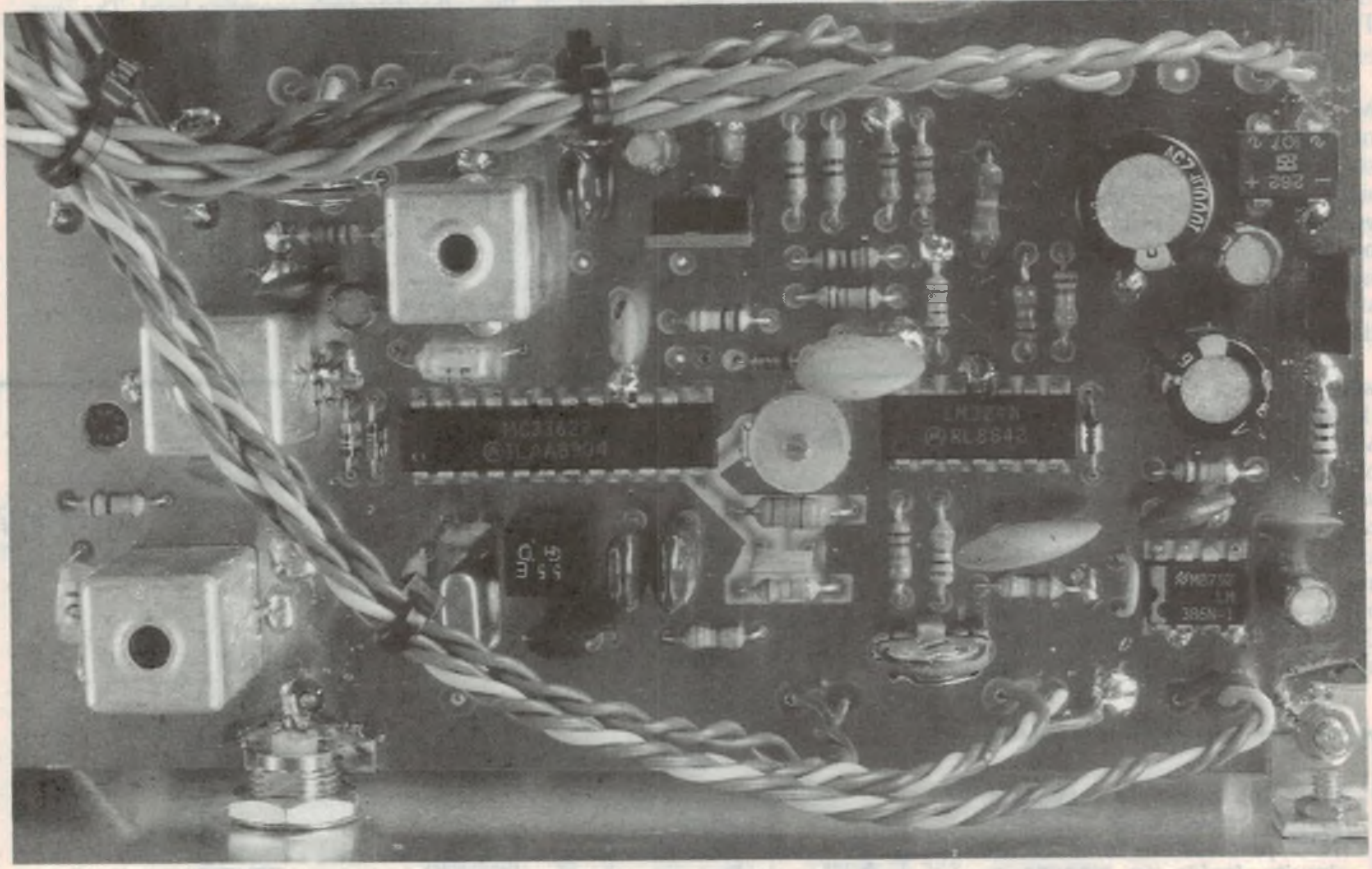


Fig.2: The complete schematic. It isn't as complex as it looks – we've just shown some of the circuitry inside the MC3362, to help explain operation.



A close-up of the PC board. There aren't many parts, as the two main ICs do most of the work.

quency Control) function is activated with switch S2. To prevent detuning when switch S2 is closed, R18 and R20 keep IC4c at the same 6V level existing at the output of IC4d.

The MC3362 has an FSK (Frequency-Shift Keying) comparator available between pins 14 and 15, for demodulation of data transmissions.

Performance

The receiver sensitivity is typically 0.7uV (for 20dB (S+N)/N) directly into the MC3362, dropping to below 0.4uV with the RF preamp. The difference between the two may not seem significant, but the extra gain of the preamp also helps to overcome latent interferences, such as those mentioned in the next paragraph.

You will notice apparent signals at 51.225MHz and 52.137MHz, even with no input applied. The first is the fifth harmonic of the crystal-controlled LO at 10.245MHz, being 'picked up' by the receiver. The second is a result of the 3rd harmonic at 30.735MHz coming through as an image frequency. However, these spurious responses will only be a problem with very small signals (less than 10uV) close to these frequencies (+/–15kHz). They appear to be unavoidable with the use of the MC3362 at these frequencies.

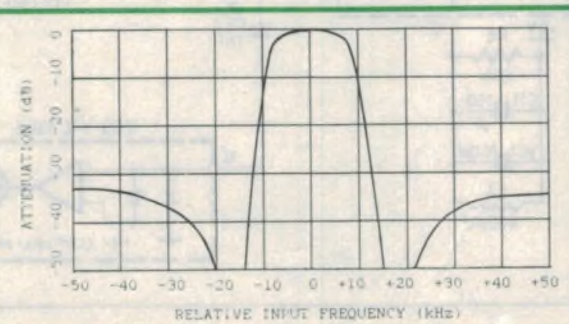
The measured frequency response of the receiver is shown in Fig.5, which is basically determined by the characteristics of ceramic filter FL2. We used the Murata CFU455E2 in the prototype, but the CFW455E will improve the out-of-band attenuation to about –50dB.

The image rejection measured between 27dB and 35dB over the band (RF preamp in).

The AFC operating range varies between 9kHz and 29kHz over the band. The range can be increased by reducing the value of R4, but that would also reduce the receiver's selectivity.

Because of variations between different varicap diodes and tuning pots, the tuning dial may not be completely accurate over the whole scale and there may also be slight drift with time. Use the AFC feature to automatically adjust for short-term drifts.

Fig.5: The selectivity response of the receiver – determined primarily by ceramic filter FL2.



NEXT MONTH

The second article will describe the construction of our new simple VHF FM receiver, plus commissioning. Stay tuned!

Begins overleaf:

A New Series on BASIC ELECTRONICS

Starting this month, we're launching a new series of articles written especially for the newcomer to electronics, who would like to learn the basics of electronics from the very start. It's been quite a while since we ran the last such series, so a new and up to date successor is very much in order.

The author of our new series is Peter Phillips, our technical editor, who is well qualified to write it as he has over 15 years' experience in teaching electronics. And here is Peter's general introduction to the series:

Peter Phillips, B.Ed., Dip.Ed., ECC

My own introduction to electronics began some 30 years ago, with a general interest in 'things electrical'. Little DC motors, lamps, buzzers and the like, even a crystal radio all played their part in my childhood. But perhaps the most significant contribution to my interest was the magazine then called *Radio, TV and Hobbies*. My father never missed an issue, and I would often browse through one of the copies from the pile stored in the garage.

As I grew up, the name of the magazine changed to reflect the technology it represented. Gone were the model aeroplanes and other hobbies, replaced now with electronics and more electronics. Bewildering to say the least for a lad with no training, but what an influence it had on me! How much I learned from my reading is hard to say, but somehow, when the time came for me get serious and enter the work force, electronics seemed the natural choice.

To be invited some 30 years later to write a new series of articles on Basic Electronics for this very magazine, now known as *Electronics Australia*, seems on the one hand a great honour, and on the other, a responsibility that is almost awesome. I learnt so much from *R, TV & H* all those years ago, and I'd like to repay that debt by helping another generation of youngsters get the same kind of introduction to this fascinating and exciting technology.

But can I impart that same sense of simplicity and friendliness that helped shape my own life? I can only try...

Volts, amps & ohms

To begin our journey into the fascinating world of electronics, we need to look at the basic ideas of electricity. Here we introduce the idea of electrical pressure or 'voltage' – measured in *volts*, the flow of charge or 'current' – measured in amperes or *amps*, and the resistance to that flow – measured in *ohms*. It's all starting right here, so why not join us?

by PETER PHILLIPS

Experimenting with electricity can be traced back to the ancient Greeks. While Homer wrote his Odyssey and Jason sought the Golden Fleece, others were marvelling at the phenomenon of making human hair stand on end with a rod of amber freshly rubbed on the fur of an unsuspecting goat. At the time nothing very useful came of this, except to scare some peasants and excite a few philosophers, but the ground work was in place for studies to be undertaken many centuries later.

In fact, it was to take nearly 2000 years before the word 'electricity' was even established. An English surgeon, one William Gilbert, circa 1600AD, is attributed with having derived the word from the Greek term *elektron* (meaning amber). In a book titled *De Magnete*, he went on to identify materials as either 'electrics' or 'non-electrics' – predecessors to the terms now known as conductors and insulators.

However it was to take another 180 years or so before studies in electricity started to get away from the phenomena associated with rubbing things together. Static electricity is hardly a force of any use other than to produce sparks, and it wasn't until Luigi Galvani hung some frogs out to dry that a useful source of electricity was developed.

Galvani, in 1790, was prompted to research the reason behind dead frogs 'twitching' when they were hung over an iron railing. The reason, of course, was that the acidity of the frog's internal juices, in combination with various metals (iron railings and the like) produced an electrical *voltage*, sufficient to cause a current to flow in the muscles of the hapless frogs. The greatest discoveries have the most humble beginnings it seems!

It was Alessandro Volta who actually developed an electric cell of any use, paving the way for the technology we know as electricity. He is commemorated by the term 'volt', just as many other electrical terms owe their name to a pioneer of the field. Because the idea of voltage is so fundamental to electronics, it deserves discussion before any other electrical quantity.

What is a voltage?

A voltage is often described as an 'electrical pressure', implying that its presence is essential if something electrical is to happen. For example, lightning is caused by a very high voltage existing between a cloud and another point. If the other point is Earth, as it often is, a lightning strike will occur.

The main thing to understand is that a voltage occurs between *two* points, and is often referred to as a *potential difference*. A battery has a voltage, or potential difference, between its two terminals, and the value of the voltage depends on how many cells are inside the battery.

A voltage is actually caused by one point having more or less electrons than another point. An electron is the basic unit of *charge*, and an atom with more electrons than protons will exhibit a negative charge, while one lacking its full complement of electrons will possess a positive charge. A voltage is therefore created when one point has excess electrons and another has a deficiency of electrons, as shown in Fig.1. Why an electron has an electric charge is another matter, which is my way of saying I don't know anyway. (For that matter, no-one really knows, even now.)

What is a current?

An electric current is nothing more than a *flow* of electrons. When you think about it, flowing electrons represent man's most used energy source – amazing when you consider that the electron is one of the smallest particles known! The voltage is the force that causes the electrons to flow in the first place, and if no voltage exists, no current (or flow of electrons) will occur.

Current is measured in amperes, usually abbreviated as the *amp*, in which 1 amp equals 6.25×10^{18} electrons flowing past a given point each second. This quantity of electrons is also called a *coulomb*, meaning an amp therefore corresponds to a coulomb of charge flowing per second. However, there is one minor point to clarify – in which direction does current flow?

When electricity as a science was not fully understood, it was realised that an electric current was something that had a direction, even if the nature of the current was a mystery. It was decided that this direction was from positive to negative, and everyone was happy until the nuclear age was born and the electron was discovered. It was then that the true nature of an electric current was discovered, with the sad realisation that all the theories about direction of an electric current were wrong – it actually flowed from negative to positive.

By this time, many text books had been written, and everyone involved in the technology accepted that current flowed from positive to negative. To

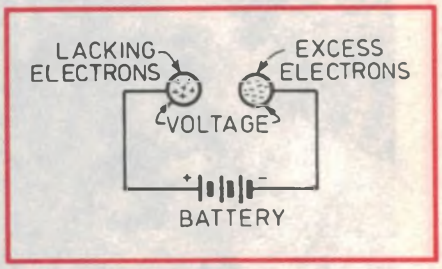


***Fig.1:** A voltage always exists between two points, and occurs if one point has more electrons than the other. The greater the difference in the electron numbers, the higher the voltage.*

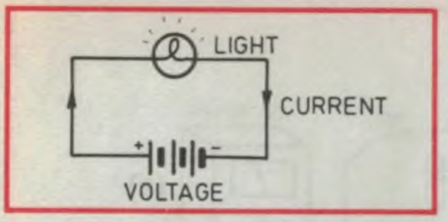


Fig.2: When a voltage source is connected to a circuit, current will flow. The current will cause an effect, such as incandescent heat in the case of a light globe.

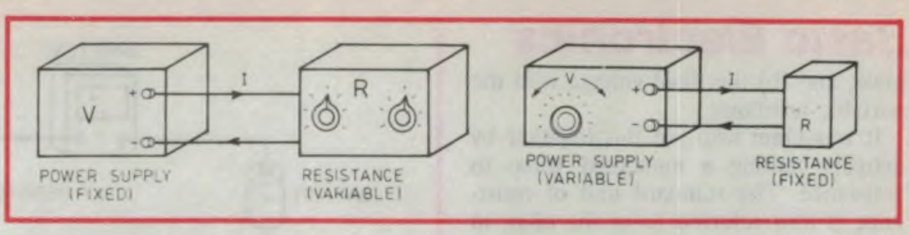


Fig.4: Current in a circuit is controlled by the voltage (V) and the resistance (R). In (a), if R is assumed to be fixed, the current will vary directly with the voltage. More volts – more current. In (b), if V is assumed to be fixed, the current will vary indirectly with the resistance value. A high resistance will therefore give a low current and a low resistance will allow a high current.

change all this was not only too big a job, but it would achieve very little, as the actual direction was unimportant, rather it was important only to realise that current *had* a direction.

So, it has become established practice to refer to current as being that electrical quantity that flows from positive to negative, while electrons flow from negative to positive. The fact that they are basically one and the same thing is one of those anomalies we have to live with.

There is no universal standard however on how to teach electronics, and over the years I have taught the principles of electricity using both directions for current. Fortunately, providing one is consistent, it turns out not to matter very much, and I shall use the convention that current flows from positive to negative. This means that arrows associated with the various electrical symbols will point in the same direction as that assumed for the current. It just makes things a little easier.

The next thing to discuss is the relationship between voltage and current. For example, what limits the amount of current if a voltage exists between both ends of a conductor? In a word: the *resistance* of that conductor.

Resistance

A commonly used analogy to electricity is plumbing, that is, water flowing in a pipe. In a water reticulation system, the amount of water that will flow (= current) is determined by the water pressure (= voltage) and the diameter of the pipe. In other words, the characteristics of the medium carrying the flow also determine the amount of flow, as depicted in Fig.3(a).

In an electrical system, the term *resistance*, as shown by the wriggly line symbol in Fig.3(b) is used to identify the opposition presented to the passage of a current. Resistance may be the result of a component designed deliberately to provide it, known as a *resistor*, or simply the characteristics of the conductor.

All materials capable of carrying an electric current possess resistance, and some materials have more resistance than others. Gold is an excellent conductor, copper rates fairly well, while ceramics, plastic and other similar materials have an extremely high resistance. This latter group are known as *insulators*, and will only conduct a current under highly adverse conditions, known as breakdown.

Resistance is measured in ohms, after George Ohm, a German scientist who formulated the most basic electrical laws of all, now called *Ohm's law*.

Ohm's law

While I hope to keep this series relatively free of mathematics, there are some things that can only be described with mathematical equations. The first set of equations are those known as Ohm's law, and relate the three electrical quantities already described: voltage, current and resistance.

Before looking at the maths, we need to assign a letter to represent each of these quantities, as otherwise the equations will look rather clumsy.

It is standard practice to identify resistance with the letter R and current with the letter I. A voltage is usually represented by V, but sometimes E (for *electromotive force*, or EMF) is used.

As you will see later on, a voltage can be either in the form of an applied voltage, from a battery or other source of power, or it can be a voltage *drop*. Common practice is to refer to the applied voltage as E and a voltage drop as V. It doesn't really matter, as the maths are still the same, but I will use this convention.

For a given value of resistance, the amount of current flowing in a circuit is *directly* proportional to the applied voltage – that is, the higher the voltage, the higher the current. For a given value of voltage, the current flowing in a circuit is *inversely* proportional to the resistance of the circuit. This means the higher the resistance, the lower the current. Fig.4 shows the idea, where (a) has the variable voltage and fixed resist-

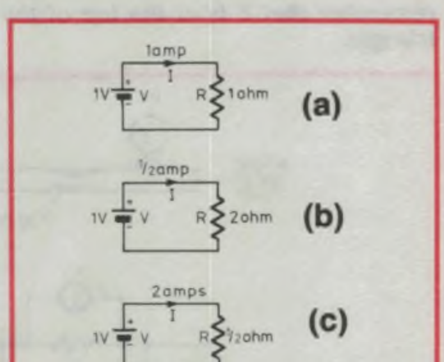


Fig.5: The relationship of current to the applied voltage and the circuit resistance is shown by using (a) as the reference. If the resistance is doubled from 1 to 2 ohms, the current will halve (b), while halving the resistance (c), doubles the current.

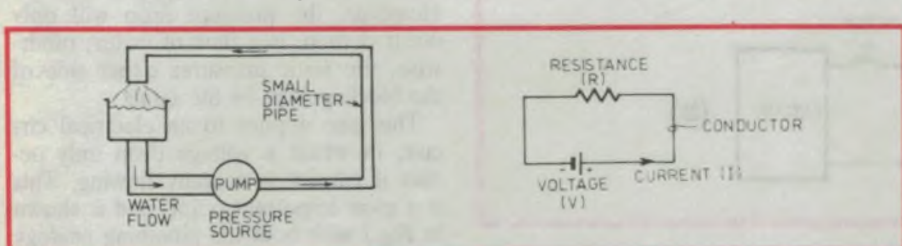


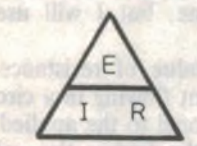
Fig.3: In (a), the water flow is limited by the narrow diameter water pipe. In (b), the current is limited by the resistance of the connecting wires and that of the circuit being operated from the voltage source.

ance, and (b) the fixed voltage with the variable resistance.

It was Ohm who put this together by actually putting a numerical value to resistance. The standard unit of resistance is now referred to as the *ohm*, in which 1 ohm equals that resistance present in an electrical circuit when 1 volt causes 1 amp of current to flow. If the resistance is doubled to 2 ohms, then 1 volt will now cause 0.5 amps to flow. Halve the resistance and 2 amps will flow. This is all shown in Fig.5.

The fundamental electrical equation is therefore I = E/R (or V/R). From this equation, two others can be developed by rearranging the terms to give E = IR and R = E/I.

Because these equations are so basic to the technology, they must not only be understood, but committed to memory. A useful way of remembering Ohm's law is with the triangle shown in Fig.6. To find the equation for any term, cover that letter with your finger. The equation to find it will be given by the remaining letters.



$$I = \frac{E}{R}$$

$$R = \frac{E}{I}$$

$$E = IR$$

***Fig.6:** A handy way to remember Ohm's law. To find the equation for any term, cover that term with your finger and the equation will be the arrangement of the remaining terms. For example, if you cover the letter I, the remaining terms will be E/R. Just remember that E is at the top of the triangle.*

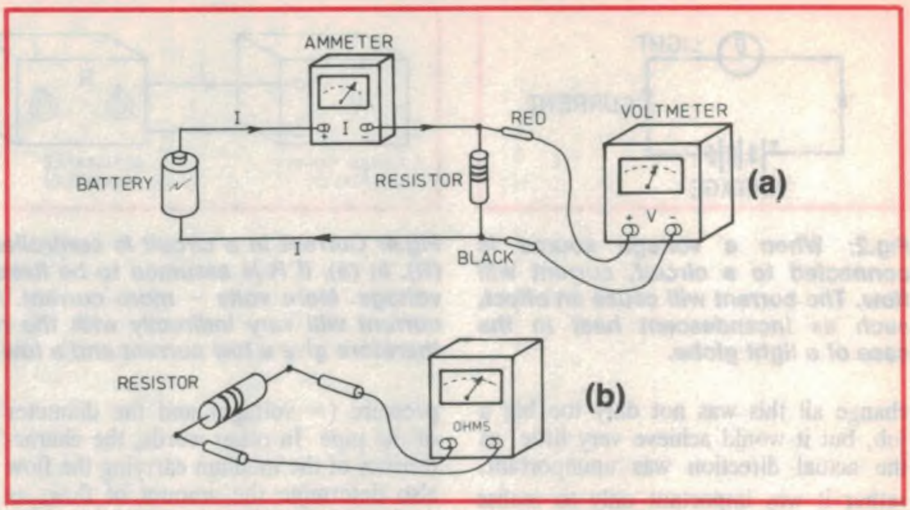


***Fig.8:** Measuring electrical values requires the voltmeter to be connected across the points in question and the ammeter to be placed so that the circuit current flows through the meter. Resistance measurement must be undertaken with at least one end of the resistor disconnected from its circuit.*

Ohm's law at work

There is one unassailable fact – Ohm's law is never wrong. There are times when it may appear to be violated, but other factors will be responsible – either that or your maths are wrong!

Another point to make at this early stage is that, despite the apparent simplicity of Ohm's law, complete understanding of the implications can be surprisingly difficult.

Because Ohm's law is the starting point of electrical theory, we need to look at some of the measuring instruments that can be used to analyse what has been discussed so far. Although three separate instruments can be identified, they are usually lumped into one instrument, commonly called a multimeter. The instruments are the ammeter, used to measure current, the voltmeter (for voltage measurements) and the ohmmeter, which measures resistance.

In later parts of the series, I'll describe these instruments in greater detail, but for now we'll look at how to use them.

Measuring voltage

The most useful instrument of all is the voltmeter, which is also the easiest to use. Because a voltage always exists between two points, a voltmeter is simply connected to the two points in question. Often one of these points is called the 'common rail' of the circuit, and voltages are measured *with respect to* this point. In many circuits, the negative side of the voltage source is connected to the common, although this is by no means standard.

If a voltage *drop* is being measured, the voltmeter is simply connected across the component creating the drop. A voltage drop can be explained by the 'water in a pipe' analogy, by equating it to a loss in water pressure due to a blockage in the pipe. The pressure before the blockage will be higher than that available after it, and the difference between the two is the 'pressure drop'. However, the pressure drop will only occur if there is a flow of water; otherwise, the static pressures either side of the blockage will be the same.

This also applies to an electrical circuit, in which a voltage drop only occurs if current is actually flowing. This is a most important point, and is shown in Fig.7 with both the plumbing analogy and the electrical circuit. If the water flow is stopped by shutting the tap, both gauges will register the full pump pressure. Similarly, if the switch in the elec-

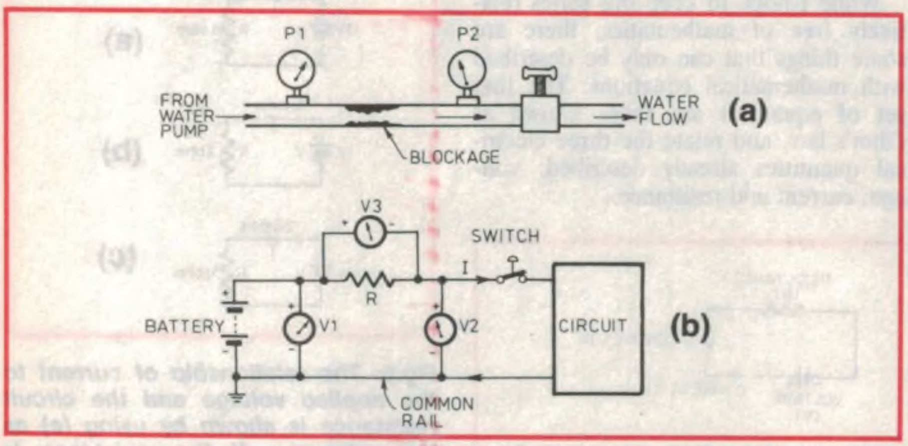


***Fig.7:** Voltage drop can be explained with a water analogy. In (a), the pressure drop equals P1-P2. Shut the tap however, and P1 will equal P2. In (b), the voltage drop (V3) is equal to V1-V2. Again, if the switch is opened, resulting in no current flow, V1 will equal V2, and V3 will be zero volts.*

trical circuit is opened, both voltmeters will show the battery voltage.

Of course, it is possible to determine the voltage drop by using Ohm's law. In the case of Fig.7(b), the voltage drop will equal IxR. Also, if the voltages V1 and V2 are measured, (in this case V1 equals E, the applied voltage), the voltage drop will equal V1-V2. Placing the voltmeter across the resistor R will allow the voltage drop to be measured directly. Because current flows from positive to negative, the voltmeter must be connected as shown to ensure it reads upscale.

Measuring current and resistance

Measuring current is a bit more difficult than voltage measurement, as the current being measured has to actually flow through the ammeter. This means the current path has to be cut to allow the insertion of the ammeter, which is often difficult in practice.

For the meter to read upscale (or show the correct polarity for a digital meter), the meter leads must be connected in the right polarity. For a correct indication, the current must enter the meter at the positive lead, and exit at the negative. By the way, another fundamental fact is that the current entering the meter must equal the current leaving it, even down to the last electron. Resistance measurement requires an ohmmeter, which is a meter equipped with an internal battery and suitable circuitry to make the meter into an ohmmeter. There are two important points to observe with resistance measurement: the resistor being measured must have at least one end disconnected from the circuit, and you, the measurer, must not hold on to the resistor leads during the measuring process.

In the first case, if the resistor is not disconnected, other components in the circuit may give false readings, as will be explained in the next part of this series. In the second instance, the human body can conduct electricity, and if you connect yourself across the resistor, the ohmmeter will measure *your* resistance, as well as that of the resistor under test. This will result in a lower value, caused by the *parallel* path resulting from your contact with the resistor.

Summary

This first article in our series has only dealt with voltage, current and resistance. These three quantities are all related by Ohm's law, and if any two are known, the third can be calculated. Measuring any of these quantities requires a suitable meter, usually incorporated in a multimeter. The multimeter can be either of the analog (moving pointer) type, or the more common digital multimeter.

All measurements require the connection of two leads, which, for voltage and current, must be connected with regard to polarity. The voltmeter is connected either across the component to measure voltage drop, or between a point and the common line to measure the voltage at that point. An ammeter requires the circuit to be broken to allow insertion of the meter.

Resistance measurement requires the resistor to be disconnected from all other points of the circuit, including the operator of the meter. See Fig.8 for a summary of the connections when measuring these electrical values.

Next time we will examine resistance and resistors as a topic. Here you will learn about such terms as series and parallel resistors, a few more equations, the resistor colour code and scientific notation. And before long you will be able to start figuring out some circuits and really getting into electronics.

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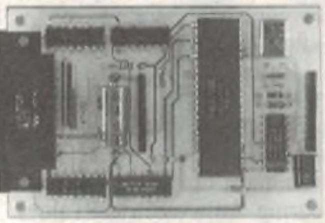

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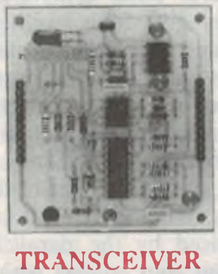

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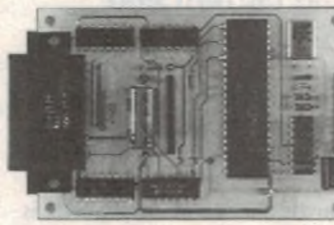

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3 DIGIT C OUNTER

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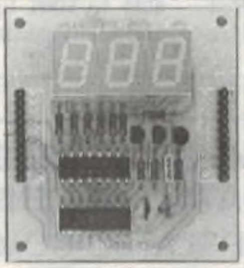
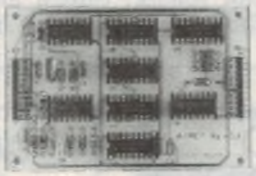


ATM01 $28.00



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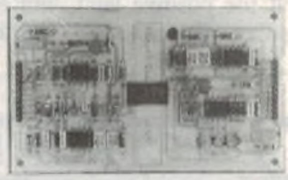

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Precision 0.05% V/F/V. 1V in, 5V out 12V @ 10mA each side, 10KV coupler.

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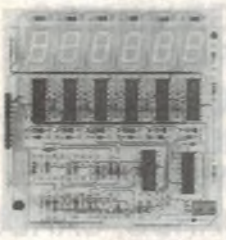

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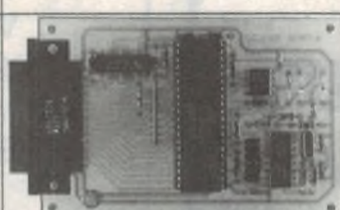


8 BIT UART

Parallel/serial/parallel TX & RX, 6 Baud rates, RS232 I/O.

ATM18 $55.00

IR BARRIER

Break apart TX/RX for security etc. range to 15 Metres, NO/NC outputs 12V @ 30mA. Noise & sunlight immune simple alignment, no lenses. For security, product counting, photography eg nocturnal flash trigger.

ATM20 $33.00

PRECISION V/F CONVERTER

Input 0 to 1V, output 2KHz to 7KHz 0.03% accuracy. Zin 500K open collector output, single +12V supply @10mA. Compensated against temp. & supply drift. Interfaces directly to ATM09 for complete data conversion link.

ATM08 $35.50

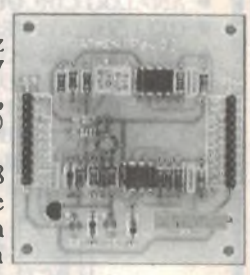
LCD VOLTMETER

3½Digit Hi contrast, ±199.9 mVsens. 9V supply@ 1mA, Zin 100MΩ

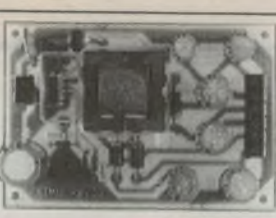
ATM14 $38.50

PRECISION F/V CONVERTER

Input 2KHz to 7KHz output 0 to 5V ±0.03% accurate, single 12V supply @ 10mA.
Matched to ATM08 for noise immune V/F/V conversion via opto couplers or data communication via radio, telemetry, modem or fibre optic link.



$35.50 ATM09

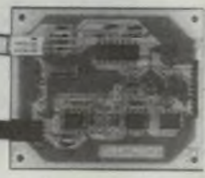


4 OUTPUT SWITCHING REGULATOR
Input 10 to 30VDC, output +5V @ 1.5A, -5V @ .1A, +2V @ .1A, -12V @ .1A Short circuit proof, O/Temp proof, High efficiency & low ripple.
ATM10 $50.50

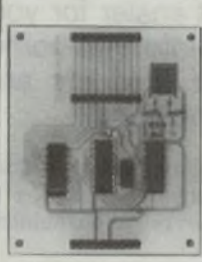
4 DIGIT COUNTER
Bright orange 1/2" displays counts to 4MHz latch,reset, overflow, 5V @ 75mA.
ATM13 $54.50

MULTI TIME BASE
Clips on to ATM13 & converts it to 50MHz 4 range Dig. Freq. Meter. 3 Dec. points & 3 Led annunciators. Interface to HCMOS & TTL logic. Blinking Led shows "on"
ATM21 $38.50

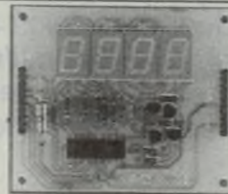
FIBREOPTIC MODEM
Full duplex DC to 500KBd with 1mm plastic cable 5V TTL in/out. Pwr drain 15mA Easy connection and preparationof ESKA EXTRA F/O cable.



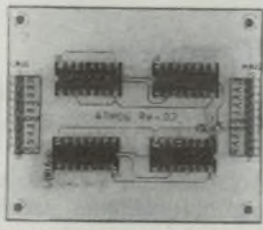
ATM05 $62.50



CRYSTAL TIMEBASE
Outputs 32KHz, 4Hz, 2Hz, 1Hz,0.5Hz 5V @ 1mA. &Precision pulses 1Sec, 500mSec, & 250mSec.
ATM04 $28.50



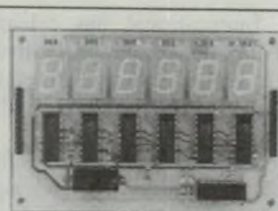
4 DIGIT COUNTER
4MHz W/latch & reset, 1/2" Orange displays TTL I/O 5V @ 75mA.
ATM02 $42.00



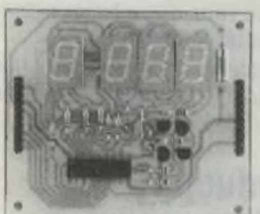
RECIPROCAL CALCULATOR
16 bit ÷"N" with 16 bit accumulator for converting elapsed time to frequency etc. Used for measuring vehicle speed, pulse rate, shutter timer and others where start/stop signals are to be converted to KM/H, M/Sec, Beats/Min. etc.
ATM06 $28.50

AT&M QUALITY

Only industrial grade components are used in our kits, they are designed for long life & hard work. Each kit has an instruction manual with full schematic diagram plus construction & testing details.
New kits are constantly being developed, contact our distributors for further details.

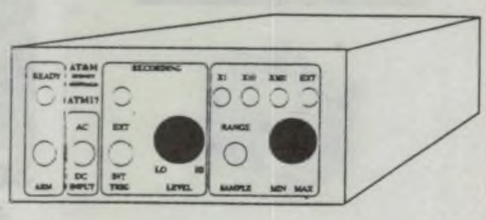


6 DIG. UP/DOWN COUNTER
Counts to 4MHz, RST Latch & U/D select, 1/2" bright Orange Displays, 5V @ 100mA.
ATM19 $58.00



9M 59.9 SEC COUNTER
4 digit counter for totalising 10Hz input frequency for general purposes such as stopwatch. Latch & reset count plus overflow avail. Hi brightness Orange digits, 5V @75mA
ATM11 $ 38.50

SPECIAL
ATM17 DIGITAL STORAGE ADAPTOR...AS PER DEC. EA



BASIC KIT$161.50 CASE $23.00

AT&M KIT STOCKISTS

SA ADELAIDE..*ECEQUIP* Ph. 2320001 *FORCE ELECTRONICS* Ph. 2125505 **QLD BRISBANE**..*St LUCIA ELECTRONICS* Ph. 2527466 **SOUTHPORT**..*SOUTHPORT ELECTRONICS* Ph .323632 **TOWNSVILLE**..*SOLEX* Ph.724466 **ACT CANBERRA**..*ELECTRONIC COMPONENTS* Ph.804654 **TAS HOBART**..*GEORGEHARVEY* Ph.342233 **LAUNCESTON**..*GEORGE HARVEY* Ph.316533 **VIC MELBOURNE**..*ALL ELECTRONIC COMPONENTS* Ph.6621381 ELECTRONIC COMPONENTS SHOP Ph.6706474 **HUNTINGDALE**.. *STEWART ELECTRONICS* Ph.5433733 **CROYDON** *TRUSCOTT ELECTRONICS* Ph.7233860 **BALLARAT**..*B.E.S* Ph.311947 **NSW COFFS HARBOUR**..*COFFS HARBOUR ELECTRONICS* Ph.525684 **GRAFTON**..*EAST COAST ELECTRONICS* Ph.431250 **LISMORE**..*DECRO ELECTRONICS* Ph.214137 **MOREE** *MOREE ELECT.* Ph. 523458 **NEWCASTLE**..*DGE SYSTEMS* Ph.691625 **LANE COVE** ..*GEOFF WOOD* Ph.4284111 **CARRINGBAH**..*HI-COM UNITRONICS* Ph. 5258318 **SYDNEY** *DAVREID* Ph.2671385 **St. LEONARDS**.. *ALCORA* Ph.9061253

DISTRIBUTORS WANTED ALL STATES & NZ

NEW PRODUCTS

State of the Art

As in previous Annual Digest issues, we have a much wider survey of new products here than in a normal issue. And they're divided into basic categories, to make it easier for you to find those in which you're most interested. Note that home electronics, solid state devices and computer products are presented separately, in their own sections of the book...

Tiny DC piezo buzzer

Kingstate International has released what is probably the smallest DC driven piezo buzzer. Only 13.8mm diameter x 7.5mm in height, the KPE242 is ideal where PCB saving is essential.

With a continuous tone of 4000 Hz, the KPE242 is suitable for DC oper ation from 3 to 16 volts. Current consumption is a small 7mA at 12V DC, while the sound pressure level at 30c m/12V DC is a minimum 70dB.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe 2141 or phone (02) 648 5455.

LCD switch

The Pixie Graphic LCD switch from Industrial Electronic Engineers is a device which brings new capabilities to data interfacing.

The graphics panel incorporates 864 pixels on a 24 x 36 matrix, using the latest supertwist technology to provide very wide viewing angle and high contrast. It also includes LED backlighting, for environments with low level ambient light conditions.

When coupled with IEE's drivers and software, the 'Pixie's' provide flexibility never before seen in a switch. The switch can be programmed to display various images, commands or signs – in fact any graphics or alphanumeric character.

Activation of the switch mechanism is through a simple pressing of the display panel. Applications include vending machines, control panels, elevator operation, vehicle systems and many more.

For further information contact M.B & K.J Davidson, 17 Roberna Street, Moorabbin 3189 or phone (03) 555 7277.

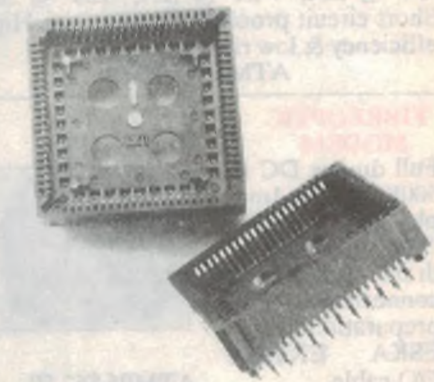
Solid state relays

Allen-Bradley Solid State Relays provide control of AC loads. Manufactured by General Hybrid Ltd, UK (formerly Allen-Bradley), they are available with control voltages of 90-280V AC or 3-32V DC.

Maximum load current ranges from 3 to 110 amps with load voltage from 12V AC to 530V AC rms.

Three basic types are available: industry standard, chassis mount, in-line PCB and flat pack PCB. All are fitted with an internal snubber circuit and are opto isolated to 4kV.

For more information contact Allan Bradley, 56 Parramatta Road, Lidcombe 2141 or phone (02) 748 2652.



PLCC sockets

The PCS series of Plastic Leaded Chip Carrier (PLCC) sockets is designed to accept Jedec type 'A' plastic leaded carriers on 1.27mm centres and allowing through-hole termination in board on a 2.54mm grid.

The sockets combine positive retention of the package with a high normal force (200 grams min), ensuring an outstanding electrical and mechanical performance. They are available in 68 and 84 positions and the phosphor bronze contacts are bright finished 90/10 tin-lead over nickel. Internal standoffs ensure the proper positioning of the chip carrier, with four drain holes assisting in cleaning after soldering.

Further information from Augat, Unit 21/26 Wattle Road, Brookvale 2100 or phone (02) 905 0533.

Multi-conductor snake cable

Acme Electronics has released a new range of Belden audio multi-conductor snake cable which features individually shielded and jacketed pairs.

The new family of cable is designed for the interconnection of audio components, such as console board equipment for the broadcast and recording industries. The loose tube construction allows for high flexibility, while the PVC outer jacket features an overall non-reflecting black matt finish for a low profile appearance.

Stocks of the new cable in 4, 6, 9, 12, 16, 20, 28 and 32-pair versions are available on short delivery. Standard lengths are 31, 76, 153 and 305 metres.

For additional information contact Acme Electronics, 205 Middleborough Road, Box Hill 3128 or phone (03) 890 0900.

Ultra-thin SMD capacitors

Murata Manufacturing released a series of ultra-thin SMD capacitors for reflow soldering applications.

The GR 42-225/226 series is available in three capacitance values: 0.15uF, 0.22uF and 0.33uF, Z5U temperature characteristics and 25V voltage.

This series provides engineers with the opportunity to mount the GR 42-225/226 series beneath PLCC type IC's, due to the extremely thin package. The case size is (1210) 3.2 x 2.5mm with a maximum thickness of 0.7mm.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe 2141 or phone (02) 648 5455.

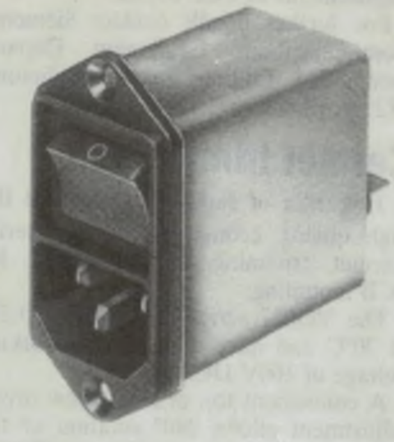
Subminiature SMD trimcap

Murata Manufacturing of Japan has released the new TZC03 series surface mount trimcap, a super low profile trimmer suitable for reflow soldering.

The trimmer has a footprint of only 3.2 x 4.5mm and an overall height of only 1.6mm, allowing for not only smaller PCB's but lower profile housings. Adjustments can be made using a conventional screwdriver with blade thicknesses up to 0.5mm, therefore not requiring any extra tools or equipment.

The trimmers are colour coded in the same manner as the well known TZ03 series through-hole mounting trimmers, alleviating the chance of accidential mounting errors.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe 2141 or phone (02) 648 5455.



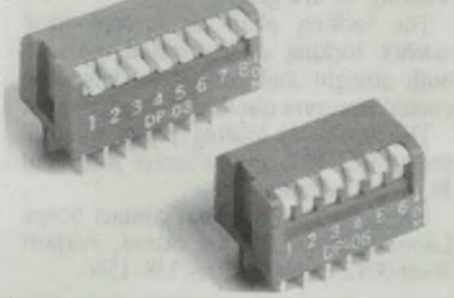
Power entry, filter modules

Schurter power entry modules and mains filter units offer compactness and compliance with international regulations. They have been approved by SEV, Energy Authority of NSW, VDE, SEMKO, UL and CSA.

The type KEA and KEC power entry modules combine an IEC power inlet rated at 10A/250V (65°C) with a safe one- or two-pole fuseholder taking 5 x 20mm or 6.3 x 32mm fuse links and a 2-4 position voltage selector switch. The type KD power entry module adds a 2-pole on-off power switch. The KEB module provides the power inlet and either 1- or 2-pole on-off switch, either illuminated or not.

All modules are available with integral mains filter.

Further information from Koloona Industries, 1/168 Belmore Road South, Riverwood 2210 or phone (02) 533 2588.



'Piano' DIP switch

Now available from Adilam Electronics are the DP/DPL Series (Piano DIP) switches manufactured by Diptronics Manufacturing Co.

These offer a mechanical life of 5000 operations minimum per switch; an electrical life of 2000 operations minimum at 50mA, 24V DC; an operational force of 400g +/– 200g; a non-switching rating of 100mA at 50V DC; and a switching rate of 50mA at 24V DC.

The switches are of the single pole single throw (SPST) type, with push down 'ON' as standard. However, push down 'OFF' (Up 'On') is available as an option.

Further information is available from Adilam Electronics, Suite 7, 145 Parker Street, Templestowe 3106 or phone (03) 846 2511.

Connector switch and line filter

Components like an IEC input plug, a 2-pole mains switch, a mains fuse and an interference suppression filter belong to the basic fittings of modern electronic equipment. All these individual components are integrated in the new universal power line filter series FN280 from Schaffner.

Besides the cost savings from the unnecessary assembly of discrete components, the filter series FN280 offers reliable protection against mains interference. The filter suppresses effectively HF interference coming from the mains supply as well as interference generated in the equipment going into the mains supply (measured according to VDE 0871/0875).

The applications for this high quality compact module should be diverse, in virtually any equipment where space is at a premium.

Further information is available from Westinghouse Systems, PO Box 267 Williamstown 3016 or phone (03) 397 1033.

High power reed switches

A new range of very small dry-reed switches from Philips Components can switch loads up to 20W, with switched currents of up to 1A, in telephone equipment, ATE, automative and security systems.

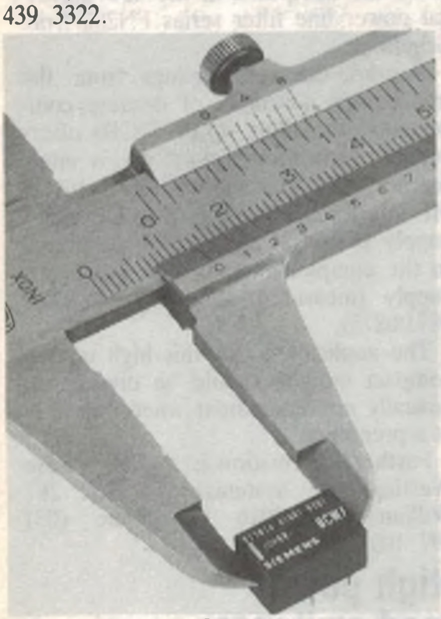
The RI-29 series 'pico' dry-reed switches use a hybrid multi-contact layer designed to switch higher currents,

while still providing excellent performance at lower currents and voltages. All this in a 1.8mm diameter glass envelope just 13.5mm long.

The switches are extremely reliable, with a life-expectancy of more than 10^9 operations and a failure rate of less than 0.3 x 10^9 per operation (when switching 10mA at 30mV, and a 200milliohm contact resistance limit).

The RI-29 series are available with Ampere-turns (At) operate values from 16 to 34. Maximum switched voltage ratings are 200V DC and 140V AC. All types are single-pole single-throw with normally-open contacts, and meet the requirements of IEC 255-9.

For further information contact Philips Components, 11 Waltham Street, Artarmon 2064 or phone (02) 439 3322.



35mW miniature monostable relay

Siemens has extended its P1 range of miniature relays with the introduction of a high-sensitivity monostable version, with 35-mW rated power for special-purpose applications. Also available on request are MR P1 relays meeting the open-contact surge voltage withstand requirements of FCC 68.302.

For further details contact Siemens, Communications Equipment Department, 544 Church Street, Richmond 3121 or phone (03) 420 7308.

Cermet trimmers

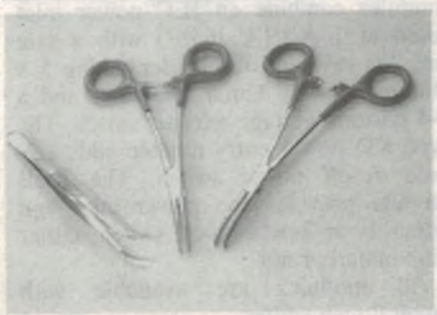
Hokuriku of Japan manufactures the high quality economical VG067 series Cermet trimming potentiometers for PCB mounting.

The VG067 series are rated at 0.2W at 70°C and have a maximum working voltage of 100V DC.

A convenient top or side screw driver adjustment allows 240° rotation of the trimmer through its range. Secure mounting is achieved through an industry standard 5mm centres 3 PCB-pin layout. Standard values are available between 100 ohm and 1 megohm.

For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon 2064 or phone (02) 439 2200.

TOOLS



'Anti zap' pliers

By adding plastic insulation to the handles of their 160mm locking pliers, Scope Laboratories have provided technicians with fewer 'surprises' when working on live gear.

The locking pliers or forceps have ratchet locking and serrated jaws in both straight and curved models. The curved tweezers also have serrated jaws.

The insulated locking pliers will sell for around $11, the tweezers for about $6, – all excluding tax.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042 or phone (03) 338 1566.

Co-ax cable stripper

Mijell Enterprises, acting as Warren & Brown's sole Australian distributor, has introduced the TC156 Coaxial Cable Stripper.

This high quality cable stripper has fast stripping times and requires simple, hand held operation. Easy access cutter cassettes, with circular blades of maximum hardness and keen edge are able to achieve durations of many hundreds of cuts.

A special feature of the TC156 is in the patented rotary blade cutting action, which when rotating forward around the cable, establishes a rolling and skiving action necessary to cut through the outer braid and foil. Then in reverse the blades lock to slice through the dielectric, leaving the cable cleanly prepared for connector fitting.

The TC156 stripper adjusts to varying cable diameters from 5mm up to 7mm and will accommodate the ten presently developed outer assemblies or popular cable/connector combinations. More will be developed in response to user needs.

After extensive use by a major telecommunications company and commencement of export sales, the TC155 and 156 are now available from Mijell Enterprises, 5 Barriedale Grove, Frankston 3199 or phone (059) 71 1853.

Soldering station has heater inside tip

Scope Laboratories has announced a new version of its high reliability hand soldering station.

This new station, coded ETC60L-9, incorporates a redesigned cartridge type heating element developed to give tended service life by eliminating mica insulation completely.

To complement this element change a new range of hollow tips has been released which allows the heat source to locate inside the tips. It is claimed that superior heat transfer and faster covery are achieved.

The iron holder is now all metal for maximum heat resistance.

The new hollow type tips and the cartridge element are not compatible with previous models, but older type irons are still plug compatible with the new station.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042 or phone (03) 338 1566.

Light-guided assembly

The Litescane range of light guided assembly directors are now available in Australia. Freestanding, tabletop and SMD models are available, in a wide range of configurations to suit almost all applications.

The Litescan units allow an operator to quickly load a PCB – error free, with a minimum of training. Programming is easily achieved on-line, off-line or using an optional digitiser with an IBM or compatible computer.

The component placement information is held in non-volatile memory, so once programmed the unit is truly stand-alone in its operation.

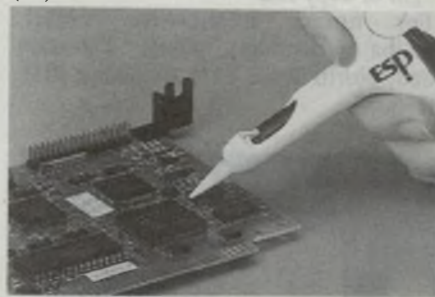
For more information please contact Computronics International, 31 Kensington Street, East Perth 6004 or phone (09) 221 2121.

Hand held 'dot maker'

ESP has announced the release of the 'Dot Maker', a hand-held dispenser which applies exact deposits of solder creams and paste flux from pre-filled caplettes – allowing the operator to locate the compound precisely where required, even with fine pitch geometry. The pre-filled caplettes come in 4 different mixtures and are available separately.

The Dot Maker comes in a compact case, providing convenient and strong storage for the dispenser and its range of accessories. These accessories include the caplettes of solder cream, tips of varying sizes and the VAC Tweezer vacuum pick-up tool to enable easy placement of SMD components.

For further information contact Electronic Development Sales, Unit 2A, 11 Orion Road, Lane Cove 2066 or phone (02) 418 6999.



SMT prototyping system

OK Industries has announced a new dual function SMT prototyping unit. The SMT-8000 incorporates a solder paste dispensing head with a manual pick and placement arm, allowing the complete assembly of surface mount boards at one station. This totally manual system yields placement rates of 500 components per hour, with no programming needed to begin production.

Solder pastes or adhesives can be dispensed by a timer-actuated head, with the operator simply guiding the needle over pads to be covered. Components are held in the anti-static environment of available stick, tape and bulk feeders. The placement arm accesses the component from the feeder and is manually guided over the pads for alignment.

Further information from Electronic Development Sales, Unit 2A, 11/13 Orion Road, Lane Cove 2066 or phone (02)418 6999.

Wire holder for Panavise

Scope Laboratories has released a wire separator and holding attachment for its Panavise range.

Shown is the model 359 holder acting as a spare pair of hands, presenting cables to a technician connecting them to a PC board. Also illustrated is the rubber jawed model 366 wide opening (150mm) vise, suited to holding a variety of irregular shaped connectors.

The ball joint below lets you tilt or rotate to any convenient position for inspection or soldering, while the suction type vacuum base model 380 can be locked instantly onto any smooth bench top.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042 or phone (03) 338 1566.

OFFICE EQUIPMENT

Low-end phone

Voca Communciations has released the ATX10 low end telephone handset.

Although it will be marketed alongside the basic Telecom handset, the ATX10 has many more features. These include on-hook dialling, a 20 number memory (10 one-touch and 10 abbreviated), and battery back-up for the memory storage.

The ATX10 is PABX compatible with an earth/flash selection. Standard tures also include tone/pulse, pause and last number redials. It is suited for both the office and home and can be attractively wall-mounted when desk or bench space is limited.

The unit comes with a 12 month ranty and retails for $109.

For further information contact Voca Communications, 11-29 Eastern Road, South Melbourne 3205 or phone (03) 697 7000.

Compact copier

Toshiba's new compact BD-2810 – weighing in at only 17 kilograms –is specifically designed to run off as many as 99 copies in one go. The paper cassette holds up to 250 sheets, reducing the time spent replenishing and reloading.

Toshiba's Automatic Toner Density Control uses an advanced microprocessor to monitor and adjust, toner density for every single copy. The system is ac tually programmed for a wide range of images and combines with Toshiba's OPC drum to ensure solids, fine lines, half-tones and even blue originals, emerge clean and crisp no matter what length of copy run.

For further information contact Toshiba (Australia), 84-92 Talavera Road, North Ryde 2113 or phone (02) 887 6054.

Automatic cordless phone

Voca Communications has released the fully automatic Voca CT7800 AUS cordless telephone claimed to be one of the first genuine domestic cordless telephones with business features.

The CT7800 AUS is totally automatic. As with a normal handset, the unit is operative as soon as the receiver is lifted. When a call is finished, the user simply hangs up. Unlike other cordless telephones, you cannot accidentally remain 'off-hook' by forgetting to flick a switch.

It has an 'off' switch on the handset which enables the user to disconnect the line for when the unit is operated independently from the base station. There is also an alarm to alert the user when the handset is left off-hook after a certain time.

The maximum range indicator is another feature not often found on other cordless units. This alerts the user with a soft beep when the unit is nearing the limit for ideal reception.

For further information contact Voca Communications, 11-29 Eastern Road, South Melbourne 3205 or phone (03) 697 7000.

Mid-range fax

The Okifax OF-17 has all the features of the popular Oki OF-10 (which it replaces) but has additions such as super fine resolution for fine detail documents, including plans and sketches. There are 30 one-touch and 70 abbreviated dial facilities to hold a complete network of fax numbers.

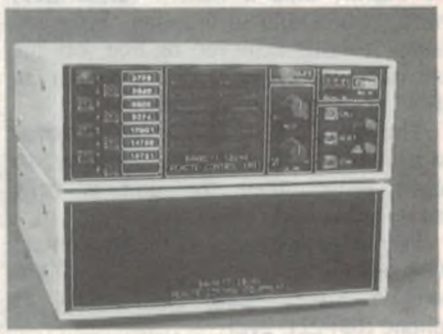
The 10-second transmission and 256K memory ensures ultra fast communication and the OF-17 has the ability to receive up to 12 pages into memory if the paper roll has run out.

The 40 character LCD keeps the operator informed of the unit's status. In standby mode, it displays date, time and the terminal's phone number.

Delayed memory broadcast, confidential broadcast memory transmission and confidential message transmission are just some of the OF-17's extra features.

Further information from IPL-Datron, 19-25 Wyndham Street, Alexandria 2015 or phone (02) 698 8211.

COMMUNICATIONS



HF remote control system

The Barrett SB240/245 is the latest in remote control technology. It utilises microprocessor technology to provide an intelligent remote control system for HF radio systems.

The advantage of using the SB240/245 combination is the ability to operate HF radio communication services in areas previously prevented from such activity. Electrical interference is now avoided by placing the transceiver in an electrically quiet location and connecting it to the office by means of a Telecom private line, or VHF link. All the original operating facilities are maintained and the user need not be aware that the radio is in fact being operated remotely.

All operations are fully monitored by the on-board microprocessor and the current system status is always displayed to the user. Control of the remote equipment is performed by DTMF tone bursts and a hand shake confirms all operations performed.

For more information contact Barrett, PO Box 198, Hamilton Hill 6163 or phone (09) 434 1700.

Smart radio modem

Data Radio Technology/GFS Electronics of Mitcham, Victoria has announced the release of a new multi-featured version of their Smart Radio Modem, the Model CPU-100 version 5.0.

Release of the version 5.0 hardware and its accompanying new version 2.0 BECSP (block exchange compelled sequence protocol), DRT claim, make their latest CPU-100 a very powerful data communications tool for both HF and VHF/UHF radio system applications. In fact they quote up to 500% higher throughout from their new version, when it is compared to an X.25 type packet modem having the same link baud rate and packet size running on an HF radio system.

For more information contact GFS Electronics, PO Box 97, Mitcham 3132 or phone (03) 873 3777.

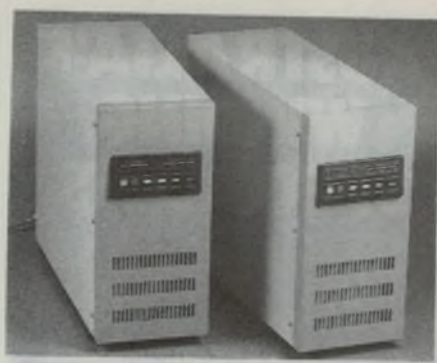
POWER SUPPLIES

'No-break' sinewave UPS

Online Control has been appointed as the authorised stockist distributor of the Datron range of on-line uninterruptible power supplies.

Available in three sizes, 1kVA, 3kVA and 5kVA, the new Datron 3000 series uninterruptible power supplies are a fully synchronised no-break sinewave UPS comprising a rectifier, battery charger, battery backed PWM 20kHz inverter, and static bypass switch.

These UPS systems are aimed primarily at the modern electronic office

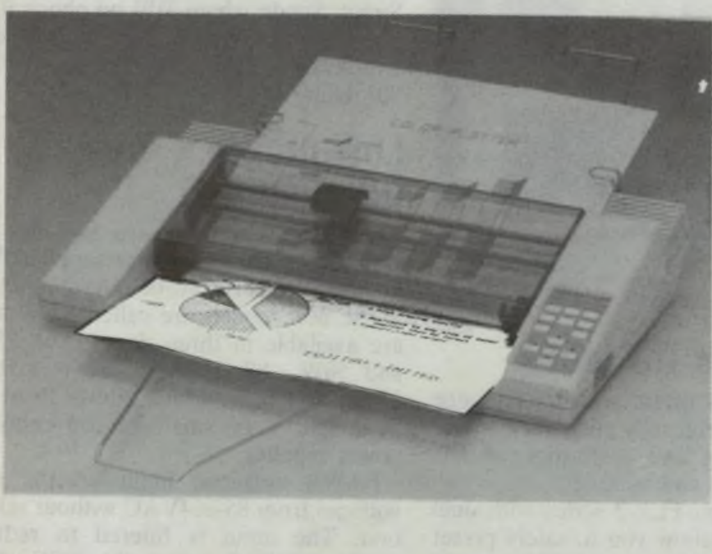


with its aesthetic appearance, ease of operation and very low acoustic noise. They are also suitable for a variety of data processing, medical, scientific and industrial applications, being particularly useful for continuous processes, such as process control or telecommunications.

Further information from Online Control, 2/7 Waltham Street, Artarmon 2064 or phone (02) 436 1313.

Dual filter for fax

The Critec 'Faxguard' is a user-installed lightning (and power surge) protection device for facsimile (fax)



machines and modems. Faxguard is claimed to be the first such device to combine protection for both power and telephone circuitry into a single unit, and is professionally designed and tested by Critec with in-house lightning impulse generators.

Critec have used novel technology to protect against overvoltage. Powerline filtering is combined with transient suppression to bring transients to within the safety zone of the fax. The same situation applies to the telephone line protector, which is able to take a massive 6000 volt/3000 amp surge input and reduce it to less than 80Von a 50V working circuit, thereby preventing any equipment damage. The telephone line protector's (patent applied) special capability of limiting lightning overvoltage to less than 80V is achieved without affecting ring current or dial impulses, which can exceed 180V in normal operation.

Further information from Critec, Technopark, Dowsings Point 7010 or phone (001) 73 0066.

Electronic DC loads

Kikusui now offers a complete range of seven electronically controlled loads, for the testing and calibration of DC power supplies and batteries.

The PLZ and PLZ-2 series with dual load settings, allow you to safely preset and maintain constant resistance and present and maintain constant current. Other features include the dynamic testing of the source by switching between two load settings, monitoring circuitry to protect the device from overload and digital displays to indicate power dissipation, input current, input voltage and resistance.

Further information from Emona Instruments, 86 Parramatta Road, Camperdown 2050 or phone (02) 519 3933.

Mil spec power supplies

Powercube (USA) manufactures Cirkitblocks - small, lightweight, encapsulated SMPS modules containing densely packed circuitry which are designed to perform a separate function within the supply.

There are many basic types of modules, which can be interconnected in a variety of ways to achieve AC-DC or DC-DC conversions. Power levels of up to 400 watts can be handled in a single string of modules, with parallel strings achieving higher total power capability.

AC source inputs of 115/240V are accommodated at line frequencies of 47-440Hz. DC input modules are provided in several wide input ranges, the highest of which has an upper limit of 270V DC. Other voltage and current ratings can be custom designed for special applications.

Powercube power supplies meet the toughest requirements for reliability form-factor and performance to such stringent specifications as MIL-STD-704, MIL-STD-461, MIL-STD-810 and MIL-E-5400.

Further information from Priority Electronics, Suite 7, 23/25 Melrose Street, Sandringham 3191 on phone (03) 521 0266 or Suite 2, 25 Chard Road, Brookvale 2100 or phone (02) 905 6024.

Low profile DC supplies

Kepco has introduced a new line of very low profile DC power supplies that feature a universal (wide range) input.

The new models are called FAW and are available in three sizes: 15W, 25W and 50W. All of them are less than 25mm (1″) high, which allows them to fit in spaces too small for conventional power supplies.

FAW's universal input accepts AC voltages from 85-264VAC without selection. The input is filtered to reduce conducted EMI below the FCC class B/VDE 0806 level.

For further information contact Elmeasco Instructions on one of the following numbers: Sydney (02) 736 2888; Melbourne (03) 879 2322; Adelaide (08) 344 9000; Brisbane (07) 875 1444; Perth (09) 470 1855.

High stability AC power

The PCR series of linear amp type stabilised AC power supplies (CV, CF), from Kikusui have been designed to provide variable stabilisation of the frequency and voltage of commercial electrical power to any value desired by the user.

The quality and stability of the output voltage waveform on the PCR series is such that they are ideally suited to a wide range of applications: from research lab experimental equipment and manufacturing line test equipment to factory power supply facilities and automated test equipment.

Also, by using the optional GP-IB interface or remote control, it is possible to apply the PCR series as an environmental testing device for simulation of commercial electrical power supply problems.

Features include a wide output frequency range: 5-500Hz (resolution: 0.01/0.1Hz); output voltage range: 1-140V/2-280V (2-range) (resolution: 0.1V).

Further information from Emona Instruments, 86 Parramatta Road, Camperdown 2050 or phone (02) 519 3933.

Lithium cells

Electrochem BCX lithium oxyhalide primary cells yield high performance and long life in low to moderate-rate applications. Wound construction in a hermetic glass-to-metal sealed stainless steel case offers safety and reliability in tough environments.

BCX power cells are available in sizes from PC to DD, with capacities from 1Ah to 30Ah. Each cell has an open circuit voltage of 3.9V, with an operating temperature of –40°C to 72°C. Multi-cell series or parallel custom packs are available.

Typical applications include CMOS memory back-up, telemetry, transceivers, surveillance devices, geological, meteorological and oceanographic instrumentation.

For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon 2064 or phone (02) 439 2200.

Mercury–free batteries

Varta of West Germany is claiming another technological breakthrough in batteries: zero mercury content in its zinc-carbon cells.

The new 'Varta Super Dry', or 3000 series is made of zinc chloride and is mercury free. It is not only environmentally friendly, but offers performance about 10% better than the previous zinc-carbon 'high performance' 3600 series cells.

The new 'Varta Super Dry' is now available in Australia in AA, C and D size. Available from Adeal, phone (03) 690 4911 or (02) 211 0422.

TEST INSTRUMENTS

Analyser

Hewlett-Packard has introduced an analyser that significantly enhances modulation-domain measurements.

The HP5372A frequency and time-interval analyser features faster time-interval histogram-result processing, eight times greater measurement memory (8K) and time-interval detect capability for analysing transient-timing effects.

Up to 8191 measurements can be made directly from the HP5372A's front panel, which allows more continuous measurements to be acquired in a single pass. This larger memory capacity enhances measurements on equipment such as laser printers, communications equipment, disk drives and agile radios.

Further information from Hewlett-Packard Australia, 31-41 Joseph Street, Blackburn 3130 or phone (03) 895 2644.

2GB/s digitising signal analysers

Tektronix has introduced a new class of instruments, called Digitising Signal Analysers (DSA), for acquiring, measuring and analysing either ultra-fast transient or repetitive signals instantly.

The new class includes Tektronix' DSA601 and the top of the line DSA602 – a 2GS/s instrument with 1GHz bandwidth, 8-bit vertical resolution, 32K record length, 12 acquisition channels, and a colour display. Both the DSA601 and DSA602 achieve vertical accuracy of +/–1% and time base accuracy to within 0.005%.

Besides outperforming ordinary digitising oscilloscopes in signal acquisition, measurement and display, the DSA600 series execute waveform processing functions up to 180 times per second. Signal processing functions include FFT, point-by-point pass/fail testing, averaging, smoothing, interpolation, integer and floating points math, signal dejitter, and envelope acquisition.

For further information on the DSA600 series please contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113 or phone (02) 888 7066.

1GHz signal generator

The Marconi 2022C is a fully programmable, synthesised signal generator offering frequency, phase and amplitude modulation in the range 10kHz to 1GHz. Tech-Rentals has recently added several to its inventory, and they are now available for hire.

All parameters on the 2022C are set by the numeric keyboard and up to 100 settings can be stored in its non volatile memory.

Frequency resolution is 10Hz below 100MHz and 100Hz above 100HMz, with the output frequency being presented on a large, easy to read, 7 digit LCD display. The internal frequency standard is a high stability, oven controlled, crystal oscillator operating at 10MHz.

For further information contact Tech-Rentals offices in each state, or ring (03) 879 2266.

Test gear from UK

Obiat has been appointed Australian distributor for the UK designed and manufactured range of electronic test and measuring instruments from Black Star.

The product range includes frequency counters, counter timers, universal counter timers in the range from DC to 2.4GHz, 15MHz oscilloscope, function generators, bench digital multimeters, a TV pattern generator, and RS232C I/O interface and memory, plus oscilloscope and multimeter test leads and probes.

For more information or a catalog on the Black Star range contact Obiat, 129 Queen Street, Beaconsfield 2015 or phone (02) 698 4776.

Optical power, attenuation meter

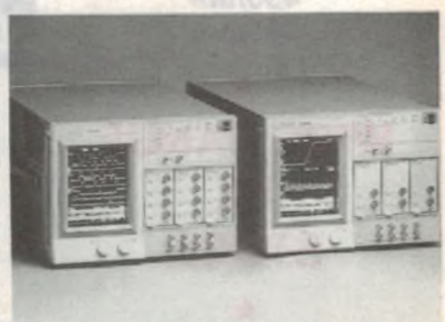
Vicom has introduced the AM4000 fibre optic attenuation and power meter, manufactured in the USA by Laser Precision.

The AM4000 is said to be unsurpassed for accuracy in testing single mode or multimode optical cable. It measures watts, dBm and dBr with +/-3% accuracy and 0.01dB resolution. The built in audio tone and analog meter makes it easy to align connectors and fusion splices, while the amount of dB loss is simultaneously displayed. The audio tone frequency corresponds directly to the amount of power transmitted, allowing the user to concentrate on the cable alignment. This enables the user to optimise the alignment for minimum loss.

A companion instrument is the AP4200. This is a stabilised light source, and can be used with the AM4000 to provide accurate measurements for cable acceptance testing, splicing and fitting connectors and end-to-end tests of installation links.

Both instruments run off internal rechargeable batteries or an external 12V DC source. They are compact and lightweight for easy use in the field.

For more information contact Vicom, 4 Meaden Street, South Melbourne 3205 or phone (03) 690 9399.



PC-based logic analyser

Smart Logic Scope model 7001 is an easy to use, high performance digital circuit tracer (logic analyser). Unlike

conventional logic analysers, it is very user friendly and low cost. It can be attached to any IBM PC/XT/AT compatible.

Operation is very simple. You simply connect test probes to test points and select the clock rate and triggering point, and all logic states of the test points will be captured and displayed on the computer screen in graphic format. The Smart Logic Scope also provides various formatted data, helpful for digital circuit analysis.

The instrument is controlled through the computer keyboard, using pull-down menus. The operating software is provided on an IBM formatted floppy diskette. Installation is done within a few minutes, with cables, probes and operating software included in the package.

For more information contact Computronics, 31 Kensington Street, East Perth 6004 or phone (09) 221 2121.

24ch instrumentation recorder

Racal's newest portable video cassette instrumentation recorder provides up to 24 channels in one compact unit, recording signals from all types of sensors with electrical output from DC to 100kHz.

V-STORE is claimed to be the most compact recorder of its type available on the market today. The light, yet rugged construction and versatile AC/DC power supply ensures suitability for a wide range of portable and laboratory applications.

Another key factor is simplicity of operation and the use of easily available VHS tapes.

V-STORE is available in 8, 16 and 24 channel configuration.

For further information contact Racal Electronics, 47 Talavera Road, North Ryde 2113 or phone (02) 888 8444.

PLD programmer

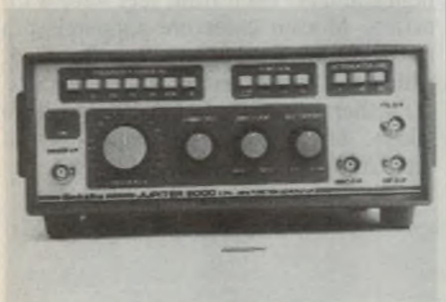
The SE4971 programmer is designed to program such devices as PALs, IFLs, GALs and EPLDs. It can program data that has been down-loaded in JEDEC format for logic circuits designed on personal computers or at workstations.

Translation formats provided include

the JEDEC format for a total of 10 types provided as standard, enabling data to be loaded from such PLD design tools as ABEL, CUPL, PALASM and AMAZE.

Socket adaptors are used to accommodate a diverse range of packages such as SOPs and PLCCs, thereby ensuring that the SE4971 will not become obsolete when new devices appear. In addition, the SE4971 provides programming algorithms for a number of device manufacturers as standard, enabling the optimum programming method to be selected by specification of type code, manufacturer and architecture.

Further information from Alfatron, 14 Jersey Road, Bayswater 3153 or phone (03) 720 5411.



Function generators

The Black Star series of UK designed and manufactured 'Jupiter' function generators are now available in Australia in two models.

The 'Jupiter 500' covers the frequency range 0.1Hz to 500kHz in 7 decade ranges, but is typically useable from 0.02Hz to 700kHz. Output waveforms available include sine, triangle, square and TTL. Inputs are provided for external amplitude modulation and external frequency sweep. Output impedance is 600 ohms and the output amplitude is from 0 to 30V p-p min. The DC offset is –15V to +15V, fully variable.

The 'Jupiter 2000' covers the frequency range 0.2Hz to 2MHz in 7 decade ranges. Output waveforms include sine, square, triangle and TTL. A variable symmetry control is provided. The sweep range is more than 2000:1. put impedances are 50 ohms and 600 ohms. A switched and a variable attenuator are provided. Output level is from 0 to 20 volts.

For further information contact Obiat, 129 Queen Street, Beaconsfield 2014 or phone (02) 698 4776.

1GHz network analyser

Anritsu has released the highly sophisticated MS3606A network analyser, which covers the 10kHz to 1GHz frequency range and allows high-speed measurements of 400us/point and a dynamic range of 120dB.

In addition, the delay range can be varied in 21 steps between 100ns to 400ms with the resolution 1/10,000 of the selected range. A scalar analysis function permits easy measurement of the frequency characteristics of tuners, CATV U/V converters, and similar devices that have different input and output frequencies.

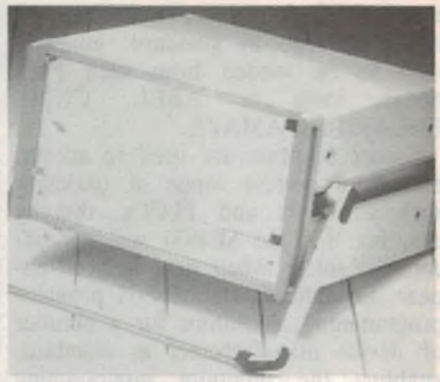
Further information from Alcatel STC, 58 Queensbridge Street, South Melbourne 3205 or phone (03) 615 6666.

ENCLOSURES

Sturdy instrument case

Knurr of Munich has introduced an extruded aluminium construction which forms the basic structure of the Mocain case. Two die-cast sections joined by cross extrusions make up identical front and rear frames.

Depth extrusions are screwed to the frame to form a conductive connection, while steel cover panels can be easily removed for servicing. Vent slots in the bottom plate and rear panel provide

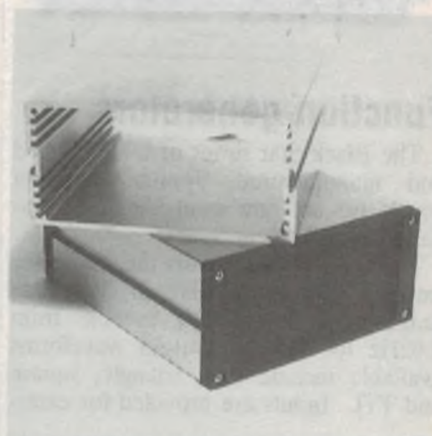


good ventilation.

The Mocain system was specially developed to hold Eurocards and electronic components designed in the modular chassis mould.

Four non-slip feet give the bench case high stability. Both front feet have a tilt action. Mocain cases are supplied with or without the combi handle-stand, which can be retrofitted.

Further information is available from Ricon, 66-76 Dickson Avenue, Artarmon 2064 or phone (02) 439 6078.



Extruded box

AIC's electronics enclosure is 100% Australian made and is suitable for housing instruments or electronic equipment. These include portable test gear, computer interfaces, electronic projects and power supplies.

The enclosure is very rugged and can easily be sealed to IP standards. It comprises an aluminium extrusion section and two plastic end panels.

The enclosure size is 44mm wide x 91mm high, the length depending on the size of the aluminium extrusion tion. The aluminium extrusion can be supplied in various standard lengths or to custom sizes.

Further information from Amalgamated Instrument Co, 7/21 Tepko Road, Terrey Hills 2084 or phone (02) 450 2962.

Computer News and New Products

Diskless workstation

Electronic Solutions has released WorkStation 286/12, a small footprint 80286-based diskless PC designed for companies needing secure workstations for their networked environments. LAN support includes ARCnet, Ethernet, Token Ring, or other LAN supported by a user installed network card in the WorkStation's standard AT-bus 16 bit expansion slot.

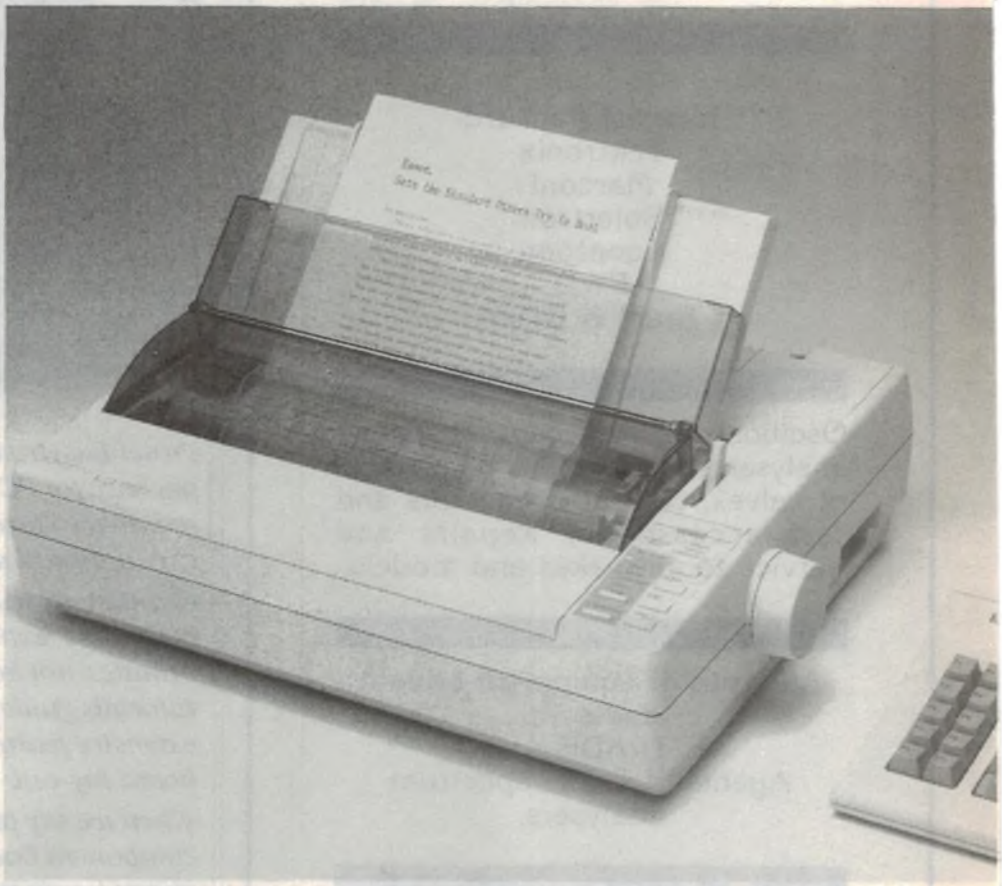
Remote booting is fully supported, so the WorkStation is fully compatible with NetWare/286, ELS Netware/286,SFT/ Advanced Netware 286,VINES/286 and other systems.

The WorkStation features an 80286 processor running at 12MHz with zero wait states, performing a Nortons SI rating of 13.7 – very speedy. The monitor is a MDA/Hercules type with a square, flat front tube for low glare and excellent text and graphics quality.

The WorkStation uses a custom AT motherboard which can be significantly upgraded for specialised and extra high performance workstation needs. RAM can be increased to 4MB, an 80287 can be added, EPROM can be increased to 128K. The board includes a full 16-bit AT slot, compatible with both 8 and 16 bit network cards.

The WorkStation 286/12 can also be supplied with facilities for external 360K/1.2MB 5-1/4" or 720K/1.44MB 3-1/2" drives. 2 serial and one parallel port are standard.

For further information and pricing contact Electronic Solutions, PO Box 426, Gladesville 2111 or phone (02) 906 6666.



24-pin printer

The LQ-550 is the newest in Epson's line of 24-pin dot matrix printers, combining reliability, high performance and ease of use. This compact, 80 column printer offers letter quality printing with advanced dual paper handling features, at an affordable price.

The LQ-550 will not replace the LQ-500; rather they will be marketed concurrently, to further strengthen Epson's position in the low-end terminal printer market.

Features of the LQ-550 include 'Smart Park' advanced paper handling; fast printing of 180cps in high speed draft mode and 60 cps in LQ; two built-in letter quality fonts, Roman and Sans Serif; and convenient Selectype control, allowing direct selection of the printer's major functions.

Further information from Epson Australia, 17 Rodborough Road, Frenchs Forest 2086 or phone (02) 452 0666.

Pocket-sized computer

The Atari Portfolio, the world's first pocket sized personal computer has been launched in Australia.

Designed in the UK, this MS-DOS compatible 'pocket PC' is based on a series on custom-built, low power chips and a variation of the 'smart card' system – used instead of conventional disk drives. It weighs less than 500 grams and measures only 200 x 105 x 29mm – about the size of a standard video cassette.

The Portfolio uses a 5MHz 80C88 processor with 128K of CMOS RAM,

16MHz 80386 system

AST Research has launched in Australia the Premium 386SX/16, which offers the speed and versatility of an 80386-based computer at an 80286-based PC price.

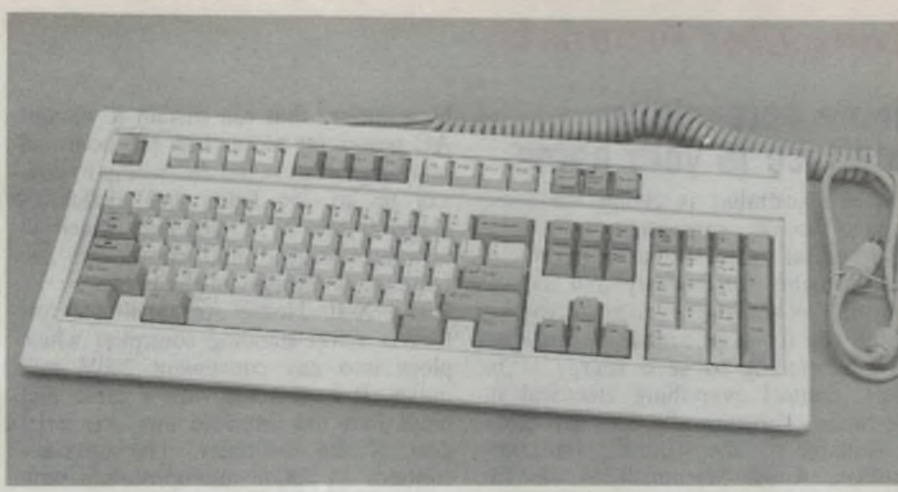
The machine features Cupid-32 architecture which provides for upgrading to a 386/25, 386/33 or 486 system when productivity needs require more power.

The 16MHz system has a zero-wait-state cache memory based on the Intel 80386SX microprocessor. It has five, full-length expansion slots (one 8-bit and four 16-bit) compatible with industry standards to allow easy expandability for the reseller or end-user.

The Premium 386SX/16 has a full megabyte of RAM. Up to 4Mb of RAM can be installed in the CPU board, and up to 16Mb of RAM can be installed using the memory expansion board.

Three models are available – the 45V, 5V and 3V, all with an AST-VGA graphics adaptor. The 45V has a 40Mb AT-embedded fixed disk drive and a 1.2Mb, 5.25-inch diskette drive. The 5V has a 1.2Mb, 5.25-inch diskette drive. The 3V has a 1.44Mb, 3.5-inch diskette drive.

Further details from AST Research, Level 3, 178 Pacific Highway, St Leonards, 2065 or phone (02) 906 2200.



Low cost AT/XT keyboard

Fujitsu has established a highly automated factory to manufacture zero defect keyboards at very compatible prices.

The FKB4700-101 is suitable for use on AT* and XT* compatible computers. It will automatically select AT* or XT* mode of operation using MPU software to determine the type of computer it is plugged into.

The fully expanded 101 keys have a USA key arrangement and use silent tactile membrane low profile switches, which give a highly reliable switching with typical maximum operating life of 30M operations. The switches have a low operating force of 55g, and are arranged in a step sculptured curve; this, combined with a two position tilt stand makes the keyboard a good ergonomic layout for quick and accurate typing. The num lock, scroll lock and caps lock keys all have built in LEDS for easy status identification.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe 2141 or phone (02) 648 5455.

expandable to 640K in 256K steps. This advanced CMOS technology has made the Portfolio so power efficient it runs on just three AA batteries. It includes a suite of integrated software consisting of a word processor, Lotus 1-2-3 file-compatible spreadsheet, diary/timer manager, address book and calculator – all linked by a universal 'clipboard' system that allows the user to move data between applications.

For more information contact Atari Computers, 376 Lane Cove Road,North Ryde 2113 or phone (02) 805 0344.

9600 baud modem

Linkware has released the Cermetek Spectrum 9600 modem range, for communication speeds up to 9600 bits per second (bps).

The Spectrum 9600 combines both V.32 and V22bis CCITT standards providing both powerful and versatile modem communications.

The modem also incorporates 'smart' software that automatically switches from leased line operation to an alternate PSTN line in the event of a failure. The whole process is transparent to users, saving both time and frustration in manually switching between communication services.

The Spectrum 9600 provides full duplex asynchronous and synchronous communications over PSTN or leased lines. Built into the specification are features such as echo cancellation and error correction, which compensate for impairments likely to occur during high-speed transmission in a dial-up environment.

For further information contact Linkware, 604 North Road, Ormond 3204 or phone (03) 578 0821.

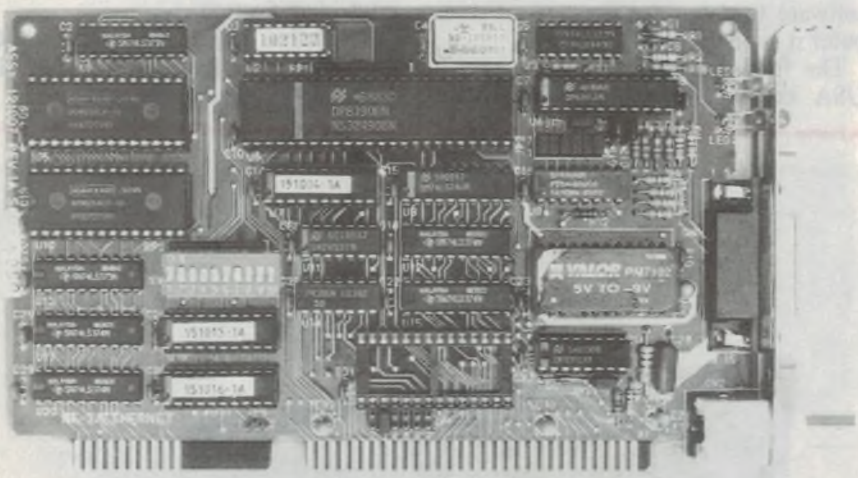
Home automation interface in your home

X-10 (Australia) is giving the most popular home computers something really useful to do around the home – control lights for security and safety, control TVs and stereos to wake you up or lull you to sleep, control heating and air conditioning to save energy – in short, control everything electrical in the home. This powerful new capability is available for the IBM PC and compatibles, Apple Macintosh, Apple IIe and IIc and Amiga for only $229 (suggested retail price).

The key to this seemingly all-powerful home automation magic is X-10's new Home Automation Interface. It's a small peripheral that is actually a self-contained microcomputer with its own microprocessor, and memory backed up by a battery that can sustain it without AC power for more than 100 hours. It sends signals over the AC wiring to control up to 256 lights and appliances plugged into X-10 modules, which in turn are plugged into convenient 240 volt outlets throughout the house.

The X-10 Home Automation Interface is a free-standing controller which plugs into any convenient 240V wall outlet. It is supplied with a cable that plugs into the interface and the serial port of the computer. The interface contains an 80C48 microprocessor with on-board ROM (read only memory), RAM (random access memory), an internal real-time clock and battery backup.

Further information from Midac Technologies, Suite 147, 313 Harris Street, Pyrmont 2009 or phone (02) 692 9111.



Ethernet adaptor card

Electronic Solutions has just released a new line of high performance Ethernet networking cards claimed to make it possible to build a high performance networked environment at a moderate cost.

The cards are all fully compatible with all industry standard networking software and topologies, including Novell Netware (NE1000 and NE2000), Gateway G/Ethernet, DECnet-DOS, PC-NFS, TCP/IP, Net-Ware 3+, OS/2 LAN Manager, UNIX/XENIX, NetBIOS and APX.

For an example of costing, the Electronic Solutions NE-2 card, a full 16 bit Ethernet card with 16/64K RAM buffer (to support multi-packet communications), ROM support for diskless workstations, support for NetWare and all Gateway communications products and 100% compatibility with IEEE registered NODE-ID costs only $449 incl. tax in 1-up quantities. Most other suppliers are quoting around $850 for products to this specification.

The cards carry a 3 month warranty plus a 14 day money-back guarantee.

For further information contact Electronic Solutions, Box 426, Gladesville 2111 or phone (02) 906 6666.

486-based PCs

Australian microcomputer developer and manufacturer, Terran Computers has released a new family of 486-based desktop personal computers.

Called the Terran T-40 range, they come complete with high resolution monitor of 800 x 600 pixels (colour or monochrome), full-function keyboard, 1Mb of main memory as standard (upgradable to 16Mb), two serial and one parallel port, 25MHz processing speed and a keyboard security system which prevents unauthorised access.

Also included as standard are four IBM PC/AT compatible and one memory expansion slots, plus keyboard/mouse and floppy disk controllers as well as a hard disk adaptor.

For additional information contact Terran Computers, Unit 2, 15 Brisbane Street, Eltham 3095 or phone (03) 439 4100.

Mac versions of Protel CAD

Protel Technology is launching versions of its PBC layout programs, to operate on the Macintosh II and SE families.

The first programs to be launched will be Autotrax and Easytrax. During the first quarter of 1990 a schematic program will be available to complement the Autotrax program, providing automatic routing through schematic netlist capture.

The Macintosh versions retain all the power and functionality of the well known PC products but they faithfully adhere to the familiar Macintosh user interface.

For further information and specifications on the Macintosh versions of Protel software and/or the PC versions, contact Protel Technology, GPO Box 204, Hobart 7001 or phone (002) 73 0100.

CAD Software Review:

DC/CAD drafting package

DC/CAD is a complete end-to-end CAD package for electronic design – from feeding in the circuit schematic to laying out the printed-circuit board, including automatic routing. Mark Cheeseman put it through its paces...

In the last few years, the rapid increase in PC board densities, accompanied by the use of multi-layer boards and the use of devices with larger and larger numbers of pin connections has made the circuit board designer's job almost impossible to perform without the aid of a computer.

The first PCB CAD packages were relatively simple affairs, with the operator having to place the components and join the pins manually. This was still a lot better than the manual tape-and-donut system which was the norm until the emergence of CAD.

The next big development was auto-routing, where the pin connections on all the components are joined by tracks laid by reading a file called a 'netlist', which is a set of instructions describing how the board is to be wired up. The auto-router then lays as many tracks as it can, according to a set of design rules.

DC/CAD is a fully integrated system for the design of circuit schematics and printed circuit boards. The package consists of an editor (used for both schematic and PCB design), an auto-router, a set of component libraries (both circuit symbols for schematic drawing, and dollies for the physical PCB layout).

A number of other programs perform functions such as design rule checking and generation of a parts list and bill of materials. Utilities are also included which read and write standard Gerber photoplotter files, and convert to and from the AutoCad '.dxf' file format.

The design process starts with the schematic. Components from the libraries are placed on the screen, and connected together with 'wires'. Components can be moved around at will, as the circuit progresses; connections to the components stay connected, and are dragged with the component. A wire is a special type of line – representing a logical connection between two or more pins on the schematic. Ordinary lines can be drawn on the schematic to aid visual interpretation, but are ignored when the netlist is generated later on.

A circuit schematic need not be restricted to a single page. Several pages can each accommodate different parts of a circuit, allowing it to be divided up into logical sections for easier editing. Connections to other parts of the circuit need only to be labelled with identical names on both sheets, and a logical connection is established for later use by the auto-router. You can specify track widths at the schematic stage, rather than having to do this later on the PCB itself.

When the circuit is completed, a netlist is generated for each part of the circuit. These intermediate netlists are then combined together into a single netlist file, the whole process being analogous to the compile-link procedure encountered in programming. Of course, any errors encountered in either of these stages are reported as they are encountered, so that they can be corrected before they go any further.

The completed netlist file is then read in to route a PC board. Before this is done, however, the size and shape of the board need to be determined, and the components physically placed in their intended places on the board. To do this, the same editor that was used to edit the original schematic is used. The editor operates in one of two environments (schematic and PCB), and this is automatically determined according to whether a PCB or schematic file is being edited. If you are starting a new file, you need to tell it whether to treat the file as a schematic or PCB file.

An exclusion line defines the area within which components and tracks on the board are allowed to exist. Exclusion lines can also be placed around parts of the board which must be kept clear, such as mounting holes or cut-outs. An auto-place feature can then be used to physically load the components onto the board, after which they can be moved around at will. Of course, you can manually place each component on the board yourself, but the auto-place command simplifies this to a single step.

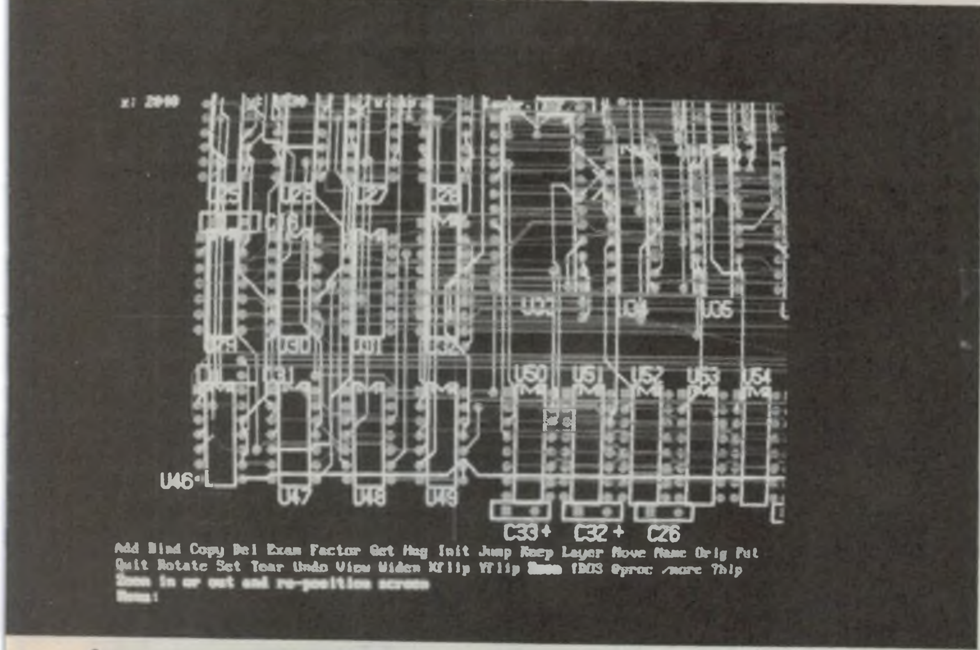
A rat's nest is usually the first step in routing the board. It gives a good idea of how components can be moved around to minimise track lengths and cross-overs. Once the board has been laid out to the designer's satisfaction, routing can begin.

The auto-router, like most parts of DC/CAD, is controlled by a configuration file, which determines the design rules – such as minimum track width and spacing, which layer has tracks running in which directions, and which tracks to give priority to (such as power-supply lines).

The package is capable of handling up to 64 layers, of which up to 32 may be trace layers (which is far more than even the most complex boards use), and can route boards of up to 32" square. The board is displayed on the screen during the routing process, so that its progress can be monitored. A running status of elapsed time and the number of tracks routed, and the number of failures and rip-ups is shown at the top of the screen.

Driving DC/CAD

Like any program of this complexity, DC/CAD takes a while to get used to. It is assumed that the user is already



A close up of the DC/CAD demo file (a CGA card design). Note the optional menus at the bottom of the screen.

familiar with circuit and PC board design principles. The command structure is quite logical, and easy to get used to. Commands follow the usual English syntax of a verb followed by a noun – for example, to Add a Symbol to the drawing, one would type the letters 'AS'.

For the newcomer, menus are displayed at the bottom of the screen, and items may be selected by pressing the first letter of the word appearing in the menu (which are the same as the commands used when the menus aren't displayed). Thus, the operator can use the menus until the commands become familiar, at which time they may be turned off to give more screen space to the actual drawing.

An on-line help facility is available at all times, to save you digging through the reference manual to find out how to use a particular command.

DC/CAD, unlike some schematic and PCB design packages, uses floating-point arithmetic for all its operations. While this may seem unnecessary for work which can be (and often is) performed using integer operations, it does have certain benefits.

For example, any component (or group of components) may be scaled up or down by an arbitrary (non-integer) scale factor, or rotated through any number of degrees (not the usual 90° increments that integer arithmetic dictates). While you may not need this ability for most circuitry, large components (such as power transistors) often need to be placed at odd angles to conserve space.

Groups of components can be collectively moved, re-sized, or rotated as a single component, and afterwards, the grouping can be removed, so that the components can be treated separately once again. Indeed, an entire drawing can be defined as a group, and then manipulated as a single component.

All files created and used by DC/CAD are in a plain ASCII format. This includes setup files, PCB and schematic drawing files, and netlists. The benefit of this is that a text editor capable of handling straight ASCII files can be used to manipulate CAD files. Using a word processor's global search and replace facility can automate some operations which would be more tedious with the usual graphics editor.

Users with an inclination towards programming can also easily write their own utility programs to perform custom operations with the graphics database, or to extract data from the file for use with other software.

DC/CAD allows extensive programming of the Function keys and mouse buttons. Six of the Function keys are pre-defined, but the other four, plus all 20 Control- and Shift-Function key combinations can be defined by the user to suit personal preferences and the particular type of design being undertaken. Indeed, it is possible to set the functions of some keys to change the functions of others, or the functions of the mouse buttons.

On-screen colours for all of the layers may be selected from a menu (or from the command line, if you can remember the numeric code corresponding to each colour), so that colours which do not contrast well with the background can be changed to something else.

The documentation accompanying DC/CAD is extensive, to say the least, consisting of a user's manual and reference manual, each in its own 3-ring binder. The user's manual provides a general overview of the package's operation, and describes how to install it on the system. A tutorial section then guides the user through the design of a simple schematic and circuit board.

The reference manual is arranged logically, with the commands for each program being grouped together in alphabetical order.

As with any CAD package, this software places heavy demands on the computer, so when selecting a computer for such work, these demands should be kept in mind. For starters, you'll need a '286- or '386-based machine – the faster the better. Machines with very high clock speeds will also perform better with a memory cache, so this should be looked for too.

While small designs can be accommodated using a standard 640K machine, anything more ambitious virtually requires the presence of expanded memory (conforming to LIM 3.2 or later), otherwise operation will slow down dramatically as the data which would be stored in this memory is paged out to disk. If you get a '386 system, make sure that you also obtain a utility to make its extended memory appear as expanded.

One addition to the computer which you should seriously consider – even if you are only designing relatively small boards – is a maths co-processor. The increase in speed between a barefoot machine and one equipped with a coprocessor is nothing short of amazing, due to the program's use of floating-point arithmetic.

Summarising

DC/CAD is quite a powerful CAD package for schematic capture and PCB design, incorporating into a single package what many vendors sell as separate items. It is also available in two versions; the 'Level 1' version priced at $960, or the rather more powerful 'Level 2' version for $5495. There's also an evaluation package, available for only $40.

Further information is available from the Australian distributor Advanced Solutions, of 47 Karrill Ave, Beecroft NSW NSW. Phone (02) 872 1981.

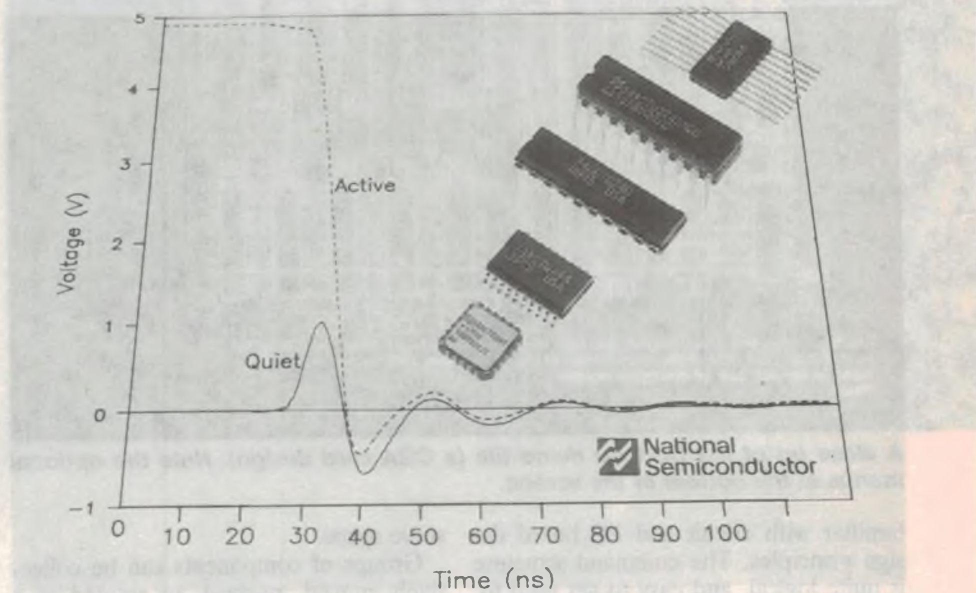
Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Lower noise FACT logic

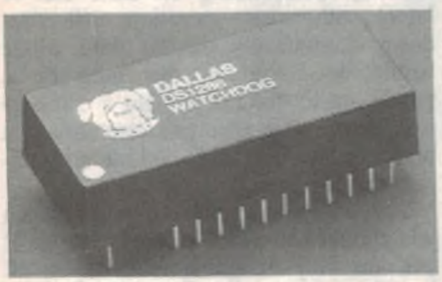
National Semiconductor Corporation has extended its industry standard FACT (Fairchild Advanced CMOS Technology) logic family with the addition of the first members of the FACT 'Quiet Series' (QS), which have guaranteed low-noise characteristics. National said the initial four QS devices have the lowest ground bounce, undershoot and dynamic threshold of any advanced CMOS logic family available today.

The FACT QS products have been designed to meet the rapidly expanding market for asynchronous applications that are particularly noise sensitive, such as clock lines, enable lines, and resets. FACT QS products are also designed to eliminate the threat of errors due to noise effects on the unprotected inputs of RAMs, PLDs, and interface-device input circuits.



The products also offer very tight output skew. For clock distribution or for skew to similar output edges, the output skew is typically less than 500ps. As with standard FACT products, expitaxial silicon essentially eliminates latchup, typically at 1.0A.

Further information is available from National Semiconductor Distributors.



Calendar chip mimics SRAM

The DS1286 'Watchdog Timekeeper' from Dallas Semiconductor keeps track of time with its 400-year calendar and features a Watchdog Timer that guards against computer malfunction.

Packaged in a standard 28-pin DIP, the DS1286 can be plugged into an existing memory chip socket. Calendar information can be read or written in the same manner as bytewide static RAM. Equipped with an internal lithium battery, the Watchdog Timekeeper lasts for more than 10 years in the absence of system power.

Accessible information includes hundredths of seconds, seconds, minutes, hours, day, date, month and year information. The date at the end of the month is automatically adjusted for months with less than 31 days, including correction for leap years. The Watchdog Timekeeper operates in either 24-hours or 12-hour format with an AM/PM indicator.

Further information from Alfratron, Unit 5, 14 Jersey Road, Bayswater 3153 or phone (03) 720 5411.

20MHz flash ADC

Micro networks, the Data-acquisition/conversion Products Division of Unitrode Corporation, has announced a new flash A/D converter which complements its existing product line of high-performance A/D converters. The MN5820, an 8-bit, 20MHz device, contains all of the support circuitry within a single package required to implement flash conversion. Furthermore, these support circuits are user-configurable, making this device very versatile.

MN5280 contains a band-gap voltage reference, VRT (voltage reference top) and VRB (voltage reference bottom) amplifiers, analog input buffer amplifier and 75 ohms input termination resistor. By exploiting the 'hybrid advantage', Micro Networks has brought together the analog functions required when implementing flash A/D conversion, simplifying the system designer's task.

Further information is available from Priority Electronics, in Melbourne on (03) 521 0266 or Sydney (02) 905 6024.

64K CMOS SRAM is non-volatile

The MK48Z08 from SGS-Thomson is a 65,536-bit, non-volatile energy source. The 'Zeropower' RAM has the characteristics of a CMOS static RAM, with the important added benefit of data being retained in the absence of power. Data retention current is so small that a miniature lithium cell contained within the package provides an energy source to preserve data.

Low current drain has been attained by the use of a full CMOS memory cell, novel analog support circuitry, and carefully controlled junction leakage by an all-implanted CMOS process.

The Zeropower RAM can replace existing 8K x 8 static RAM devices directly, conforming to the popular byte-wide 28-pin DIP package (JEDEC).

For more information contact Promark Electronics in Sydney on (02 906 1300 or Melbourne (03) 878 1255.

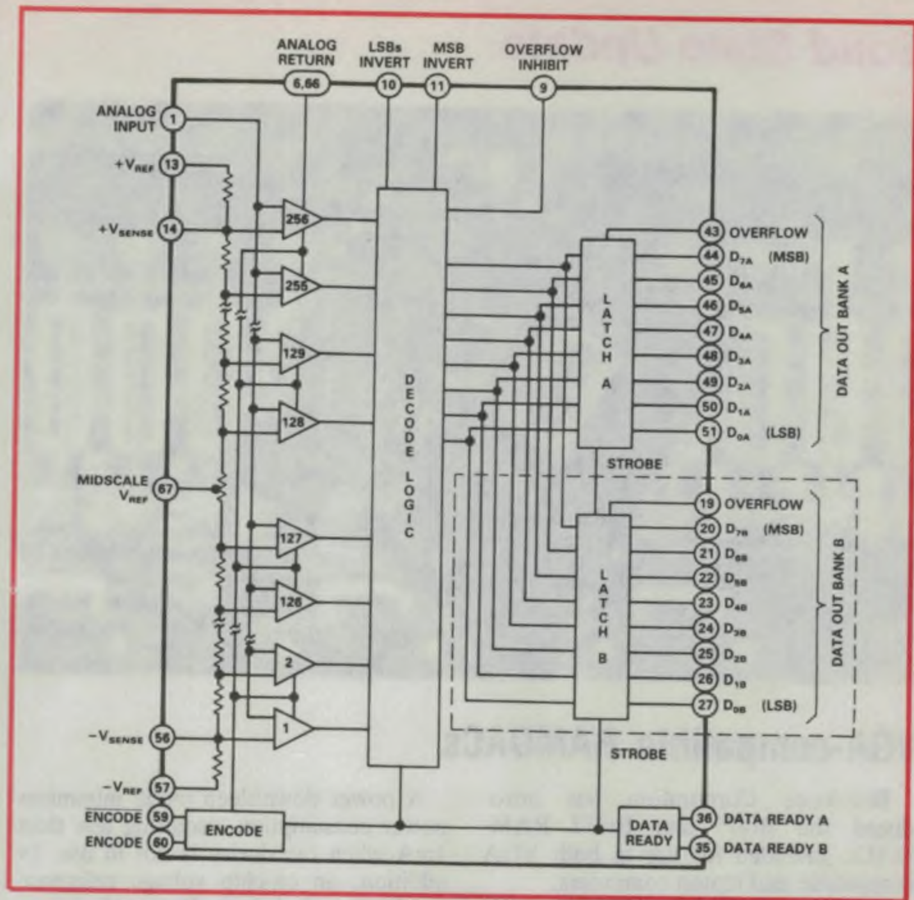
8-bit flash ADC operates at 300Msps

Producing 8-bit analog-to-digital conversions at up to 300 megasamples per second (Msps), Analog Devices' AD9028 (and related AD9038) have guaranteed critical ac specifications. Both flash converter devices are identical in performance, but offer a choice of digital interfacing rates.

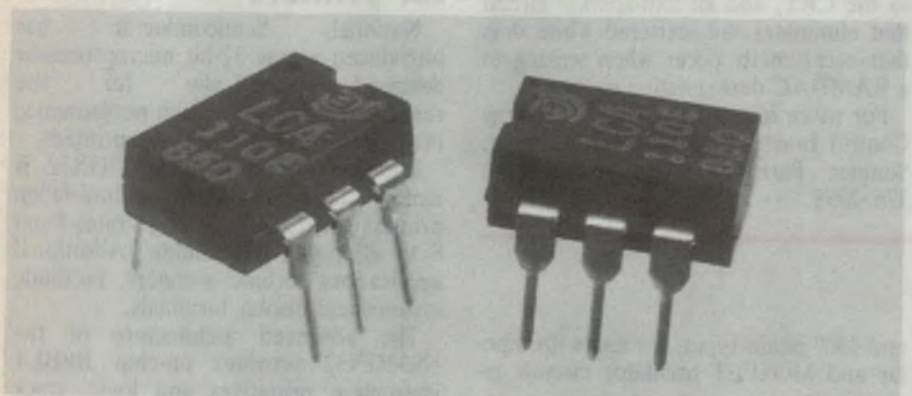
The AD9028 uses a single parallel ECl-compatible output latch, while the AD9038 provides a 1:2 demultiplexed output via two latches for convenient interface with slower digital logic or memory. Key applications include digital scopes, transient recorders, radar, phased array beam forming, missile guidance, and electronic warfare.

Enhancing the 300Msps sampling rate is a 250MHz analog bandwidth, 36dB SNR for 92MHz inputs, and 47dB SNR for 9.3MHz inputs (both tested at 250Msps), with harmonic distortion of 40dBc at 92MHz and 56dBc at 9.3MHz. Maximum differential and integral nonlinearities are the same: 0.75LSB (J grade) and 1.0LSB (K grade) with guaranteed 8-bit 'no missing codes' performance.

Fabricated in an advanced bipolar VLSI process, the AD9028 and AD9038 feature sense connections at the +Vref and –Vref inputs for accurate full-scale calibration; a tap at the midpoint of the reference ladder is available to minimize integral nonlinearity.



For further information, contact Avisun, Unit 9, 1 Short Street, Chatswood 2067 or phone (02) 417 8777.



Solid state AC/DC switch

Theta-J's OPTOMOS Solid State Switch LCA110E, optical isolation of 3750VRMS, is the first of a series of Theta-J Solid State Switches to be released with Telecom Approval (RA88/141).

The LCA110E is ideal for Telecom Tip/Ring, Dial Pulse and Ring Generator Switching as well as Data Acquisition mutiplexing applications.

The switch optically couples a LED with proprietary photovoltaic IC to control a pair of custom DMOS output chips. This provides the capability of driving AC and DC loads directly from CMOS circuits. The 2mW of drive power of 100 times lower than most sensitive mechanical relays and allows direct drive from a microprocessor.

For further information contact IRH Components, 32 Parramatta Road, 2141 or phone (02)648 5455.

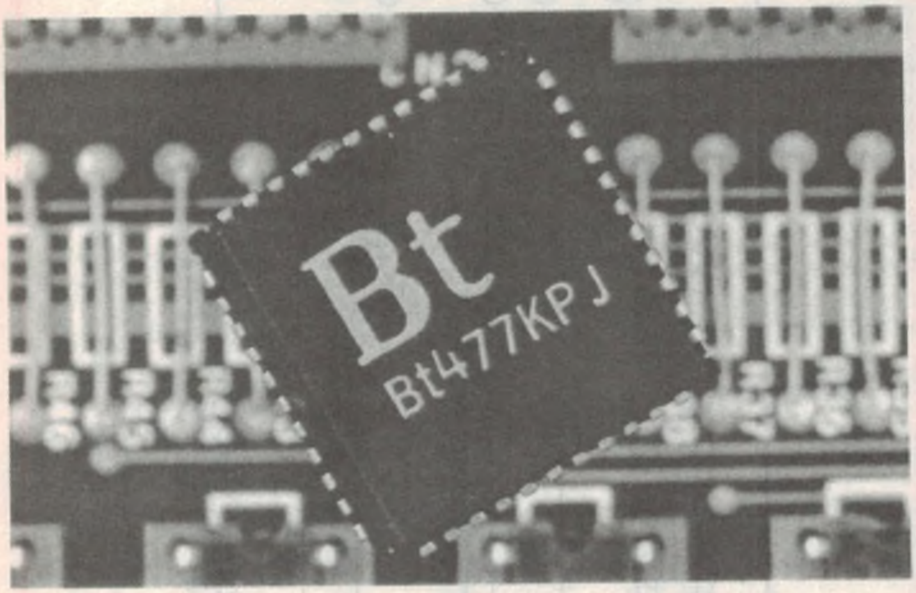
Single-chip fax modem

A CMOS single chip FAX modem IC has been released by Energy Control International.

The Yamaha YM7109 LSI is a one-chip modem for half-duplex synchronous data transfer at 9600, 7200, 4800, 2400 and 300bps (CCITTV.29, V.27ter, V.21 ch2). With its built-in programmable dual tone originating function and programmable dual tone detection function, this LSI is designed for use with a public telephone network and is ideal for modem applications for G3 facsimile machines.

The YM109 also has a built-in interface register which can connect to the data base. Through the interface register, via a parallel interface, the microcontroller can set the operating mode, set various parameters, read status flags and transfer the data to be transmitted or received. The transfer of the transmit and receive data, as well as modem operation, can also be performed via a serial interface.

For further information contact Energy Control International, 26 Boron Street, Sumner Park, 4074 or phone (07)376 2955.



VGA-compatible RAMDACs

Brooktree Corporation has introduced the Bt475 and Bt477 RAMDACs, intended for use in both VGA compatible and laptop computers.

Similar to their predecessors the Bt471, Bt476 and Bt478, the Bt475 and Bt477 are 80MHz, 256 x 18 and 256 x 24 (respectively), colour palette RAMDACs suitable for use in desktop publishing, CAE/CAD/CAM, image processing, instrumention, and other high-resolution colour graphics applications. However, Brooktree has also incorporated a number of additional features on the new RAMDACs to make them more suitable for use in laptop computer systems that offer the option of driving a VGA monitor.

A power down/sleep mode minimizes power consumption, requiring less than 1mA when the device is not in use. In addition, an on-chip voltage reference has been included to allow a single external resistor to set the full-scale output current of the triple 8-bit DACs.

The Bt475 and Bt477 also offer two new features: on-chip comparators used to verify and indicate proper connection to the CRT, and an anti-sparkle circuit that eliminates the scattered white dots that occasionally occur when writing to a RAMDAC during active video.

For more information contact Energy Control International, 26 Boron Street, Sumner Park 4074 or phone (07) 376 2955.

Two-port SAW resonator

Murata Manufacturing Company of Japan, has recently released a two-port surface acoustic wave resonator, the SAR series, for the UHF band.

The resonators are said to make oscillator design the in UHF band a much simpler process and increases the power handling ability by about 10 times, when compared with the earlier single port SAW resonators.

The standard frequency range is currently tailored for CATV, remote control, and security applications, however Murata is prepared to manufacture to specification for other applications.

The SAR series are available in O° and 180° phase types, for use with bipolar and MOSFET oscillator circuits respectively.

Typical circuit parameters for the series are insertion losses of 5.6dB, loaded Q of 4400, and input and output impedances of 50 ohms.

The small size and accurate frequency of oscillation of these resonators makes them suitable for use in small remot controllers such as automotive burglar alarms, garage door openers, and building access systems.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe 2141 or phone (02) 648 5455.

Surface mount stepper driver

Ericsson Components has released the PBL 3770A, a high performance stepper motor drive circuit in a 28-pin plastic PLCC package.

The PBL 3770A is a bipolar monolithic circuit intended to control and drive the current in one winding of a stepper motor. It is a high power version of PBL 3717 and special care has been taken to optimise the power handling capability without suffering in reliability.

The circuit consists of a TTL-LS compatible logic input stage, a current sensor, a monostable multivibrator and a high power H-bridge output stage. The circuit is pin-compatible with the PBL 3717 industry-standard driver.

Two PBL 3770A's and a small number of external components form a complete control and drive unit for LS-TTL or microprocessor-controlled stepper motor systems.

Key features include half-step and full-step operation; switched mode bipolar constant current drive; a wide range of current control, 5 to 1800 mA; and wide voltage range, 10-45V.

Further information is available from Ericsson Components, PO Box 95, Preston Vic 3072 or phone (03)480 1211.

32-bit processor for printers

National Semiconductor has introduced a new 32-bit microprocessor designed specifically for the requirements of high-performance imaging systems such as page printers.

The new processor, the NS32GX32, is aimed at mid-range feature-laden printers which provide page rates from 8 to 80 pages per minute. Additional applications include scanners, facsimile systems and display terminals.

The advanced architecture of the NS32GX32 provides on-chip BitBLT instruction primitives and logic, stack instruction syntax tuned for PostScript execution, and an on-chip two-way set associative data cache for character generation.

Other advanced features include a low-cost floating-point solution for graphics processing, an on-chip instruction cache, and a clock frequency of up to 30MHz.

The NS32GX32 is optimized for use with low-cost memory. Because of its highly efficient architecture, wait states have limited impact on performance.

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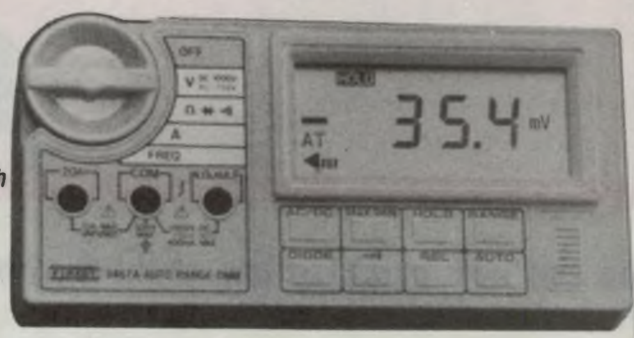

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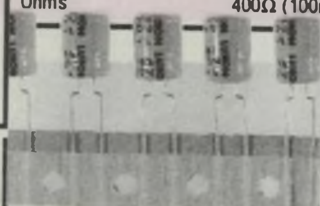

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ATM09	F/V converter	42.60
ATM10	Quad Power Supply	60.60
ATM11	10 Minute Controller	46.20
ATM12	6 dig Batch Counter	75.00
ATM13	3 Digit Counter	65.40
ATM14	3 1/2 digit LCD DVM	42.60
ATM16	10kV Isolator	70.80
ATM17	Storage Adaptor	193.00
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ATM19	6 dig Up/Dn Counter	69.60
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ATM25	22/3 Radio Modem	66.60

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Did you get your copy of our new catalogue in December's Electronics Australia? If you didn't then ask for a copy with your next order. This issue has a list of all the most wanted semiconductors

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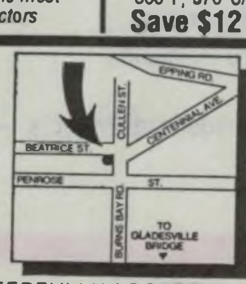

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SPECTRUM

Communications News & Comment

Conducted by DAVID FLYNN

Intelsat VI launched

The success of the International Telecommunications Satellite Organisation (Intelsat) continues, with the first in its new Intelsat VI series of communications satellites now flying over the Atlantic Ocean.

Intelsat VI is the world's most complex and most sophisticated commercial communications satellite, and at nearly two tonnes it is also the heaviest. Launched aboard an Ariane rocket from French Guiana, the first in this series of five birds can carry as many as 120,000 telephone calls and three colour television channels. Compare this to the 240 two-way voice circuits or one black and white TV channel offered by Early Bird, Intelsat's first satellite, launched 25 years ago.

The useable life of satellites has also improved, with the VI series designed for reliable service up to 13 years – almost twice that of the previous series.

Intelsat has already planned its next series of satellites, the Intelsat VII, designed for the specific requirements of countries in the Pacific Ocean region. The VII series will use higher power transponders and spot beams, driven by a 4000 watt solar array, to allow for the use of smaller and less expensive ground stations. The first in the series is due for launch in 1992.

There are now 85 commercial communications satellites in geostationary orbit around Earth, the most extensive network belonging to Intelsat, whose 14 birds provide voice, television, data, fax, telex and videoconferencing services.

UK soon for digital cellular?

Great Britain could become one of the first countries to offer the proposed European-standard (GSM) digital cellular mobile telephone system, with the announcement by Mercury Communications of their plan to establish the country's third cellular network under the GSM specification.

Mercury, a private competitor to British Telecom, expects to have the network operating by 1992, at a projected cost of A$2 billion. It will compete directly against the established British Telecom and Racal Vodafone cellular systems, but with the advantage of being useable across the channel in any other country with a GSM network.

Developments in the digital cellular telephone service (DTCS) are being watched with interest by local and international companies, with an eye to the ever-growing need for increased capacity in cellular systems – either through intergration of DCTS into an existing analog network, or the opening of an additional purely-digital service.

More on bulletin boards

Following our recent listing of Australian computer bulletin board services with a leaning towards radio communications, the following overseas BBS's may be of interest – but don't forget that they are charged at the usual ISD rates.

Trio-Kenwood's new BBS includes product news, service tips and modifications for various Kenwood amateur radios and communications receivers; the BBS is open between 0100 and 0500 UTC weekdays and 24 hours on weekends, on 0011-1-(213) 761 8284 (data rates from 300 – 2400 baud).

The Association of North American Radio Clubs (ANARC) has one of the world's most comprehensive radio-related bulletin boards, with numerous message areas for all aspects of radio hobbies and reports from around the world; call 0011-1-(309) 688 0604 (uses North American Bell tones, on 300 and 1200 baud; available 24 hours).

The AMSAT group maintains two bulletin boards for disseminating information about amateur radio and satellites – on 0011-1-(515) 961 3325, and 0011-1-(314) 447 3003. Both are available 24 hours and take speeds up to 1200 baud.

Locally, Sydney's 'Shortwave Possums' BBS has increased its content of public domain software for shortwave and amateur radio, and also features a number of interesting text files and reports – SWP operates to 2400 baud, 24 hours a day, on (02) 651 3055.

Pick of the pirates

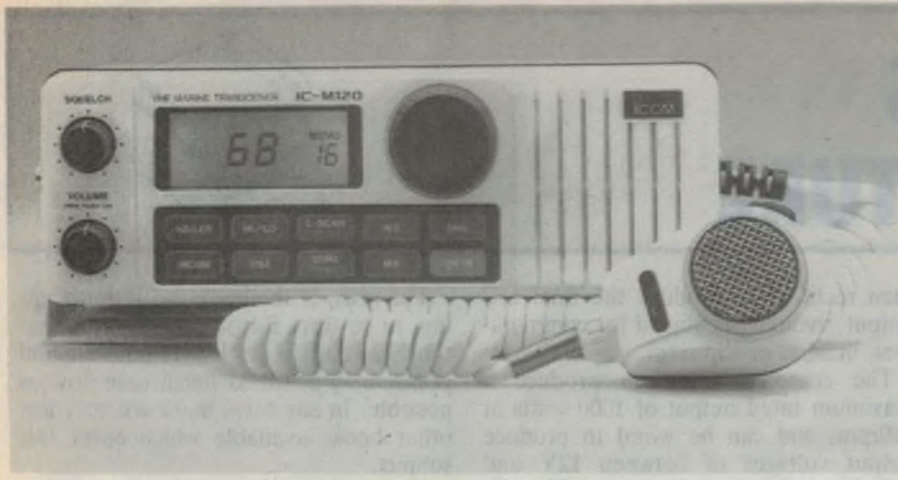
Officers in the Department of Transport and Communications have expressed concern over the ease with which a new amateur radio can be modified to operate from 26 – 28MHz continuous, with all modes and high power.

The Uniden HR-2510, imported into Australia by Uniden Corp, is ostensibly a 'full feature' mobile transceiver covering the 10 metre amateur band (28 – 29.7MHz) in AM, FM, SSB and CW modes, with an output of up to 25 watts. Drawing on Uniden's extensive experience in the communications field, including many years of success with its CB radio range, the HR-2510 has proven popular with overseas amateurs due to its reasonable price, performance and high level of features.

Set for the same favourable response

Stamp for Radio Australia's 50th

Australia Post has released a special stamp issue to commemorate the 50th anniversary of Radio Australia. Designed by Brian Sadgrove, the stamp depicts a globe being covered by radio waves advancing from the south-east corner (where Australia is usually depicted) to cover the rest of the world. The stamp costs 41c and is available from local post offices.



Icom's new IC-M120 marine VHF transceiver, which provides full coverage of all international marine channels along with 10 weather channels. Features include 24 memory channels, advanced scanning, instant access to the emergy channel 16, and selectable 1W/25W output.

from Australian hams, the radio has also been welcomed by local pirates, who've heard in advance that it is easily converted to cover the de facto 'international pirate bands' of 26 – 28MHz, and the CB band in-between.

An added attraction is the availability of FM, which became the latest 'fad' for pirates following recent proposals that the AM mode be replaced with FM on the 27MHz CBRS. Although this did not eventuate, the interest generated in FM has remained, with '27FM' the subject of much experimentation by pirates.

Investors ready for comms market boom

Having bought into nearly 30 prime communications sites, and with construction of additional towers under way, the private company Australnet is gearing up to obtain a large slice of the lucrative mobile communications market.

Australnet first came to notice earlier last year, as a group of investors who saw potential in the concept of providing communications facilities and services as an independent business, as in the USA, rather than the traditional Australian approach whereby the facilities are owned and operated by major communications equipment suppliers.

Australnet is proud to boast that they claim no association with anyone from the communications industry, and operate solely as a dedicated facilities provider.

The company has expressed keen support for UHF trunked radio systems, which it believes are greatly underutilised in Australia, and has obtained several 800MHz frequencies to establish a trunked network stretching from Melbourne to Brisbane. Interest is also being shown in conventional VHF land mobile radio, wide area paging, radio and television microwave relay and the possible second cellular telephone system – for which any aspiring licensee will require an estimated 200 towers.

More delays for Sydney FM licences?

The owners of Sydney AM stations seeking a place on the FM band have been warned by DoTaC that the closing date for conversion submissions may be extended until April 1990.

Following court action by Sydney station 2WS, claiming it was disadvantaged in the tendering process, the date was moved back to December 29 – but Departmental advisers claim that if 2WS wins the court case, then in the interests of fair play all stations should be given another 90 days to re-assess the tender guidelines.

This is assuming the loser of the court case did not appeal against any decision, which would of course even further delay the closing date.

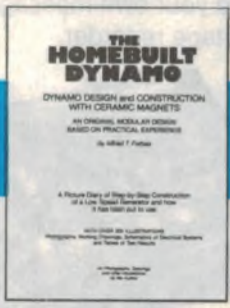
With all other areas having announced the successful tenders, and the first of these (Melbourne 3KZ) due on air this month (January), Sydney is lagging far behind, and stations may not even be on air by the time DoTaC calls for two new FM licences under 'stage two' of the national FM plan.

Companies or organisations with communications news items which they believe would interest our readers can send them directly to David Flynn, PO Box E160, St James 2000.

NEW BOOKS AND LITERATURE

DC generators

THE HOMEBUILT DYNAMO: Dynamo design and construction with ceramic magnets, by Alfred T. Forbes. Todd-Forbes Publishing, 1987. Hard covers, 308 x 220mm, 182 pages. ISBN 0-9597749-0-4. NZ price NZ$87.90 including GST; Australian price A$85 postpaid airmail.



This seems to be essentially a 'do-it-yourself' book for the person who would like to build their own low-speed DC generator, using reasonably accessible materials and the kind of tools available in most home workshops. The author apparently lives the self-sufficient rural life in New Zealand, and the book grew out of the immediate need to produce local power for purposes such as lighting at night. Not finding any existing books on how to build a generator, he worked it out for himself, did it the hard way – and then decided to write this book to help others do likewise.

The construction of the generator itself has been simplified so that it requires no previous knowledge of electrical machines, no castings, no welding and – surprisingly – not even any soldering! All electrical connections are made by means of 'B-B' connector strips, although soldering does appear to be involved in making the unit used to magnetise the rotor magnets.

The generator itself, or 'dynamo' as the author prefers to call it, is basically a three-phase alternator with a flat disc rotor having ceramic permanent magnets cemented into slots in its periphery, rotating between two stator assemblies carrying circular arrays of C-shaped laminated poles and windings. The AC output from the windings is then rectified to produce the final DC output, avoiding any need for commutators, brushes or slip rings.

The complete unit can produce a maximum rated output of 1000 watts at 740rpm, and can be wired to produce output voltages of between 12V and 36V for different applications. The author himself shows how it has been used with a converted bicycle frame, to produce a pedal-powered system sufficient to store energy in a marine battery, for powering up to eight 13W fluorescent lamps at night. Apparently he has found that about one hour of vigorous pedalling per morning will provide sufficient charge for the next night – and he catches up on his reading (as well as his exercise) while doing this!

But back to the book itself. The description is very detailed, with over 300 photographs covering virtually every tiny aspect of the construction process. Perhaps there's too much detail for the person with existing electrical knowledge, but the author apparently wanted to ensure that even those without this knowledge would be able to tackle the project confidently, and this he certainly seems to have achieved.

As examples of the detail given, he describes how to make a simple hand-powered diamond saw to cut the Philips strontium ferrite ceramic block magnets (purchased unmagnetised) into the much flatter profile magnets needed; how to make a magnetiser for the flat magnets, using an old telephone magneto and a capacitor bank; how to wind all of the stator coils; and even how to cut down transformer 'E' laminations, to make the 'C' laminations needed for the stator pole assemblies.

Incidentally he also gives a listing of the sources for virtually all of the components and materials used in the project, and discusses alternatives and substitutes in cases of supply difficulties.

So all in all, it's a very complete description, and one that should be of considerable interest – not just to self-sufficiency and 'alternative lifestyle' enthusiasts, but also to those who've always wanted to try building a home generator but thought it was beyond them.

The price of the book is a little daunting, to be sure. But it looks as if the author has had to publish it himself, and presumably needs as much cash-flow as possible. In any case, there are very few other books available which cover this subject.

The review copy came direct from Todd-Forbes Publishing, at PO Box 3919, Auckland NZ, who can supply single copies direct for the prices shown. However it is apparently also available from some booksellers – presumably those specialising in titles on self-sufficiency, in particular. (J.R.)

Microwave ICs

MMIC – MONOLITHIC MICROWAVE INTEGRATED CIRCUITS, by Yasuo Mitsui. Published by Gordon and Breach, 1989. Soft covers, 217 x 140mm, 127 pages. ISBN 2-88124-286-3. US list price $47.

One of the latest releases in the Gordon and Breach 'Japanese Technology Reviews' series, and in this case obviously an addition to the Electronics category. The author is an eminent engineer working in the LSI Research and Development Laboratory of Mitsubishi Electric Corporation, in Itami City, Japan.

Essentially the aim of this volume is to review the development of GaAs MMICs and their associated fabrication technology over the last five years, with particular emphasis to Japanese contributions and trends. This should make it of particular interest to anyone either working in the field, or wanting to get a comprehensive overview of the current state of this very significant technology. It isn't always easy to remain aware of developments in Japan, due to the language barrier.

After a brief introduction, the author discusses GaAs IC processing technology, with particular reference to the active and passive circuit elements used in MMICs. The active devices discussed both here and later are essentially MESFETs, with very little about HEMTs and other more recent devices.

The second and larger main section deals with examples of specific GaAs MMICs, in various application areas: lower frequency amplifiers, low noise amplifiers, power amplifiers, broadband amplifiers, oscillators, mixers, switches and phase shifters, frequency dividers, attenuators and MMICs in subsystems. The book then ends with a brief summary, followed by a list of some 148 reference papers.

For anyone wanting an insight into recent Japanese work in this exciting and pioneering field, it should be of great interest.

The review copy came direct from the publisher in New York, but the book itself notes that Gordon and Breach Science Publishers have an office in Melbourne, whose address is Private Bag 8, Camberwell 3124. (J.R.)

S–VHS video

SUPERVIDEO – THE REPORT: The Future of Consumer Video. Researched and produced by Right Hemisphere, October 1989. Comb bound A4, 49 pages. Price $48 including post and packing.

A report on the impact to date of the Super-VHS (and ED-Beta) video systems on the Australian domestic video market, with concise information on the new technology itself and predictions for the future. It is intended for professionals working in the production or sales areas of the video industry, or in fact for anyone wanting a solid insight into where the industry might be heading.

Aspects covered include the development of S-VHS, competing systems, how S-VHS and ED-Beta work (in both technical and not-too-technical forms), compatibility considerations, analysis of the various market segments, market forecasts, distribution and duplication, and relevant trends such as IDTV, EDTV, HDTV and Supercable. There is also a final summary of the current state of the Australian market, with its widespread lack of interest in and awareness of the potential of S-VHS, ED-Beta and Hi-Band Video 8.

Although written in concise form, for rapid reading by busy executives and other professionals, it seems to present a thorough, readable and accurate assessment of the current situation in Australia with regard to enhanced-performance video systems.

The report is available directly from Right Hemisphere Pty Ltd, 28 Adeline Street, Faulconbridge 2776. Phone (047) 51 5280, or fax (047) 51 1127. (J.R.)

Construction Project:

'Master control' power switch

This project uses an old idea in a new application that will prove very useful. Using the master-slave principle, it switches power to a slave appliance when a master appliance is turned on or off. Now you can control power to your TV set from the armchair by simply using the remote controlled VCR. No more blank, snow-filled screens and white noise at the end of the movie!

by BRANCO JUSTIC

The idea of a master appliance being used to switch power to other peripheral (or slave) appliances has been around for some time, but we can't recall a project like this one having been presented in *EA* before. The project has many uses apart from the original purpose for designing it.

The aim was to produce a device that could turn off the TV set by simply turning off the VCR, getting rid of all that unwanted noise and snow at the end of a movie. As it turns out, we came up with something even more useful – a project that also includes line filtering and over-voltage protection as well as the ability to work in a number of master-slave applications.

With the price of some infrared remote controlled VCRs now costing less than $400, it has become usual for their owners to use the remote feature as an add-on to the TV set. This way a conventional TV set can be operated from the armchair – at least as far as channel selection is concerned, anyway. But one important feature not available is remote on-off for the TV set, now made possible with this project.

Of course, it can be used in other applications. For example, a computer installation normally has a separately powered monitor, printer, perhaps even an external hard disk. With this project, the peripherals can be driven from the slave outlet, with the computer supplied by the master outlet. Now the computer's front panel on-off switch will control everything together.

You might also use it with an audio system. Here the amplifier could be the master appliance, causing power on or off for the turntable, tape recorder or whatever else the system uses.

The bonus however is that a complete line filter and over-voltage protection system is built in. A fuse is also included, giving added protection and possibly saving a trip or two to the fuse box in the event of an appliance failure.

Perhaps you may even want to build this project just for the line filtering it offers, as many a VCR or computer falls victim to surges on the power lines and transient spikes!

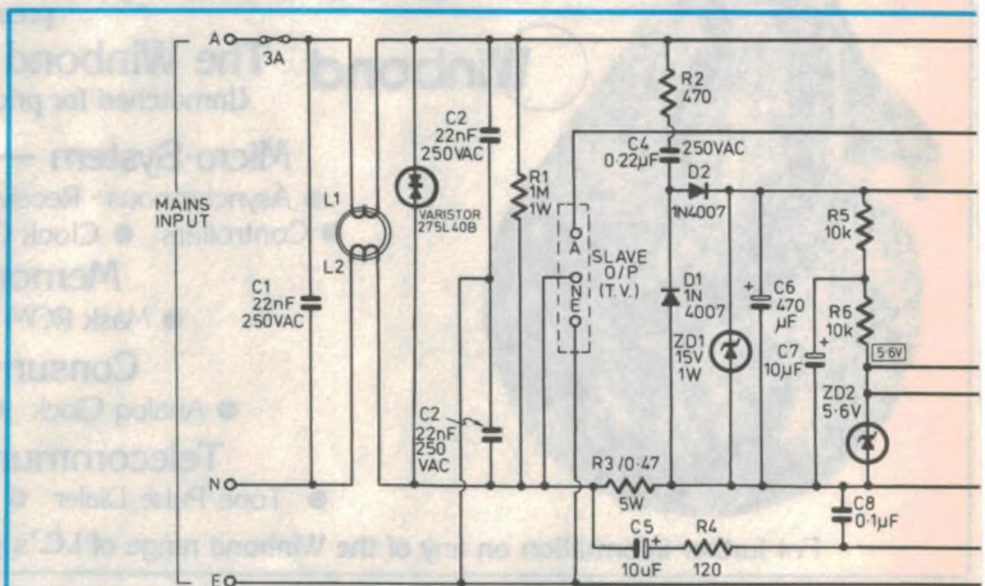
Circuit details

The incoming mains supply is connected through a 3 amp fuse to the low pass filter made up of C1, L1, L2, C2 and C3. Although the inductors L1 and L2 are wound on a common toroidal former, they are still electrically separate.

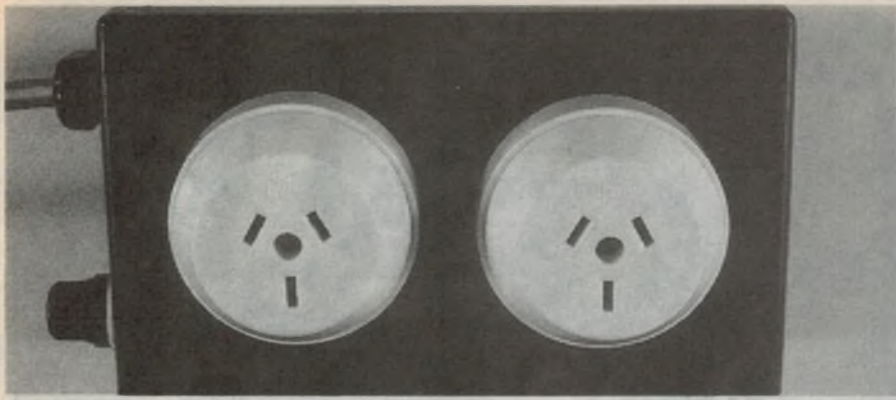
This filter section has a cut-off frequency of approximately 100kHz, which effectively suppresses any RF signals or transient spikes which may be present on the incoming mains supply.

The varistor connected at the output of the filter behaves as an open circuit at normal mains voltages of around 240V RMS, but becomes a very low resistance if the mains voltage exceeds 275V RMS. This means that any noise spikes above the turn on voltage of the varistor are shorted out, preventing them damaging appliances connected to the unit. Resistor R1 discharges capacitors C1, C2, C3 and C4 when the unit is disconnected from the mains supply.

Capacitor C4 is used to couple power



The circuit schematic. Current sensing of the master appliance is achieved by sen
the Schmitt trigger of IC1b, in turn operating the relay to supply power to the slav



Enjoy remote on-off for your TV set with a remote controlled VCR and our master-slave switch. It also includes mains filtering and spike suppression, for good measure.

to the electronics of the unit. At 50Hz it has a reactance of approximately 14.5k ohms, limiting the current to around 16mA (RMS). The negative half cycles are clamped by D1 and the positive-going half cycles are limited to a voltage of approximately 15V by the zener diode ZD1. The resultant 15V DC supply is filtered by capacitor C6.

After passing through the mains filter circuitry already described, the neutral is connected directly to the 'slave' 240V output socket and then via a 0.47 ohm, 5W resistor (R3) to the neutral terminal of the 'master' output socket. A voltage will therefore be developed across R3 only when current is being drawn by the appliance connected to the master output socket.

The voltage developed across R3 is coupled via C5 and R4 to the inverting input of amplifier IC1a. Resistor R4 and capacitor C8 make up a low pass filter, to further attenuate noise pulses and prevent them being coupled to the amplifier stage. The gain of the amplifier associated with IC1a is determined by R7 and the resistance of the preset trimpot VR1.

The gain adjustment (VR1) determines the actual current the master appliance needs to draw before the unit switches power to the slave outlet. This adjustment is necessary as some appliances draw a small current even when they are switched off. For example a VCR when turned off at its front panel switch still draws current to power its display (usually a clock) and the electronics that senses the remote control signals. In fact, the difference between this current and the normal operating current (assuming no tape motors are on) is often relatively small.

A reference voltage of 5.6V, decoupled and filtered by R5, R6, C7 and C10, and then regulated by ZD1 is applied to the non-inverting input of IC1a, also setting the output and the inverting input of IC1a to 5.6V. The difference voltage applied to IC1a is therefore the voltage developed R3.

The AC component of the output from IC1a is rectified by D3 and connected via current limiting resistor R8 to C11. Thus when current is being drawn by the master output, the voltage across capacitor C11 will increase from its normal value of around 4.8V to a higher positive value, depending on the load current taken by the master appliance. This voltage is then applied to the non-inverting input of the Schmitt trigger stage IC1b, through R10.

The 5.6V reference voltage developed across ZD1 is connected to the inverting input of IC1b, which has its hysteresis voltage set by R10 and R11. As a result, the output from IC1b will switch to a value of around 15V when current is being drawn by the master output. C11 is discharged by R9 when the master output is switched off.

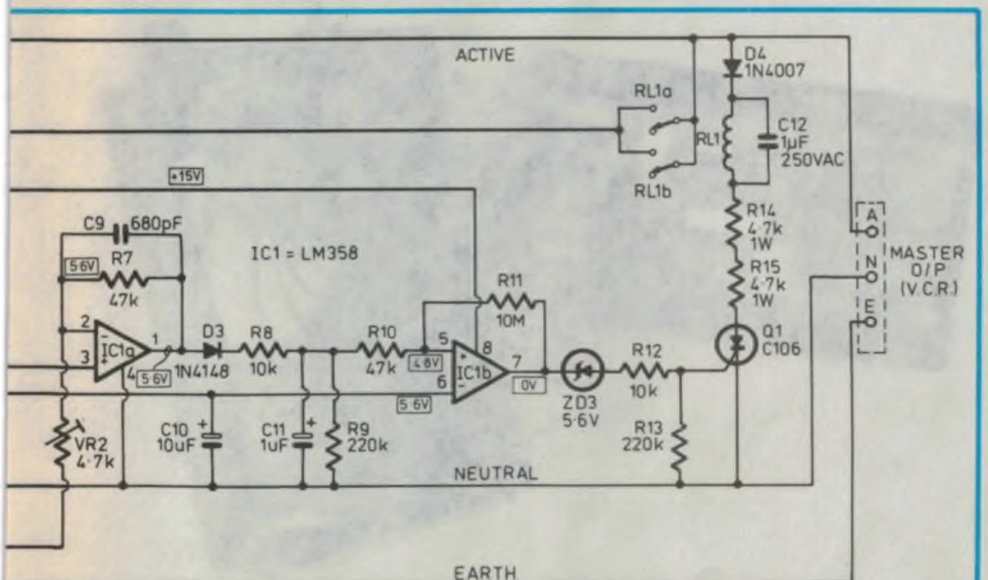
When the master appliance is drawing current, the output of IC1b will be sufficiently high to cause ZD3 to be forward biased. This will result in the flow of gate current to the SCR (Q1), supplied via R12. As a result, Q1 will switch on, in turn causing current to flow in the relay coil through the series components D4, R14 and R15. Resistors R14 and R15 are necessary as the relay used in the prototype is for 110V operation. Because the diode and the SCR only conduct during the positive half cycle of the incoming mains supply, capacitor C12 is used to prevent chattering of the relay.

The active line is connected to the slave output socket through the relay contacts. Note that the two contact sets in the relay are connected in parallel. The active line, after filtering, connects directly to the master output socket.

Construction

This project is available as a kit from Oatley Electronics, and includes a toroidal ferrite core with a single winding already wound on the core. The wire will first have to be removed from the core and then re-used to wind two separate single layer coils of approximately 25 turns each. The two coils need to be wound in counterphase, to prevent the AC current saturating the core. For details, refer to the component overlay diagram.

The wire provided can be soldered without removing the insulation, but this requires quite a lot of heat to perform. We recommend that you tin the



...ing a voltage drop across R3 which, after amplification by IC1a triggers ... outlet.

wire ends prior to assembling the coil onto the PCB, otherwise damage to the PCB tracks may result.

Follow the component overlay diagram to assemble the rest of the circuit, leaving the relay until last. As usual, double check the orientation of the polarised components prior to soldering them to the PCB – that is all electrolytic capacitors, diodes, the SCR and the IC.

When the relay is positioned on the PCB, it will be noticed that no holes are provided for two of its terminals. These are the normally closed terminals, and as they are not used in this project they should be snipped off. Now insert the relay into the PCB, then bend and solder the remaining six terminals to the copper tracks on the PCB.

Once the PCB is completed, the plastic box holding everything needs to be drilled to accommodate the two chassis mounting mains sockets, the cordgrip grommet, the fuseholder and the PCB. The PCB is attached to the lid of the box using nylon nuts and bolts, with 10mm spacers between the lid and the PCB.

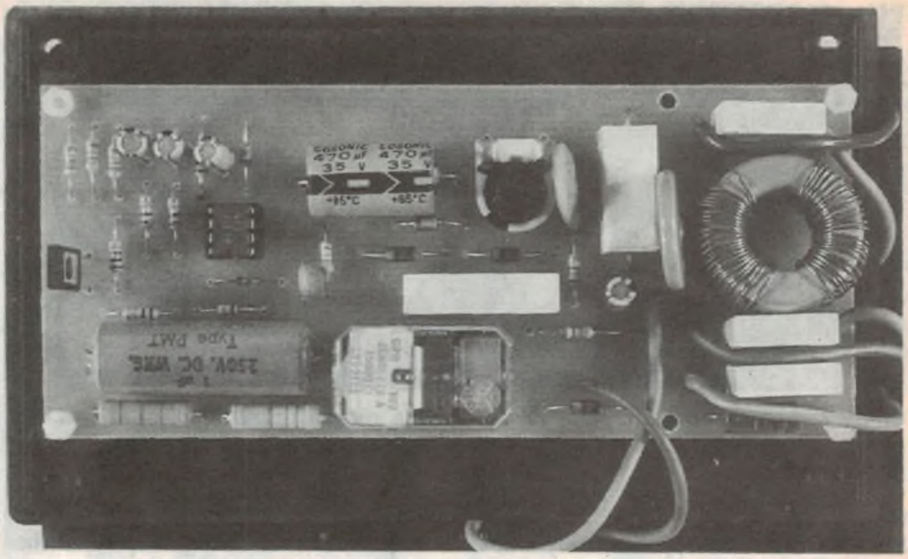
The two power outlet sockets will need to be prewired prior to mounting them onto the box. In case you aren't sure, the blue wire is the neutral, brown is the active and the earth wire is the yellow/green wire. Use wire taken from the mains cable for this purpose.

It is important to carefully follow the assembly diagram when completing the mains wiring. Watch the following points as you undertake this task:

(1) The active wire from the 240V plug connects to the *end* terminal of the fuse holder.

(2) All the earth wires, that is the earth from the mains input, those from both outlets and the earth wire to the PCB should be twisted together, soldered, then terminated with an insulated screw connector. Take particular care, as this wire is the safety wire between you and an electric shock if an appliance becomes faulty.

(3) Make sure the three pin plug is correctly wired. The active wire (brown) should be connected to the correct pin of the plug to ensure it is actually the active wire. The active terminal of a three pin plug is the pin at 11 o'clock, looking at the plug from the back (connection side).



This photo shows the printed circuit board and all components. The board is attached to the lid of the plastic case using nylon bolts and nuts, separated with 10mm spacers.

(4) The active terminal of the panel mounted power outlet, when viewed from the rear (connection side) is the terminal at the 1 o'clock position. Points (3) and (4) assume you have the earth pin at the 6 o'clock position, of course.

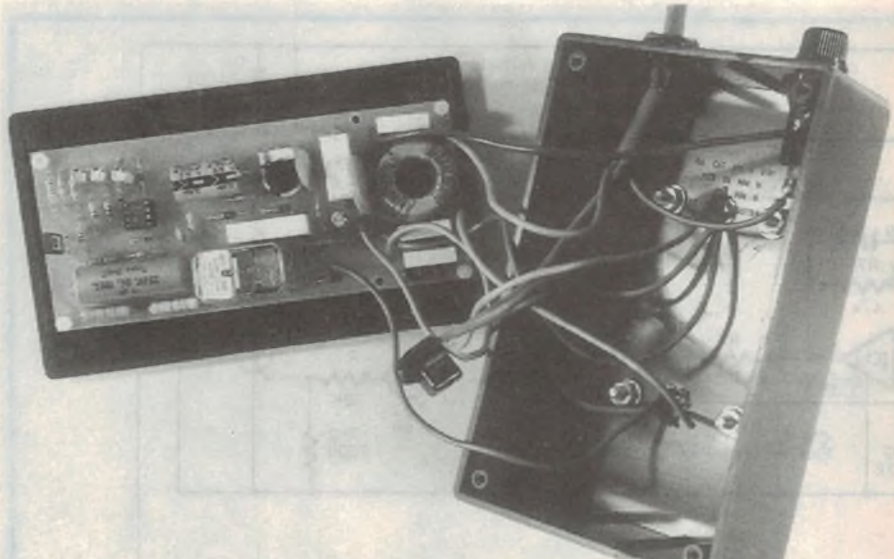
(5) As already described, use 240V rated wire for all the mains wiring, not hookup wire.

Testing

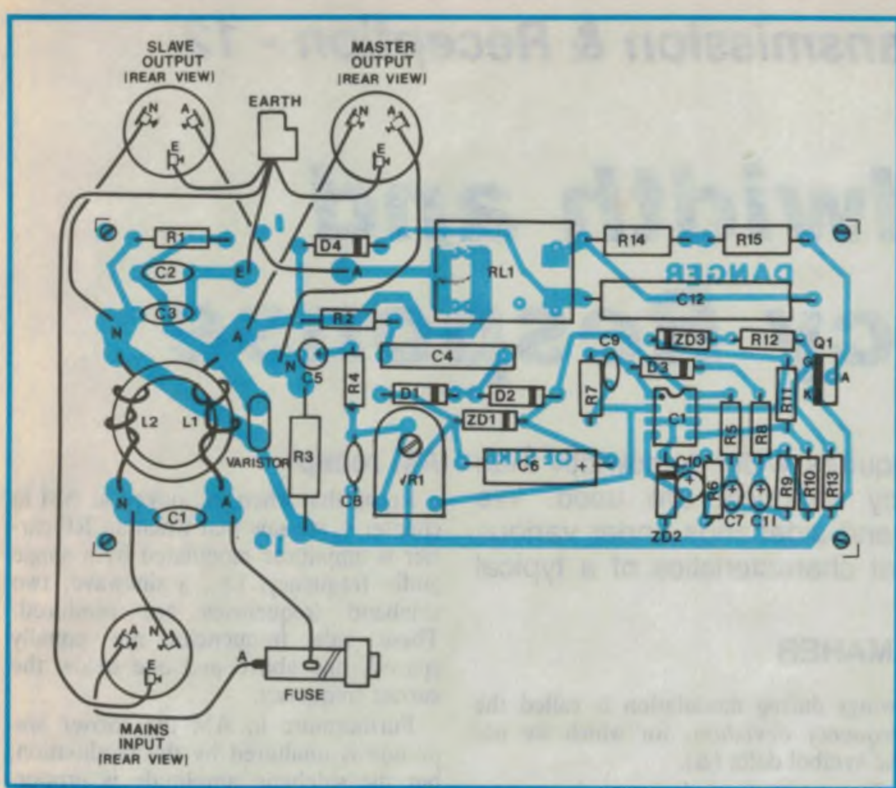
Once the unit has been assembled, it should be carefully checked to make sure that all mains wiring is properly terminated. While you are at it, double check all the connections to the PCB as well and look for any errors with component mounting.

The only adjustment is the potentiometer, which for testing purposes should be set to its maximum clockwise position. Now, with a 3A fuse fitted to the fuseholder, and everything mounted correctly in the plastic case, the unit is ready to test.

First plug the unit into a power outlet and confirm that everything survives when the power is turned on. Leave power connected for long enough to determine that no components are overheating. The relay may initially pulse on when power is first applied, but should quickly return to the off state and re-



This view of the prototype shows how everything fits together. The mains wiring should be tucked away safely when the case is finally assembled.



The layout diagram. The three pin plug and the power outlet sockets are shown as viewed from the connection, or rear, side. The diagram shows how the earth wiring was terminated in the prototype and uses an insulated screw connector over the soldered, twisted joint of the four earth wires. Make sure you follow the winding directions shown for the toroid.

main there.

If all is well, the unit can now be tested to see if the relay operates when an appliance is connected to the master outlet. Try a range of low power appliances, such as a desk lamp, a soldering iron, test equipment and so on. Then confirm that an appliance plugged into the slave outlet operates in conjunction with the master appliance. If not, switch the unit off and make sure the potentiometer is correctly set. Alternatively, try a master appliance that takes more power.

If fault finding is necessary, we *strongly* recommend that you use an isolation transformer (240V-240V). Note that the common line in the circuit is the neutral wire, after R3, and not the earth wire. The DC voltages shown on the circuit assume no current is being drawn from the master outlet, and all voltages are with respect to the common line. The voltages shown are those obtained on the prototype, and component variations may cause differences of up to 10%. If voltages are being read that exceed this variation, start checking components, particularly the orientation of the electrolytic capacitors.

The final adjustment is the potentiometer. As already explained, some appliances consume power when switched off at their front panel switch, particularly VCRs. The correct setting of the potentiometer will prevent the idling current of the master appliance from switching the relay, triggering it only when the appliance is switched on. Perform this adjustment with great care, as although the neutral wire is used to sense current, mains voltages are still present on the PCB. Experiment with the setting to obtain the most reliable performance.

Finally, assembly the case and the master-slave switch is ready to do your bidding.

Incidentally, kits of parts for this project are available from Oatley Electronics, who also provide a back up service for repair and fault finding.

WARNING

This project involves mains wiring and is not isolated from the mains power supply. It should be considered hazardous and only those experienced with mains wiring and testing should attempt its construction!

PARTS LIST

1 PCB coded OE89VCR
1 Fuse holder and 3A fuse
1 Toroidal ferrite core
2 Chassis mount, 240V sockets
1 Plastic case, 150 x 90 x 50mm
1 Mains plug and 3 core flex
1 DPST relay with 110V, 15k ohm coil
1 Clamp for mains lead
4 Nylon nuts, bolts and 10mm spacers
Miscellaneous screws, hookup wire, enamelled copper wire, rubber feet.

Resistors

All 1/4W, 5%: 1 x 120 ohm, 1 x 470 ohm, 4 x 10k, 2 x 47k, 2 x 220k, 1 x 10M.
All 1W, 5%: 2 x 4.7k, 1 x 1M.
1 0.47 ohms 5W, 10%
1 4.7k horizontal mount trimpot

Capacitors

1 680pF ceramic
1 0.1uF ceramic
3 22nF, 250V AC rated
1 0.22uF, 250V AC rated
1 1uF, 250V AC metallised polyester
1 1uF, 25V low leakage electrolytic
3 10uF, 25V low leakage electrolytic
1 470uF, 25V electrolytic

Semiconductors

1 1N4148 signal diode
3 1N4007 diodes
1 15V, 1W zener diode
2 5.6V, 400mW zener diode
1 LM358 dual operational amplifier IC
1 2SC106 SCR
1 275L40B varistor

Kits of parts for this project are available from:

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985

Postal address (mail orders):

PO Box 89, Oatley West NSW 2223.

PCB, all parts and components. $54.95
partial kit including PCB and PCB components only $32.95
Post & Packing charge............ $4.00

The PCB artwork for the project is copyright to Oatley Electronics.

FM Bandwidth and Frequency Response

Frequency Modulation or FM requires wider bandwidth than AM needs, so higher frequency channels are used. We investigate the pattern of carrier and sidebands under various modulation conditions and look at characteristics of a typical FM station.

by BRYAN MAHER

Have you ever wondered just why all our FM (frequency modulated) broadcast stations operate up in the VHF band around 100MHz? Perhaps you are irked at times when a certain FM station cannot be received in some locations.

Because VHF transmission prefers a line-of-sight path between transmitter and receiver, a hill or highrise building in the way can block your music reception completely.

That's a pity, because AM broadcast reception down in the HF band is easy all over city and suburbs, despite hills and buildings! Why can't the FM stations be on HF frequencies? True the HF band is already overfilled with AM stations and there's no space left there. But that's not the real answer.

There is a valid technical reason why FM broadcast stations must operate on quite high carrier frequencies. It comes down to the question of transmitted bandwidth!

How wide an RF channel is required to accommodate an FM station? Good question! But please read on...

FM terms

In the previous chapter we looked at definitions of some terms. We use fc to denote the carrier centre frequency. Without any modulation the station would simply transmit a sinewave signal at frequency fc. But when it is frequency modulated by an audio signal, the station frequency swings up and down – i.e., it *deviates* from fc, at the same rate as the frequency of the audio. We call the audio frequency fa.

How far the station RF frequency swings during modulation is called the *frequency deviation*, for which we use the symbol delta (Δ).

The amount of deviation is proportional to the *volume* of the audio signal.

The modulation index, mf, was defined previously as the ratio of how far (on the RF frequency scale) the station frequency deviates, divided by the frequency fa of the audio signal which is causing that deviation.

Putting all this concisely in symbol form:

fc = RF carrier centre frequency
fa = audio modulating frequency
Δ = RF frequency deviation (proportional to audio volume)
mf = modulation index
mf = Δ/fa.

The definition of modulation index mf makes it clear that – at constant volume – low audio frequencies cause high values of mf. Conversely high audio frequencies give rise to low values of mf. But does it matter? Why should we bother about the value of this modulation index?

We beg your indulgence for a few minutes. Soon we shall see that the value of mf decides the effective station bandwidth, hence the width of the channel allotted to each station. Of course wider channels mean fewer stations per megahertz of the spectrum. And for linearity reasons we must have a carrier frequency much higher than the bandwidth.

Before considering the transmitted bandwidth during music or speech, first let's take the simpler case of modulation by single tone sine wave audio.

AM recap

Recall that when we looked at AM in chapter 4, we saw that when an RF carrier is amplitude modulated by a single audio frequency, i.e., a sinewave, two sideband frequencies are produced. These side frequencies are equally spaced, one above and one below the carrier frequency.

Furthermore in AM the carrier amplitude is unaltered by the modulation, but the sideband amplitude is proportional to audio amplitude. Therefore in AM transmitters the total output power increases, by as much as 50%, with modulation.

FM sidebands

But in FM systems the picture is very different:

(a) The amplitude of an FM carrier (i.e., centre frequency fc) is not at all constant. Under some conditions of modulation the carrier power can even be zero.

(b) The total output power is always constant.

(c) The amplitude of sidebands depends on both the amplitude and the frequency of the audio.

(d) Even for a single tone (sinewave) audio modulating signal, frequency modulation produces (in principle) an *infinite* number of sideband frequencies. These are spread out, in pairs, above and below the carrier frequency, spaced at frequency increments equal to the audio frequency, as sketched in Fig.1.

(e) Sideband components appear as sets of pairs, each pair spaced the same frequency increment above and below the carrier.

(f) In any one pair, both sidebands have the same amplitude.

(g) But the amplitudes of different pairs vary widely.

(h) The amplitude of each pair of sidebands is a different function of the modulation index mf.

(i) The amplitude of the carrier fc is yet another function of mf.

Modulation index mf

Fig.1(a, b, c, d) are representations of the patterns of FM sideband frequencies generated by four different values of mf with single tone sinewave modulation. The vertical axis represents relative amplitude of carrier and sidebands, while the horizontal axis represents radio frequency. All of the graphs are drawn to same scale.

Many Australian FM stations use +/–75kHz maximum deviation with audio frequency response up to 15kHz.

But the modulation frequencies used are higher than this. As well as the original audio signal, stations transmit a 19kHz pilot tone, the stereo 'difference' signal, and often ancillary information carriers. For these reasons, at the transmitter, the modulation frequencies can extend up to 70 or 75kHz. (Stereo, pilot tones and ancillary transmissions will be discussed in later chapters of this series.)

With a frequency deviation (delta) of 75kHz and modulation frequencies fa = 75kHz the frequency modulation index mf is:

mf = delta/fa, so
mf = 75kHz/75kHz
mf = 1.0

As well as our FM broadcast stations there are other FM transmitters. Telemetry systems and multi-channel communication links may use a still wider range of modulating frequencies.

If a transmitter using 75kHz deviation is modulated by 150kHz signals then mf given by:

mf = 75kHz/150kHz
= 0.5 (minimum)

Fig.1(a) shows the sideband pattern generated by FM transmissions when mf = 0.5 and single tone sinewave modulation is used. In the figure the vertical axis indicates relative amplitude of carrier fc and sidebands.

Many sidebands

The horizontal axis represents the frequency of carrier and sidebands. We see that many sideband frequencies appear in equal amplitude pairs, equally spaced above and below the carrier frequency. The spacing is equal to the audio frequency fa. Thus sidebands appear at frequencies (fc+fa), (fc-fa), (fc+2fa), (fc-2fa), and so on.

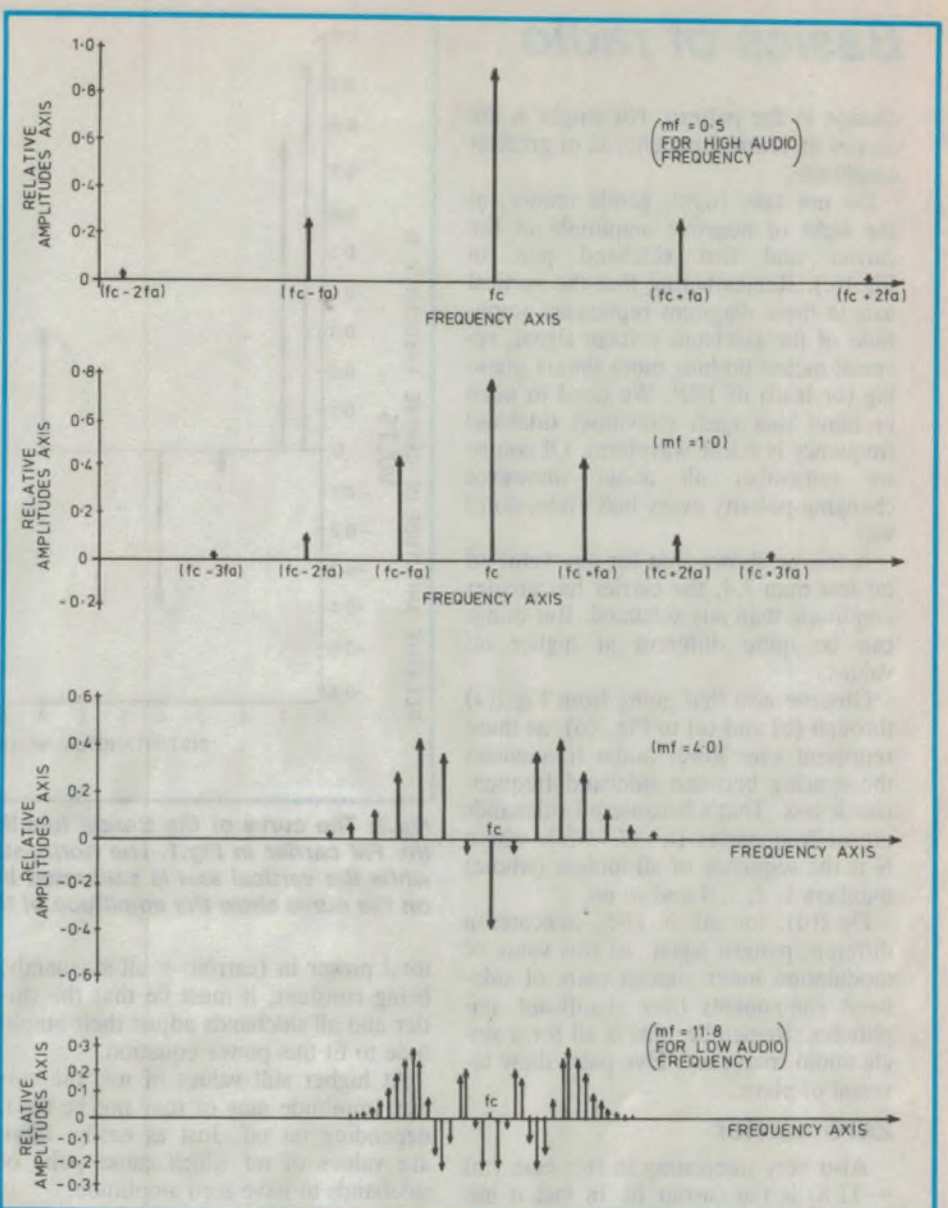


Fig.1: The relative carrier and sideband amplitudes for audio signals of equal amplitude but different frequency, used to modulate an FM transmitter. The differing frequencies give different modulation indices, and hence different energy distributions in the carrier and sidebands. In (a) mf is 0.5; in (b), 1.0; in (c), 4.0; and in (d), 11.8.

For mf = 0.5, Fig.1(a) in principle extends an unlimited distance, above and below carrier frequency (i.e., to right and left of the figure).

So there are many more sideband frequencies than are shown, spaced at every multiple of the modulating frequency fa. But calculations show that for mf = 0.5, all sidebands beyond the first and second pairs have very low amplitudes. The third sideband pair at frequency (fc +/–3fa) have a relative amplitude of only about 0.01, while the fourth pair (fc +/–4fa) are extremely weak, at approximately 0.003.

Incidentally all diagrams in Fig.1 are drawn to represent the same audio volume, hence the same value of RF deviation.

Sideband amplitudes

Fig.1(a) represents the situation when a very high audio frequency is used. Figs.1(b, c, d) progressively show the changing pattern of sidebands for decreasing audio frequency, all at the same volume.

Fig.1(b) (half the audio frequency compared to Fig.1(a)) shows significant amplitudes in at least the first three pairs of sidebands, with mf = 1.0.

Fig.1(c) shows the effect with audio frequency reduced to one quarter of that in Fig.1(b). Now we see a great

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change in the pattern. No longer is the carrier or centre frequency fc of greatest amplitude.

Do not take fright, gentle reader, at the sight of negative amplitude of the carrier and first sideband pair in Fig.1(c). Remembering that the vertical axis in these diagrams represents amplitude of the sideband voltage signal, reversal means nothing more than a phase lag (or lead) of 180°. We need to keep in mind that each individual sideband frequency is a sine waveform. Of course we remember all about sinewaves changing polarity every half cycle, don't we?

It can be shown that for any value of mf less than 1.4, the carrier has greater amplitude than any sideband. But things can be quite different at higher mf values.

Observe also that going from Fig.1(a) through (b) and (c) to Fig.1(d), as these represent ever lower audio frequencies the spacing between sideband frequencies is less. That's because all sidebands are at frequencies (fc +/– Nfa), where N is the sequence of all integer (whole) numbers 1, 2, 3, 4 and so on.

Fig.1(d), for mf = 11.8, indicates a different pattern again. At this value of modulation index sixteen pairs of sideband components have significant amplitudes. Remember this is all for a single audio frequency. Five pairs show reversal of phase.

Zero carrier

Also very interesting in this case (mf = 11.8) is the carrier fc. In fact it has zero amplitude.

Do not be startled at this, for many values of mf can bring about a zero-valued carrier.

Recall we said earlier that the total power transmitted by an FM station is at all times constant, regardless of the modulation frequency or amplitude. This means that a transmitter represented by Fig.1(a, b, c, d) is putting out the same power in all four cases shown. In Fig.1(a and b) for low values of mf, the carrier carries most of the power, while the remaining power is in the sidebands.

In the case of mf = 4 (Fig.1(c)) the sidebands possess a large fraction of the station power, with less power in the carrier. But when mf = 11.8 as in Fig.1(d), all the power is carried by the collection of sidebands, with none in the carrier.

Under any condition of sidebands, the total power in (carrier + all sidebands) being constant, it must be that the carrier and all sidebands adjust their amplitude to fit this power equation.

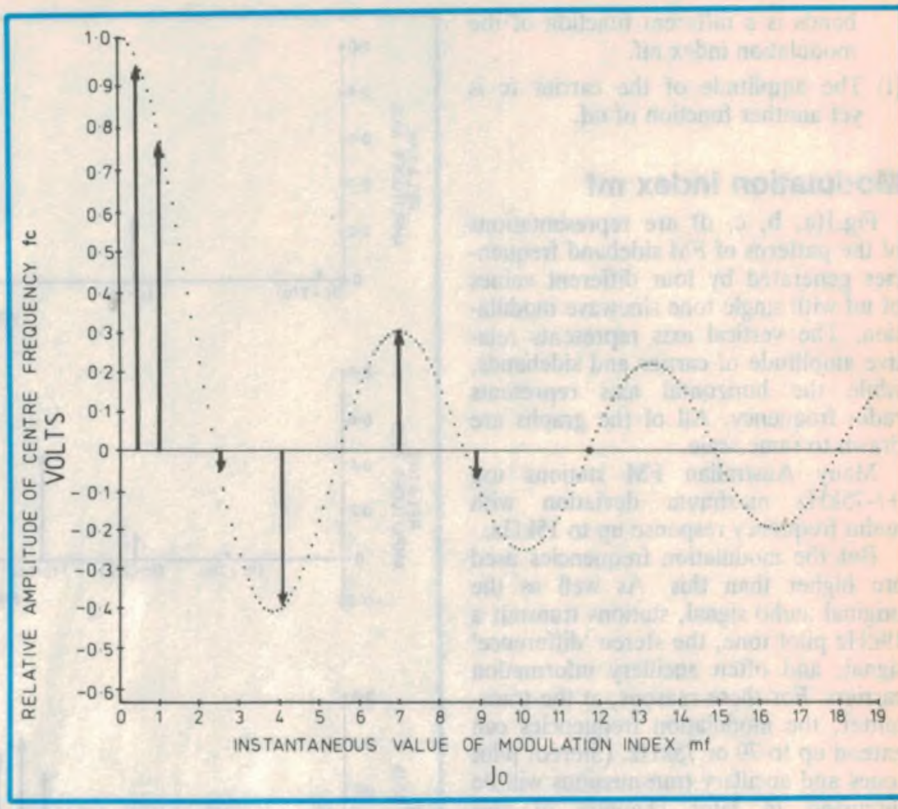

Fig.2: The curve of the Bessel function J0(mf), used to find the amplitude of the FM carrier in Fig.1. The horizontal axis is direct reading in values of mf, while the vertical axis is calibrated in relative amplitude. Vertical lines drawn on the curve show the amplitude of the carrier at specific values of mf.

At higher still values of mf, the carrier amplitude may or may not be zero, depending on mf. Just as easily, there are values of mf which cause pairs of sidebands to have zero amplitude.

As a glance at the whole of Fig.1 shows, under various modulation conditions the amplitudes of different sidebands can assume all sorts of values. But an overiding general pattern is that, for each value of mf, sidebands far from the carrier have smaller amplitudes.

This fact makes it unnecessary to transmit all sidebands. "Just as well", you may interject: "It's impossible to broadcast an infinite number of these side frequencies!" FM broadcasters transmit the carrier plus all significant sidebands. You receive sufficient sidebands to reproduce hifi music at low distortion in your FM receiver.

All that's fine for single tone modulation. But you may object, as everyone knows that music or speech is a complex mixture of many frequency components.

True. But all complex sounds can be represented by combination of many sine waveforms, or single tones. These frequency components will have various amplitude and phase differences. Fourier analysis, and all that stuff!

It is possible to (laboriously) calculate for each audio frequency component its frequency and volume, and resultant value of modulation index, mf. We won't attempt that task, but you can imagine how the result yields a vast array of sidebands. Each of Fig.1(a, b, c, d) – and many hundreds more, one for each audio component – could be superimposed to yield a picture of a veritable maze of thousands of sideband frequencies.

All those that fit within the station's allotted RF channel would be transmitted. A typical Australian capital city FM station would have characteristics similar to those shown in Table 1.

Need for VHF

Now we see the importance of VHF or UHF operation for FM transmission and reception. The transmitted bandwidth is very high – up to 262kHz or +/–131kHz).

Recall our earlier remark about system linearity. In both the station's transmitter and your receiver will be

A Typical FM Transmitter

A typical Australian capital city FM station would have characteristics similar to these:

Carrier frequency, fc	Some allotted frequency in the 88 to 108MHz VHF band
Carrier frequency stability	+/–10ppm, i.e., +/–1kHz in 100MHz
Frequency deviation, delta	+/–75kHz
Audio frequency,maximum	15kHz
Audio frequency, minimum	30Hz
High audio frequency pre-mphasis	50 microsecond time constant
Audio linearity (without pre-emphasis) (Most of linearity error occurs in audio preamps, less in modulator and transmitter stages)	+/–1.5dB (30Hz to 15kHz)
Highest modulating signal (Including pilot tone, stereo and ancilliary signal frequencies)	70 to 75kHz
Modulation Index, delta (complex components)	1.0 minimum up to 2500 maximum
Significant transmitted bandwidth	262kHz
Transmitter final stage output power	3kW
Losses in coaxial feeder to antenna	–1.0dB
Type of coaxial feeder cable used	Copper inner conductor within 90mm copper pipe
Antenna gain	+4.0dB
Overall gain from transmitter output to radiated signal	+3.0dB
Effective Radiated Power(ERP)	6kW (= 3kW + 3dB)
Antenna directional pattern	Radiated signal confined to approx. horizontal direction. Preference given to directions of greatest population.
Antenna site	Mast or tower on highest available point (hill, mountain, city skycraper building etc.)
Transmitter site	Immediately below antenna mast, for shortest coax feeder to minimise feeder losses.

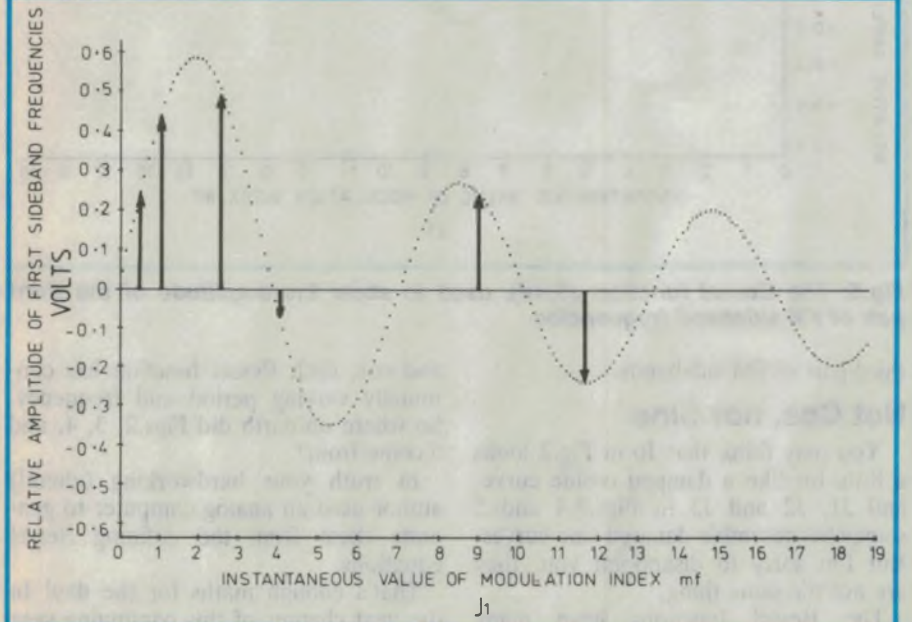

Fig.3: The curve of Bessel function J1(mf), used to find amplitudes of the first pair of FM sidebands for various values of mf.

found resonant LC circuits tuned to the carrier frequency, fc.

Those tuned circuits must respond, not only to the carrier, but also to all transmitted sidebands, covering from (fc-131kHz) up to (fc+131kHz).

Tuned circuits can only maintain reasonable Q when responding to signals a small fractional distance either side of centre frequency, fc. To satisfy the desired sideband coverage, +/–131kHz must be only tiny compared to the FM carrier frequency, fc. Usually a fraction around 1/500 to 1/1000 is recommended.

All Australian FM stations are allotted carrier frequencies somewhere in the VHF band between 88MHz and 108MHz. With typical transmitted bandwith +/–131kHz, the bandwidth-to-carrier frequency ratio is between (131kHz/88MHz) = 1/671 and (131kHz-/108MHz) = 1/824, which is satisfactory.

This is the real reason why all Australian FM broadcast stations will be found at the higher frequencies provided by the VHF band.

Of course in the future, should FM stations be placed higher up in the UHF bands (as some overseas are), the fraction would be better still.

Explanations

Readers of an enquiring inclination may yet object that Fig.1 is very pretty, and sure, we accept the idea of multitudinous sidebands. And the spacings each multiple of the audio frequency fa is believable. But where on earth do we get all those funny values for carrier and sideband amplitudes? Good question!

The truth is that FM gives the mathematicians a real field day. The equations, which we won't go into (sigh!) show that the transmitted signal voltage is not a sinewave. Rather it has the form of a (Sine of a Sine) function, which gives rise to an infinite set of curves called 'Bessel functions of the first kind'. These are denoted by the symbols J0, J1, J2 etc, each of which is a separate function of the modulation index mf.

The first four of these functions are shown here as Figs.2, 3, 4 and 5. We knew readers would not want pictures of all of them (because – you guessed it – there are an infinite number of them!).

The first curve, Jo(mf) is shown in Fig.2 for values of mf from 0 to 19. This is used as a calibrating curve to show the amplitude of the carrier fc for various values of mf. In Fig.2 your humble author has taken the liberty of drawing some vertical lines with arrows. Voltage

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vectors if you like.

The voltage vector drawn upwards on Fig.2 at the point where mf = 0.5 is 0.939 in length. This gives us the relative amplitude of the carrier in Fig.1(a) where mf = 0.5.

Similarly, vertical voltage vectors drawn on Fig.2 at points where mf = 1.0, 4.0 and 11.8 give us the carrier amplitude values for use in drawing Fig.1(b) (mf = 1.0); Fig.1(c) (mf = 4.0); and Fig.1(d) (mf = 11.8).

Incidentally Fig.2 only shows the Bessel function for mf values from 1 to 19, but this function extends indefinitely to the right. So Jo(mf) can be used to find the carrier amplitude for any range of mf.

Looking at Fig.2 it's clear why the carrier is very big in Fig.1(a) where mf = 0.5, and a little smaller in Fig.1(b) at mf = 1.0. Then also the reversed phase carrier in Fig.1(c) where mf = 4.0 is explained by the downward voltage vector drawn on Fig.2 at the point where mf = 4.0.

Because Jo(mf) in Fig.2 is an oscillatory type continuous function, sometimes positive, sometimes negative, it must cross zero at many points. One such zero crossing occurs in Fig.2 at mf = 11.8, which is why the carrier has zero amplitude in Fig.1(d) for mf = 11.8.

In like manner, other Bessel functions are used to show amplitudes taken by pairs of sidebands for any value of mf. Fig.3 shows the curve called J1(mf), which gives the amplitude of the *first* pair of sideband frequencies. Again we have drawn vertical voltage vectors at a few points to show where we got the amplitude of the first sidebands in Fig.1(a, b, c, d).

All Bessel functions are oscillatory, so it follows that any pair of sidebands are likely to have forward or reverse phase, i.e., they may be drawn upwards or downwards on diagrams like Fig.1. As well any pair of sidebands can have large, small or zero amplitude at different mf values.

By the same method Fig.4, a picture of the curve J2(mf), yields the amplitude value for the *second* pair of FM sidebands for any mf. Vertical lines drawn on the Fig.4 show the voltage vectors for mf = 0.5, 1.0, 4 and 11.8. These vectors were used to give the heights of the second pair of sidebands in Fig.1(a, b, c, d).

Fig.5 shows the curve J3(mf), giving amplitudes in similar manner for the third pair of FM sidebands.

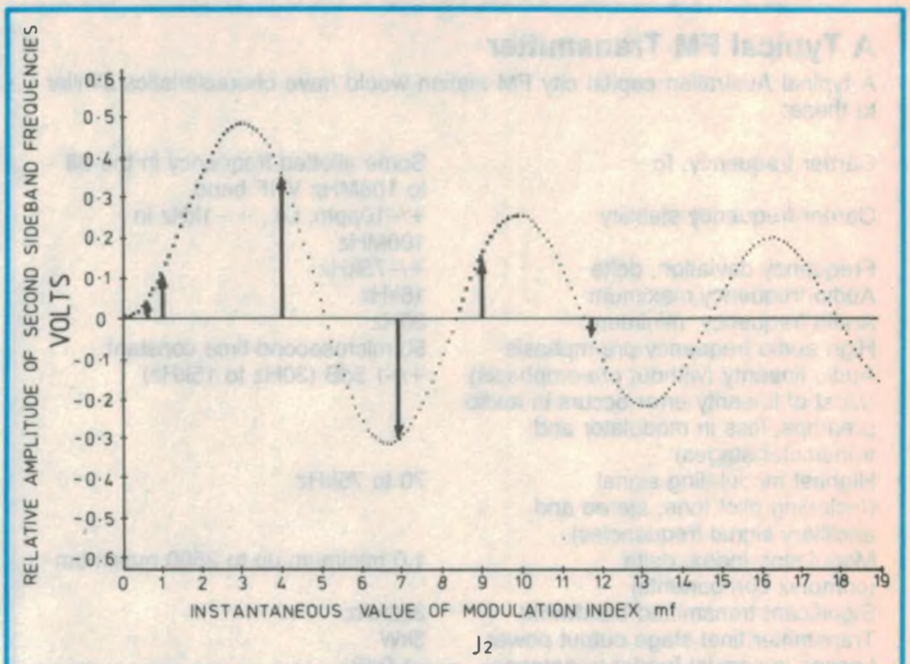


Fig.4: The Bessel function J2(mf) is similarly used to find the relative amplitude of the second pair of FM sidebands for various values of mf.

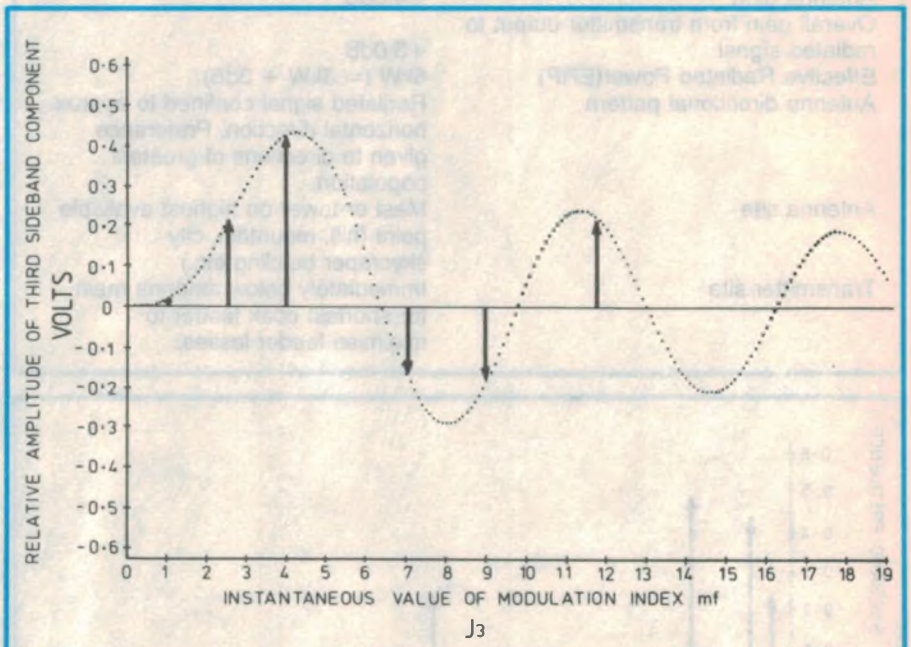


Fig.5: The Bessel function J3(mf), used to show the amplitude of the third pair of FM sideband frequencies.

Not Cos, nor Sine

You may think that Jo in Fig.2 looks a little bit like a damped cosine curve, and J1, J2 and J3 in Figs.3,4 and 5 somewhat resemble damped sine curves. But I'm sorry to disappoint you, they are not the same thing.

The Bessel functions have many properties quite different from damped cos and sine. For one thing, unlike sine and cos, each Bessel function has continually varying period and frequency. So where on earth did Figs.2, 3, 4, and 5 come from?

In truth your hardworking (ahem!) author used an analog computer to generate them from the defining Bessel equations.

That's enough maths for the day! In the next chapter of this continuing saga we delve into the mysteries of FM receivers.

Understanding fluorescent lamps

The humble fluorescent light is taken for granted these days. Their ubiquity ensures that no-one ever thinks about them much. But if you are ever asked how one works, there could be trouble. In this article, the author examines some of their physics and chemistry.

by RICHARD WALDING

Ever since I saw a fluorescent light fitting explode and blow black tar over the ceiling of my childhood home, I've been interested in these lamps. Until I started teaching about them, I thought I knew it all – but really knew nothing.

Let's start by looking at the essential components which make up a typical fluorescent light fitting. As most *EA* readers will probably be aware, these consist of the *ballast*, the tubular fluorescent lamp itself and the automatic *starter* switch.

The ballast is an inductor – a choke coil consisting of a winding of copper wire around a laminated soft iron core. Typically the resistance is around 50 ohms and the inductance 1.25 henry or so.

Tubes come in two diameters – the traditional 38mm (1.5") version which has been around since 1953 and the newer, high efficiency 26mm (1") tube which was released in 1983. The new lamps (18W, 36W and 58W) are electrically and mechanically inter-changeable with the old (20W, 40W and 65W). They come in three lengths – 1200mm, 1600mm and 1800mm. The 1200mm, 36/40W is the most commonly used luminaire, particularly in domestic lighting.

The tubes contain a mixture of inert gases saturated with mercury vapour. The old tubes are filled with a mixture of 10% argon and 90% neon, at a pressure of 2.5 torr (330Pa). This is about 0.003 atmospheres. Of this, the partial pressure of the mercury is about 6 millitorr at the normal operating temperature of 40°C. The new tubes contain 25% argon and the more expensive krypton (75%), at a pressure of 1.5 torr (200Pa).

The inside surface of the tube is coated with a mixture of halo-phosphors, extracted from the natural mineral *fluor-apatite* – calcium fluoro-phosphate $(CaF_2)Ca_3(PO_4)_2$ – blended to produce light of the desired colour temperature or balance. The four common types are (1) Warm white (2900 kelvin); (2) White (4100K), which is called 'Cool White' in the USA or 'Daylight' in the UK; (3) a warmer colour, called 3500K; and (4) the bluish 'Daylight' (6200K).

The 4100K tube is the most popular in offices, schools and homes. It provides good contrast for reading black ink on white paper. Specialised applications such as operating theatres require tubes of special colour temperatures, often made to order.

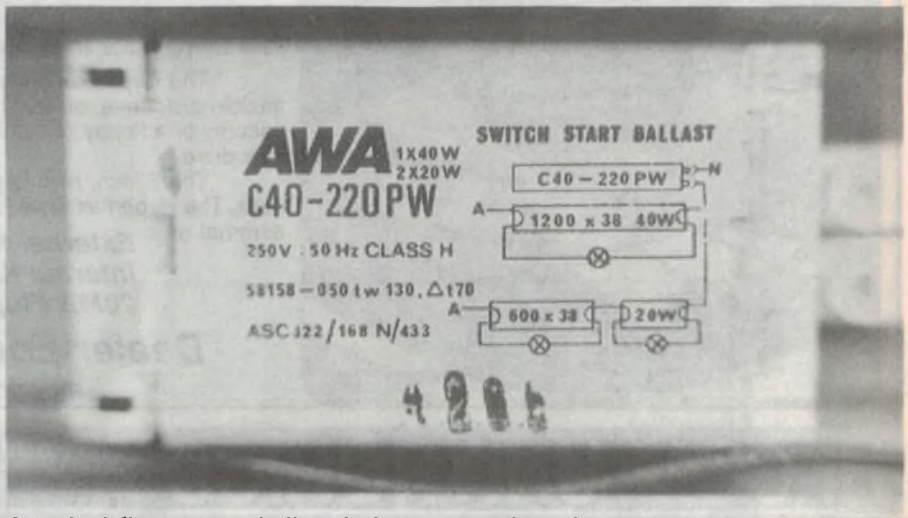
The bi-pin end caps support the lamp's filaments. These filaments are triple coils of tungsten wire, of resistance typically 2 ohms and with an after-coating of free barium metal and the alkaline earth metal oxides, principally strontium and calcium. The addition of a small percentage of zirconium oxide has been found to reduce barium evaporation by two-thirds.

There is one filament at each end of the tube and they are surrounded by 'cathode shields' to prevent end blackening. Attached to the cathode shield is a small glass vial, about 10mm long and 2mm wide, which originally contains the exact amount of mercury needed for that tube. For a 1200mm x 26mm tube, the vial would contain about 50 micrograms of mercury.

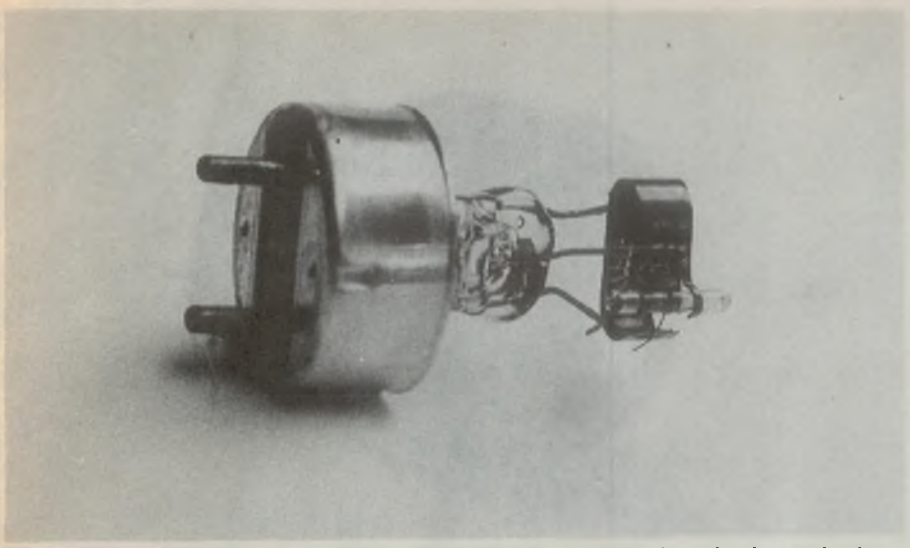
During manufacture, once the tube is filled with the inert gases and the end caps attached, a wire on the cathode shield is heated electrically. This melts into the vial and releases the mercury as a vapour into the partially evacuated tube.

The *starter* consists of a bi-metallic switch inside a 'glow-bottle' containing mercury and argon gas. A 100 microfarad foil capacitor is connected across the terminals. The device is housed inside a polycarbonate cap.

Lampholder fittings are usually made of either polycarbonate or Noryl, a polyphenylene oxide – polystyrene



A typical fluorescent ballast inductor, capable of handling one 40W lamp or two 20W lamps. It has an inductance of 1.5 henries.



The end assembly from a lamp, showing the shielded cathode and glass sealing pinch.

copolymer. Ultimate temperatures inside lamp fittings can reach 98°C (enclosed twin 65W at 240V + 6%), which is below the softening point for the above materials (130°C and 140°C respectively). These plastics are specified in the standards for lampholder materials.

Polycarbonate is a break-resistant plastic used in many security applications. Try and break a starter's cap, and you'll see what indestructable means. Occasionally the terpolymer acrylonitrile-butyadiene-styrene (ABS) or urea formaldehyde is used. Diffuser screens are made from an acrylic (polymethylmethacrylate)/polystyrene blend.

How they work

Having looked at the various components separately, let us now examine the way they work together in normal lamp operation. The various components are connected together as shown in Fig.1, with the ballast, tube filaments and starter switch in series across the mains.

1. Pre-heating When the wall switch is closed, 240V AC is immediately applied across the terminals of the starter via the ballast and filaments. This voltage sets up a purple glow discharge inside the glow-bottle of the starter, which allows current to flow. The current path is thus initially from mains active through the ballast, one tube filament, the starter, the other filament and back to mains neutral.

The current flowing through the tube filaments (0.5A) begins their pre-heating. Within one second, the heat produced by the glow discharge inside the starter causes its bimetallic strip to straighten, closing the switch. This allows the full voltage to be applied across the ballast and filaments.

A 10V potential drop now occurs across each filament (3 – 5V with the older tubes). This causes the filaments to heat more rapidly, and a copious number of electrons are produced from the barium by thermionic emission. In effect, the electrons boil off from the sea of electrons in the filament metal, like water molecules evaporating from liquid water.

2. Starter switching As the glow discharge in the starter stops when the bimetallic switch closes, the strip cools rapidly and the bi-metallic switch opens again. The 0.5A current in the circuit drops to zero, in 1.5 microseconds.

The field in the ballast starts to decline, but inductors being what they are, a self-induced field is produced, creating a striking voltage of about 800V across the ends of the tube.

3. Emission This striking voltage immediately starts a glow discharge along the length of the tube. The resistance of the path through the gas-filled tube decreases rapidly, from a few megohms to about 300 ohms.

With the increase in current and if the voltage were maintained, the current would increase without limit until the lamp was destroyed. It is therefore essential that some stabilising impedance be placed in series with the circuit to limit the current. A resistor could be used, but this would involve a relatively high power loss; consequently the stabilising impedance is provided by the ballast.

The inductor (ballast) restricts the run-away of current by holding it at about 0.43A, and maintains a 150V potential across the ends of the tube. In other words, the ballast stabilises gaseous conduction so that if the current increases, the voltage across the tube decreases and vice-versa.

4. Discharge Electrons are accelerated by the potential across the tube and gain energy from the field. They make collisions with each other (*elastic* scattering), which only exchanges energy between electrons; they also make elastic collisions with the inert gas and mercury atoms, which deflect them with only small enegy losses; and they make *inelastic* collisions with the mercury atoms, which either ionises them or excites them to upper energy states from which the atoms radiate. The inert gases undergo no electron transitions as the lowest argon excited state is a few electron volts above the ionisation energy for mercury (10.4eV).

The positive ions in the tube are accelerated to much lower velocities by the field about the tube, because of their heavier mass – an Hg^+ ion is some 350,000 times the rest mass of an electron.

As a result of these multiple influences on the electrons, the electron gas in the plasma acquires a distribution of velocities which is almost exactly symmetrical and Maxwellian.

It is the presence of approximately equal numbers of free electrons and ions in the gas that results in the gas plasma being an electrically conducting medium. The maintenance of this conductivity requires production of electron-ion pairs as fast as they are lost by recombination. As recombination occurs when the pairs diffuse to the tube wall rather than in the volume of the gas,

TABLE 1: Mercury discharge emissions

Wavelength (nanometres)	Spectral Region	Intensity
253.7	UV	15000
435.8	violet	4000
365.0	UV	2800
1013.9	IR	2000
404.7	violet	1800
296.5	UV	1200
564.1	green	1100
614.9	orange	1000
184.9	UV	1000
312.6	UV	400
320.8	UV	400
326.4	UV	400
434.7	violet	400
265.3	UV	400
313.2	UV	320
365.5	UV	300
187.0	UV	300
579.1	yellow	280
690.7	red	250
577.0	yellow	240
366.3	UV	240
579.0	yellow	100

the loss rate and production rates are dependent on tube diameter and gas fill pressure.

The production rate also varies greatly with electron temperature, because the fraction of electrons that have enough energy to ionise a mercury atom increases exponentially with temperature. Consequently, there is a characteristic electron temperature at which the discharge will maintain a steady state. This is produced by operating the tube in a circuit with series impedance (the function of the ballast) so that the potential difference between the electrodes decreases with increasing current.

5. Fluorescence The UV radiation is absorbed by the phosphor coating on the inside of the tube, raising the atoms to an excited state. Within one hundred millionth (10^{-8}) of a second, the excited electrons drop back to ground – but not in one step. Most of the atoms lose some vibrational energy by collisions with the gas, causing a decrease in the energy level of the excited state without emitting radiation. The atom then drops back to the ground state, emitting radiation. Because the emitted radiation has less energy than the absorbed radiation, its wavelength will be longer. In the case of the fluorescent light, about 40% of the absorbed radiation is re-emitted as visible light – the final output from the lamp.

Another view of the lamp end assembly, showing the cathode filament inside its shield.

Energy losses

The net effect of the operating conditions within the gas discharge column of a fluorescent lamp is to give the following distribution of energy losses:

Ionisation loss 1%
Elastic collision loss 28%
Radiation loss 71%

One of the principal functions of the inert gas is to slow down the rate of diffusion of electrons and ions to the tube wall. The gas pressure can be adjusted so that diffusion and hence electron temperature is brought to the desired optimum level. This level must be high enough so that excitation and radiation losses greatly exceeds elastic collisions losses, but low enough that the excitation of the desired state of the mercury atom predominates over excitation of all higher energy states, including those of the inert gases.

Mercury excitation

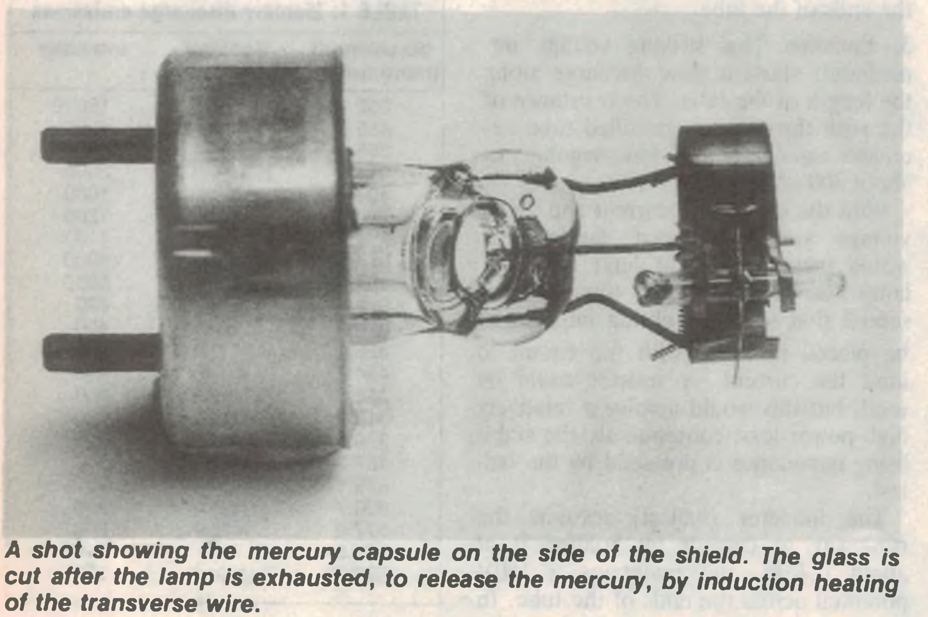
Experiments by Franck and Hertz in 1914 and onwards showed that the mercury atom could accept only certain amounts of energy (quanta) – namely 4.9eV, 6.7eV and 8.8eV, thus confirming Bohr's postulates. These energy levels of an atom are the definite states in which an atom can exist.

The lowest energy level is known as the *ground* state and in a fluorescent tube, 99% of mercury atoms at any one instant are in this state. Levels above the ground state are called the *excited* states. There are an enormous number of these. The excitation energy is the energy needed to raise an atom from the ground state to the excited state.

When an electron drops from an excited state to a lower state (it doesn't have to return to ground state in one step), energy is released in the form of radiation. The wavelength of the radiation is related to the loss of energy of the electron. Quite simply, the wavelength is inversely proportional to the energy change – the formula is given elsewhere.

The number of transitions theoretically possible from an excited mercury atom is enormous – 350 have been catalogued – but as selection rules forbid many transitions, for practical purposes, the number of significant transitions is a dozen or two (Fig.2). The spectrum of the light emitted by excited atoms contains a number of spectral lines, each of which is a single colour or wavelength.

In the visible region, violet predominates, giving mercury its characteristic glow discharge. A closer examination of the emission spectrum shows that there are about eleven lines in the visible region, but the fluorescent lamp relies on the existence of just one line – the 253.7 nanometre (nm) emission in the



A shot showing the mercury capsule on the side of the shield. The glass is cut after the lamp is exhausted, to release the mercury, by induction heating of the transverse wire.

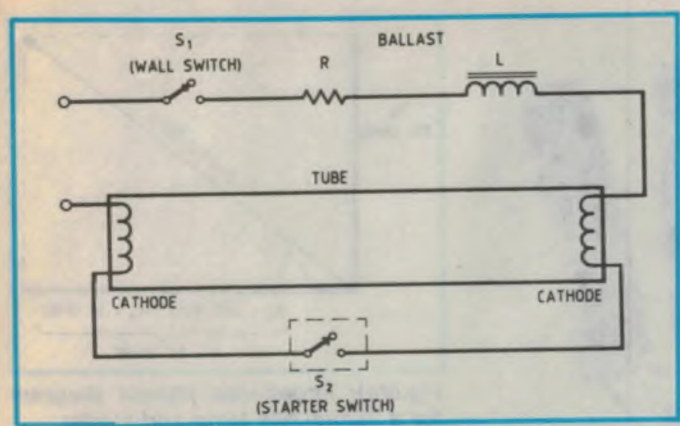
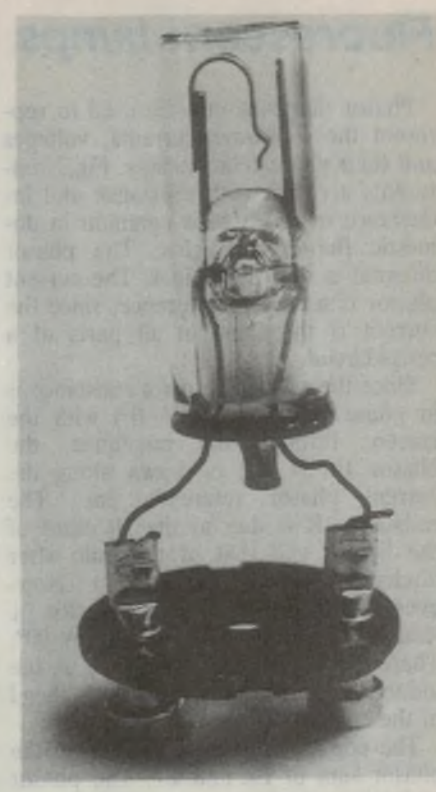


Fig.1 (left): The basic circuit used in most fluorescent lamps, with the ballast, tube cathodes and starter switch connected in series.



Inside a starter switch, showing the 'glow bottle' with its bimetallic strips.

UV. With proper choice of operating conditions and parameters, the 71% radiation loss mentioned above can be split up into 65% due to the 253.7nm UV transition and 6% 'useless' (including surprisingly 2% visible) radiation loss.

Table 1 lists 22 lines of the mercury spectrum, in order of intensity. It is easy to see why a mercury discharge is purple.

If operating parameters are chosen wisely, this optimum level of a 4.86eV excitation will predominate over all others to produce the 253.7nm radiation.

Efficiency

As noted earlier, 40% of the UV radiation absorbed by the phosphor coating on the wall of the tube, is re-emitted as visible light. And we have just seen that 65% of the energy lost by the gas discharge in the tube is in the form of 253.7nm UV radiation. Thus the total efficiency of the tube in converting electrical energy into visible light is 65% x 40%, that is 26%. Although some of the ground state mercury atoms will also absorb the 253.7nm UV light, no energy is lost as the mercury atom will immediately re-emit it.

In a 1200mm long tube, the first 30mm is dark as it is behind the cathode. The next 10mm is bright, due to the discharge, and then there is a 10mm non-radiating dark space first noticed by Michael Faraday and now called the *Faraday Dark Space*. The main glow discharge is about 1100mm long.

All fluorescent lamps produce a 100Hz flicker (two discharges per mains cycle) which can cause problems in industrial applications, particularly if machinery operates at sub-multiples of this frequency. A lathe could appear stationary under a fluorescent lamp. In large installations, capacitors can be used to change the phase relationship between two bulbs in parallel and eliminate the problem.

Operating parameters

The question 'Why are fluorescent lights long and thin rather than short and fat?' can be answered by looking at experimental data.

The efficiency is a maximum of 83.3 lumens per watt at 26mm diameter – at 20mm and 35mm diameter the output is only 79.9lm/W.

The dependence on length is easier to understand. The power consumption by the discharge is divided between power consumption at the electrodes, which produces comparatively little UV radiation, and the power consumption in the discharge column which does produce ultraviolet. The column power consumption is proportional to the arc length and as the electrode power consumption remains constant, the longer the tube, the greater the fraction of total power input consumed by the column.

The efficiency is a maximum for an infinitely long lamp. For a 26mm diameter tube, the output is 83.3lm/W at 1200mm length; 67lm/W at 600mm and 94.5lm/W at 1800mm length. Manufacturers have chosen 1200mm as a convenient length, without too much loss of efficiency.

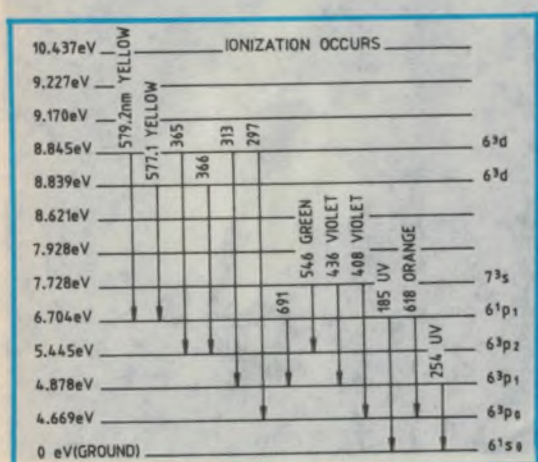


Fig.2: The excited mercury atom has many transitions, each giving a UV wavelength.

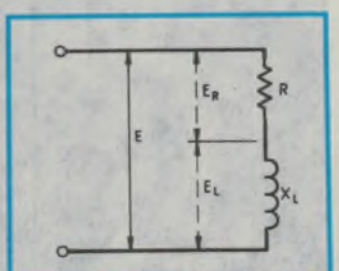


Fig.3: A fluorescent lamp and ballast have a nett series resistance R and inductive reactance L.

Power Factor

Power in a DC circuit is equal to the product of current and voltage. In an AC circuit, the power at any instant is equal to the product of current and voltage at that instant. When E and I are in phase, the *average* power over a complete cycle is the product of these values, as it is for DC; but when E and I are out of phase, E can be positive when I is negative, resulting in a zero value for power at 180° phase difference.

Fluorescent lamps

Phasor diagrams may be used to represent the sine-wave currents, voltages and their phase relationships. Fig.3 represents a circuit with resistance and inductance in series as is common in domestic fluorescent lights. The phasor diagram is drawn in Fig.4. The current phasor is used as a reference, since the current is the same in all parts of a series circuit.

Since the voltage across a resistance is in phase (phase angle = 0°) with the current through the resistance, the phasor E_R = I.R is drawn along the current phasor reference line. The resistance R is due to the 50 ohms of the ballast and that of the bulb after discharge (approx. 350 ohms). However, the voltage across the inductor E_L leads the current in the circuit by 90°. Therefore E_L = I.X_L (where X_L is the inductive reactance) is drawn 90° ahead of the current phasor I.

The applied voltage E is equal to the phasor sum of E_R and E_L. The phasor addition is the hypotenuse of the triangle and represents E or I.Z. The angle phi, or the angle between the applied voltage E and the current I, is the *phase angle* of the circuit.

The Apparent Power (S) used by the lamp is given by the product of E and I, while the Actual Power (P) is the lesser amount E_R.I. This latter quantity is the true power consumed. It is related to apparent power by $P = S.\cos\phi$ or $P = E.I.\cos\phi$. The quantity $\cos\phi$ is called the *power factor*.

When current and voltage are in phase (ϕ = 0°) the power factor is unity, because cos 0° = 1.

Electricity supply authorities specify the minimum allowable value for power factor in various installations. The Watt-hour Meter is used by the supply authority to measure power consumed at the installation. The speed of the motor and hence the number of electrical units

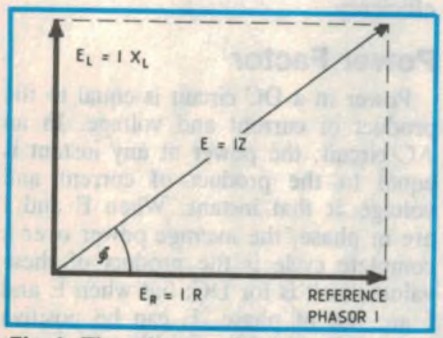
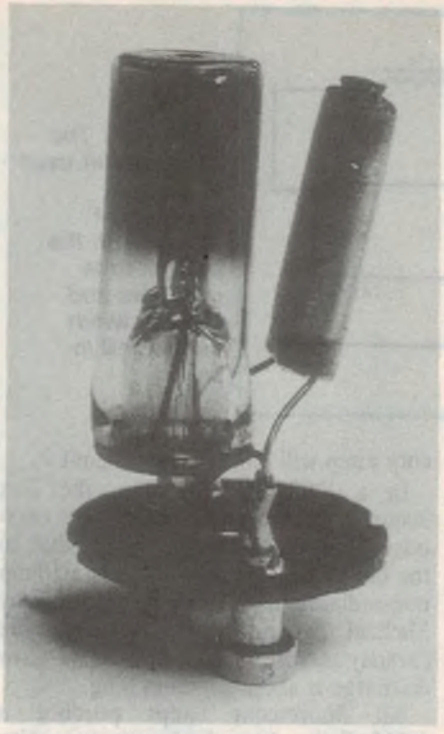


Fig.4: The phasor diagram for a lamp and ballast combination, showing the lagging phase angle phi.



A foil capacitor is connected across the starter's glow bottle switch, for suppression of RFI.

charged is proportional to E.I.cosϕ. If the power factor was zero, electricity would be free as the meter would not register.

To increase power factor to the allowable minumum, a capacitor can be added in series to the circuit. As voltage drop across the capacitor lags current by 90°, the voltage phasors for the inductor and capacitor are co-linear but have opposite directions. The phasor sum of these two is less than either, resulting in a lower value for phase angle ϕ and thus a higher power factor.

In domestic applications, the supply authority will generally allow 240W of

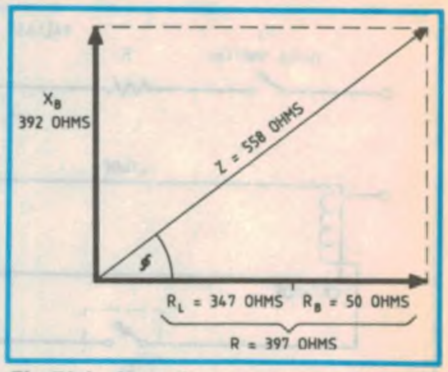


Fig.5(a): Impedance phasor diagram for a 26mm/36W lamp and starter.

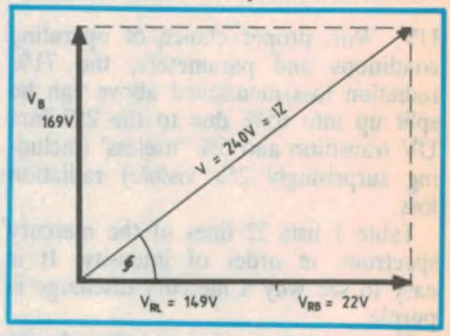


Fig.5(b): The corresponding voltage phasor diagram for Fig.5(a).

The phosphor is a white powder coating the inside of the glass tube. It can be tapped out of a broken lamp, as shown.

non-corrected power, thus capacitors are rarely seen in household fluorescent lights. In larger installations, a capacitor will be included in the lamp fitting or back at the central switchboard. The old paper and tar capacitors in domestic fluorescents are a thing of the past, and readers who have had one explode over the ceiling will appreciate why.

Typical phasor diagrams for a 26mm, 36W fluorescent are shown in Figs.5(a) and 5(b). The total resistance R is made up of the resistance of the lamp after ignition (R_L = 347 ohms) plus the resistance of the ballast (R_B = 50 ohms), that is 397 ohms. The inductive reactance $X_B = 2.\pi.f.L$, which is 392 ohms at a frequency of 50Hz.

The voltage across the ballast $V_B = I.X_B$, which equals 0.43 x 392 or 169V, assuming a current of 0.43A. The voltage drop across the resistance in the ballast $V_{R(B)} = I.R_B$ or 22V.

The voltage drop across the resistance of the lamp $V_{R(L)} = I.R_B$ or 149V.

The total impedance Z = V/I or 240V/0.43A, which equals 558 ohms. In theory, total resistance $R = Z.\cos\phi$, thus $\phi = \cos^{-1}R/Z$, which equals 44°. Power factor is thus 0.7.

Electronic ballasts

Recently, electronic ballasts have been introduced. Their cost of $40 – $50 is ten times the cost of the inductive ballast.

The Australian Standards Committee was unable to decide whether these new devices were a transformer or an inductor, as they have the features of both – so Australian manufacturers are loathe to incorporate them, for fear of having to refit installations once standards have been decided.

The new Parliament House in Canberra is one of the few places where electronic ballasts have been installed. The ballasts incorporate a frequency generator and because they include a small inductor to limit current, the power factor is about 0.95.

By using a light sensor as a potentiometer in a DC circuit within the lamp fitting, they are able to be dimmed automatically down to 25% in response to ambient light (sunlight) in the building.

The Author

Richard Walding (B.App.Sc., Grad.Dip.Tch., M.Sc., M.Phil.) is a chemistry and physics teacher at Moreton Bay College, in Brisbane. He is an Associate of the Australian Institute of Physics and The Royal Australian Chemical Institute.

Letters *Continued from page 7*

met RCA executives. He deliberately got 'lost' at the San Francisco Exposition (1933/4). There was an area on Russian opera at the Expo, and every spare minutes Ishibachi had he would 'hide' himself away – much to the annoyance and disapproval of Takayanagi – San!

Ishibachi married in 1936 and his daughter Penelope, born December 1936, married John Nakoa (1930-1975). Both Nakoa and Ishibachi were tragically killed in an auto accident just outside Nara, Japan in November 1975 on the way to the airport to meet four of my colleagues and I from Australia.

It was that day I met Kenjiro Takayanagi, then a sprightly 76 year old, Penelope and his family. They were all very gracious with us and asked us to stay for the funeral, which we reluctantly did. We later found out that we had saved Takayanagi's 'face' by attending such funeral. I only had small talk with the great man, but he impressed me with his warmth and willingness to share all his knowledge with those that sought it.

Now, nearly 14 years on, I have been bitten by the electronics/computer bug and although extremely amateur and novice in my comprehension, would like to learn more. Takayanagi and his associates talked about radionics and radiesthesia, and the making of such instruments to heal people at a distance by diagnosing their bodily fluids *et al* with these machines. Would any reader of *EA* wish to offer salient advice?

I have read Dr D.V. Tansley's book *The Dimensions of Radionics* and have descriptions and diagrams of the machines he talks about. I firmly believe that this science radionics could help mankind.

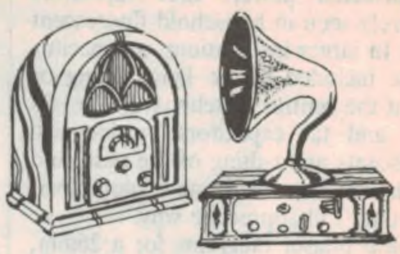
I am an Accredited Natural Therapist and run a small Institute on Natural Science in Far North Queensland. We teach courses on subjects such as Iridology, Homoepathy, Philosophy and Human Sciences. We have a Society that has a Research Department and we are keen to investigate the pros and cons of radionics, its usefulness or otherwise.

Bill Youngson, PhD
Mareeba, Qld

Comment: Thanks for the personal recollections of Mr Takayanagi and his family, Bill. If any material on radionics is sent in by readers, we'll pass it on.

Vintage Radio

by PETER LANKSHEAR



Pilot's 'Super Wasp'

Every industry has its landmarks – models which met a demand at the right time with the right price, performing well and setting the direction for future progress. One such radio was the Pilot Radio 'Super Wasp' shortwave receiver, introduced early in 1929.

Until the late 1920's radio amateurs, who in 1912 had been banished to the region above 2.0MHz, had the shortwave spectrum largely to themselves.

Some wealthy hams could afford receivers from the few manufacturers making shortwave equipment; but the great majority, in the best spirit of amateurism, made their own. In any event, receiver technology above 2.0MHz was very limited.

The superheterodyne did exist, but it had a long way to go before it was to be suitable for shortwave reception. It was very expensive and RCA, the patent holders, would not issue manufacturing licences.

Typical broadcast receivers had a couple of tuned triode RF stages, a grid leak detector and two audio amplifier stages. But for shortwave work, this type of receiver was quite unsuitable. It could not provide any worthwhile gain, its selectivity was completely inadequate and it was useless for unmodulated morse transmissions.

Regeneration essential

The regenerative grid leak detector was unchallenged for shortwave work. By contemporary standards it was sensitive and selective, and it also provided – in the oscillating condition – a heterodyne or beat note for code reception.

A single valve regenerative detector with tapped or plug-in coils, connected to a transmitting aerial could, and often did, constitute a practical receiver for hams. Where they could be afforded, one or two audio amplifier stages following the detector provided adequate level for headphone reception.

Shortcomings

Of course regenerative receivers have some limitations, which require 'trade offs'. The gridleak detector is a 'square law' device which, put simply, means that sensitivity falls off rapidly with decreasing signal strength, and no amount of audio amplification can compensate.

Attempts to improve matters by increasing aerial coupling leads to another problem. Resonances in the aerial and feeders damp the oscillating ability of the detector, at certain frequencies. (In fact this characteristic was used as the basis of the *grid dip oscillator*.) Increasing the amount of feedback to counter this effect results in difficult regeneration control.

The ideal regeneration characteristics are a smooth, almost imperceptible onset of oscillation, with no detuning as the control is advanced.

Successful broadcast band enthusiasts' receivers such as the Hammarlund Roberts and Browning Drake had shown that a solution to these problems was to include a neutralised triode tuned RF amplifier between the regenerative detector and the aerial. Unfortunately however, triode neutralisation was unsatisfactory over the range of frequencies involved in short wave RF amplification.

Screen grids arrive

In October 1927, America's RCA introduced the UX-222, and Britain's Marconi Osram released the S625. These screen-grid tetrode valves virtually eliminated grid-anode capacitance, and hence the need for neutralisation in RF amplifiers.

Here seemingly was the answer to some of the shortwave receiver problems. However attempts by amateurs to add tuned RF screen-grid amplifiers to shortwave receivers were not very encouraging. What was not generally appreciated was the need for thorough shielding, to prevent feedback and instability.

The best that could be done was to

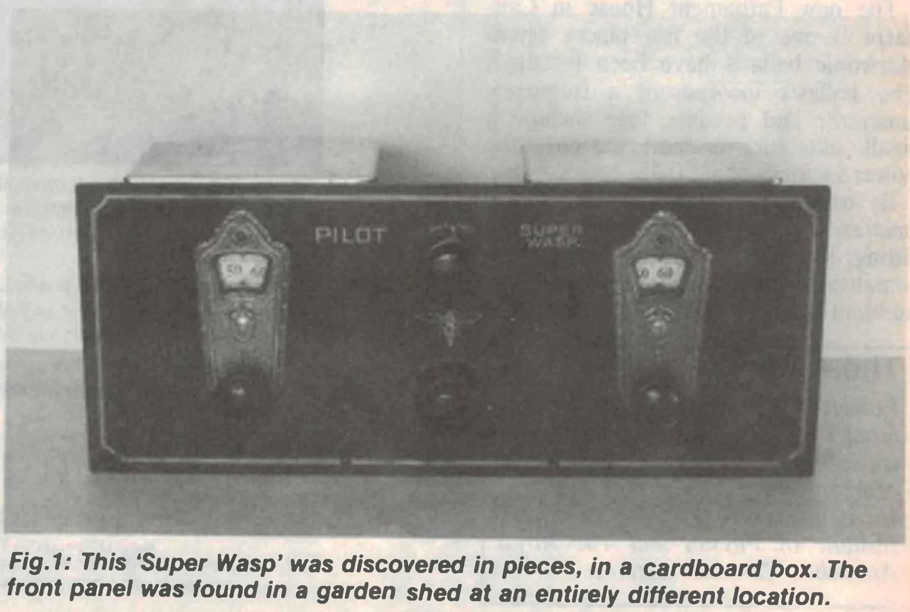


Fig.1: This 'Super Wasp' was discovered in pieces, in a cardboard box. The front panel was found in a garden shed at an entirely different location.

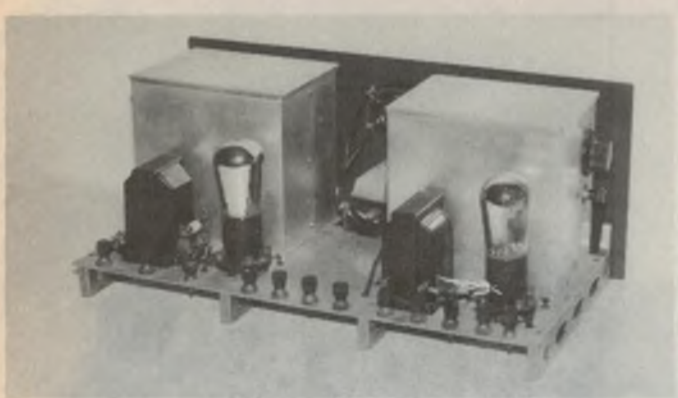
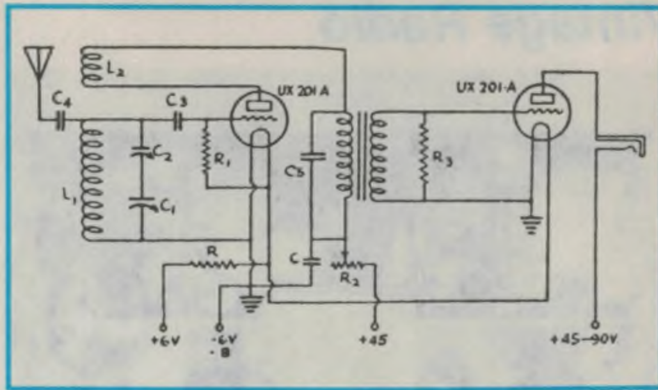


Fig.2: ***The audio amplifier stages and terminal strip at the rear, behind the shielding boxes. Note the chassis struts, for shielding and rigidity.***



Schematic for a typical 2-valve amateur receiver of the 1920's. Given the right conditions, sets like this could receive signals from the other side of the world.

use an untuned screen-grid valve between the aerial and the detector. This did not give much amplification, but did eliminate aerial loading. However, as the lack of aerial tuning resulted in strong signals cross modulating the isolating amplifier, the majority of shortwave users continued with simple receivers.

By now, commercial interests and broadcasters were alert to the potential of shortwave communication. Not only had amateurs achieved remarkable results, but also the success of the Australian Beam Wireless project made a considerable impact.

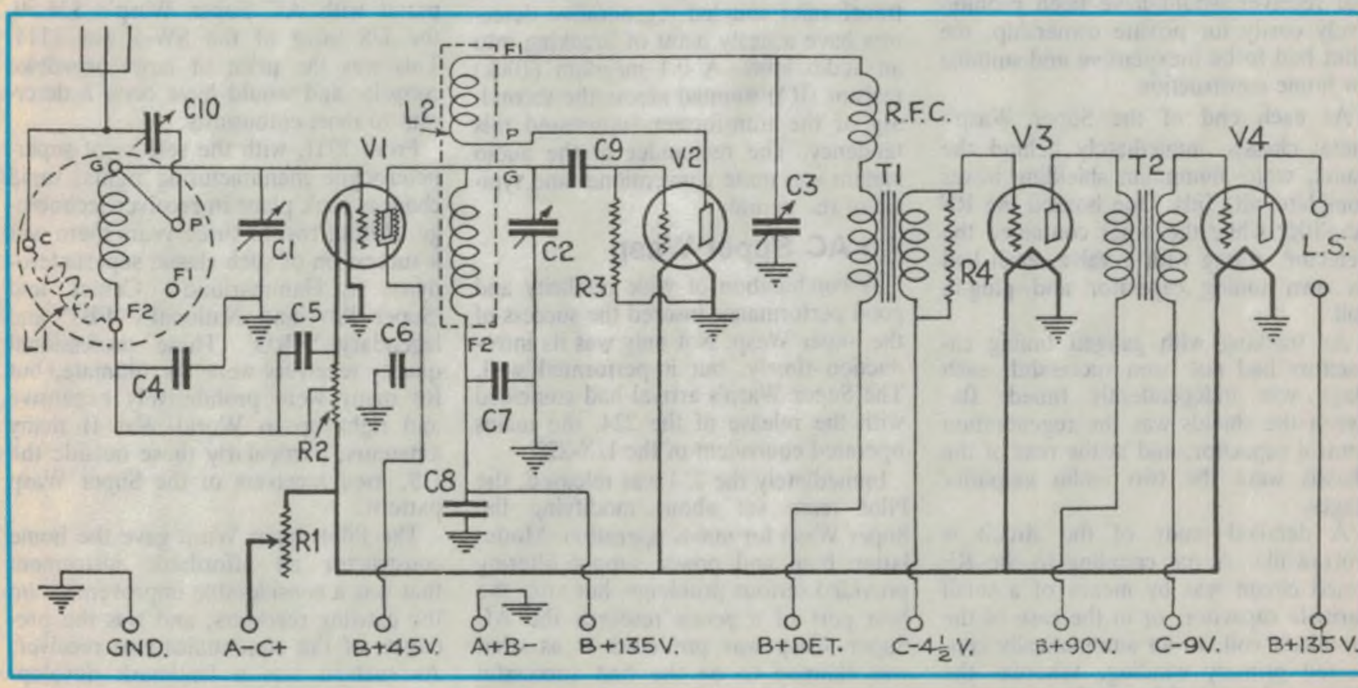
In 1928, General Electric, who understood the importance of shielding and solid mechanical construction, produced a successful shortwave receiver for RCA. Called the AR-1496, it used a UX-222 tuned RF amplifier followed by a regenerative detector and two transformer coupled audio stages. Intended for commercial work only, production of AR-1496 receivers was limited, and only three are known to exist today.

Enter Pilot

A major firm catering for the amateurs and home construction enthusiasts was the Pilot Radio & Tube Corporation of Brooklyn, New York. Pilot turned out a wide range of well made components, and sponsored a quarterly magazine called Radio Design, featuring projects for home construction. Needless to say, Pilot marketed kitsets for all these designs.

Towards the end of 1928, Pilot featured the 'Wasp', a conventional regenerative detector and two audio stage receiver using five plug-in coils to cover from 500 down to 17 metres. Using low loss coil formers, rigid construction and a metal panel, the Wasp proved to be a superior receiver of its kind and represented the best that could be achieved with the simple regenerative receiver.

Clearly, the way to further development of the amateur shortwave receiver lay with taming the RF amplifier. Pilot commissioned a team headed by Robert S. Kruse to come up with some answers. A consulting engineer in receiver design, Kruse was one of the leading shortwave receiver designers of the day. He had been Technical Editor for Sterling's authoritative *Radio Manual*, and had written extensively for the leading amateur magazine *QST*.



The Super Wasp's schematic. Fixed capacitors were all mica: C4, C5, C6, C7 and C8 were all 10nF, while C9 was 100pF. R1 was 6 ohms, R2 was 5+10 ohms, R3 was 3M and R4 was 100k.

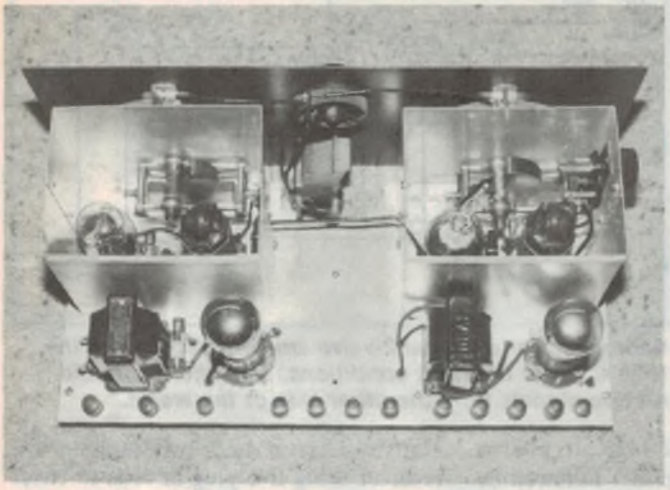


Fig.3: With the shield lids removed, the RF and detector stages are revealed. The second audio transformer is an AWA replacement.

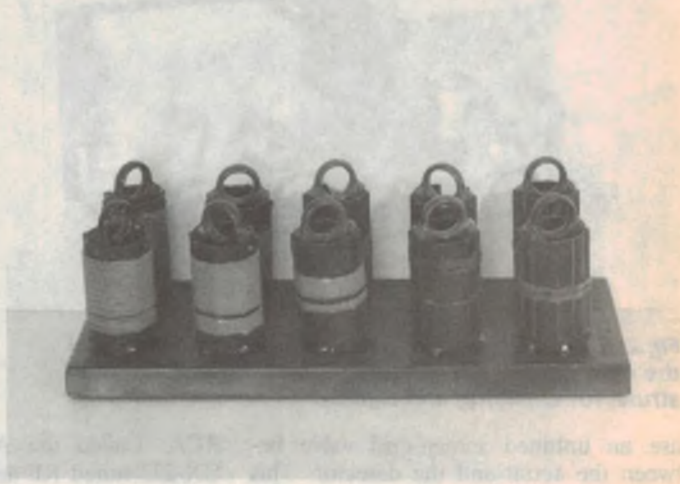


Fig.4: Bandswitching for shortwave receivers was still in the future. The Super Wasp's plug-in coils were inconvenient, but efficient.

Wasp with more sting

The results appeared early in 1929, as the 'Super Wasp'. Similar in concept to the AR-1496, the Super Wasp was a well-screened version of the earlier Wasp, with the addition of a tuned screen grid front end.

The 1928 edition of the *Radio Manual* includes a full description of the AR-1496 and as editor, Kruse would have been familiar with General Electric's work. This knowledge would have been of considerable assistance in the Super Wasp project, but whereas the commercial receiver would have been prohibitively costly for private ownership, the Pilot had to be inexpensive and suitable for home construction.

At each end of the Super Wasp's metal chassis, immediately behind the panel, were aluminium shielding boxes complete with lids. One housed the RF amplifier while the other contained the detector. Along with a valve, each had its own tuning capacitor and plug-in coil.

As tracking with ganged tuning capacitors had not been successful, each stage was independently tuned. Between the shields was the regeneration control capacitor, and at the rear of the chassis were the two audio amplifier stages.

A detailed study of the circuit is worthwhile. Aerial coupling to the RF tuned circuit was by means of a small variable capacitor, or in the case of the broadcast coil, to an automatically connected primary winding. Whereas the '01A triodes had 5.0 volt filaments, the UX-222 had a 3.3 volt filament. R2 provided the necessary voltage drop, which also became the '222 grid bias. With no primary winding for the detector tuned circuit, the tuned winding served as the anode load for the RF stage.

Also on the detector coil was the all important feedback winding, connected to the detector anode. RF energy from the detector anode was controlled by the variable capacitor regeneration control C3, at the other side of this winding.

The RF choke filtered the audio fed to the first audio transformer T1. Just at the most sensitive point of operation, transformer coupled regenerative detectors have a nasty habit of breaking into an audio howl. A 0.1 megohm (100k) resistor (R4) shunted across the secondary of the transformer suppressed this tendency. The remainder of the audio system was quite conventional and typical of the period.

An AC Super Wasp

A combination of wide publicity and good performance insured the success of the Super Wasp. Not only was its introduction timely, but it performed well. The Super Wasp's arrival had coincided with the release of the 224, the mains operated equivalent of the UX-222.

Immediately the 224 was released, the Pilot team set about modifying the Super Wasp for mains operation. Modulation hum and power supply filtering provided serious problems, but after the best part of a year's research the AC Super Wasp was produced – as what was claimed to be the first successful AC regenerative, shortwave headphone receiver.

With a 224 RF amplifier, and type 227 valves for the detector and audio stages, the AC Super Wasp was similar in concept to the battery set, but with additional filtering and RF bypassing.

Advances after 1930

Pilot soon had competition. By mid 1930, National with the assistance of the indefatigable Mr.Kruse, had produced the superbly made AC powered 'SW-5 Thrill Box'. Again, it was a regenerative TRF – but with a tetrode detector, ganged tuning, pushpull output stage and a metal cabinet. However, compared with AC Super Wasp's $34.50, the US price of the SW-5 was $114. This was the price of large broadcast console, and would have been a deterrent to most enthusiasts.

From 1931, with the release of superheterodyne manufacturing rights, rapid changes took place in receiver technology. Within two or three years there was a succession of such classic superheterodynes as Hammarlund's 'Comet' and 'Super Pro' and National's 'FB7' and legendary 'HRO'. These professional quality receivers were the ultimate, but for many were prohibitively expensive and right up to World War II many amateurs, particularly those outside the US, used receivers of the Super Wasp pattern.

The Pilot Super Wasp gave the home constructor an affordable instrument that was a considerable improvement on the existing receivers, and was the precursor of the communications receiver. As such it was a landmark development, and well worthy of a place in any collection of vintage receivers.

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Information centre

Conducted by Peter Phillips

What a year!

Hands up those who tried to solve the technical teaser in the October 1989 edition and gave up! No wonder – a printing error crept in, and... well, er – sort of made it impossible. I'll explain further on, but please refrain from making a Peter Phillips doll and sticking pins in it! As well as setting things straight I've also received some history on the problem, from a reader who remembers how it was posed in the first place. As well, B.H. from Dapto gives in. Remember him? He wanted to know who invented radio.

It is now exactly 12 months since we revamped these columns into one offering a platform for readers not only to seek advice, but to participate by offering opinions, advice, suggestions and so on. And what a time we've had! The green house effect, MEKP, the microphone pre-amp with its unnecessary resistor, Tesla, some brickbats, even a few bouquets. And to string it all together, some technical information on projects, both past, present and wished for.

I'm sure B.S. now has a green house watering system that is the envy of Bungendore. This month sees some more of the same, but first let's wind up the Tesla-Marconi contest. To date it's Tesla 23, Marconi 0. Aren't there any Marconi supporters out there?

Another round

I have to hand yet more correspondence supporting Tesla as the prime inventor of radio. The first letter really answers the question, at least as far as the US Supreme Court sees it:

In 1943, the US Supreme Court ruled in Tesla's favour that his patents had anticipated all other wireless communication patents, including Marconi's. The first Tesla patent was granted in 1898 and points back to as early as 1893 as the birth of wireless communications. So there you have it. I would not say Marconi stole the idea, but rather independently developed it much further than Tesla ever did. (G.B., Camberwell, Vic).

The next letter offers a copy of a paper presented to the Antique Wireless Association (US) titled 'Priority in the Invention of Radio – Tesla vs. Marconi.' It was kindly supplied by G.P. of Tugun, Qld, who also advises that an excellent text on Tesla is one titled *My Inventions*, an autobiography of Nikola Tesla, edited and introduced by Ben Johnson, published by Hart Brothers, Vermont (USA), ISBN 0-910077-00-2 (soft cover version).

The paper, written by Leland Anderson, technical editor of the Colorado School of Mines Research Institute commences with the same comment supplied by G.B. (above). It ends with the following acknowledgment by John Stone (1869-1943), a prominent mathematician and contemporary of Tesla.

'...He did more to excite interest and create an intelligent understanding of these phenomena...than anyone else...and it has been difficult to make any but unimportant improvements in the art of radio telegraphy without travelling, part of the way at least, along a trail blazed by this pioneer who, though eminently ingenious, practical and successful in the apparatus he devised and constructed, was so far ahead of his time that the best of us then mistook him for a dreamer.'

And finally B.H., the correspondent who started all this, gives in...

It seems I must eat humble pie and bow to the might of opinion expressed by your readers. I have to admit my belief that Marconi invented radio was based on little (or no) research, and I am most appreciative to your readers for their contribution to my education. (B.H. Dapto, NSW).

By the way, *EA* ran an excellent series on Tesla in the September, October and November 1983 issues. Now, leaving that one to rest, we'll proceed to a letter concerning contemporary radio communications.

Satellite reception

The following letter, condensed from the original, asks if we at *EA* intend presenting projects to support reception of satellite broadcasts. It also provides some useful information.

Although it is nearly five years since Aussat 1 was placed in orbit, it has been a huge disappointment to those wishing to take a harmless, furtive look with a small dish at what Aussat has to offer. There are other satellite broadcasts visible to our (southern) region, including Intelsat V-8. It has a usable signal strength and features a number of channels of unscrambled video. There are others as well, including various Asian and Russian geostationary satellites, which because of their footprint would require a 10m or 14m dish to receive here.

Unfortunately, even a basic 6 metre dish with preamplifier costs around $23,000, putting the hobbyist well out of the running. However, the general assumption that a satellite dish needs to be round is false. A squarish antenna is far easier to construct and manoeuvre and can provide more surface area.

On paper, the parabola of $y = x^2$ with an x scale of 1000mm = 1 and a y scale of 20mm = 1 appears to provide a shallow enough surface for a 10 metre square or even a 14 metre square. This could be constructed with lightweight metal and wood for the frame and pliable wood or plastic strips for the curvature and fine wiremesh for the parabolic reflector. True, it would be large, and I wonder if anyone has built such an antenna.

I am aware that Plessey Australia holds the monopoly on satellite receiver systems for the 'ku' band. Does this *mean that electronic journals are not permitted to publish constructional articles on low noise amplifiers, down converters and receivers even for the C band? How about it guys, it is time you developed something along these lines particularly with the expected drop in prices of GaAsFETS. (S.K., Hobart, Tas).*

Thanks, S.K. for your letter and confidence in our ability. The problem with such a project is access to a suitable dish, which as you point out is either rather large or expensive. We are not planning such a line of projects at this time, but would welcome any that have been developed by our readers.

Which is hottest?

Here's a little question worth musing over:

Does an electric kettle produce hotter boiling water than an electric jug? I pride myself in the ability to sip black tea directly after having made it with water from an electric jug. I cannot do the same with tea made from an electric kettle, or an urn with full bottom heating.

Am I right in suspecting that there are a few degrees difference between boiling water and the local heating from a wire jug element? (G.G., address not on letter)

I seem to remember from schoolday physics that for the same altitude and hence air pressure, water will always boil at the same temperature. But perhaps I'm wrong – or there's some other factor, like the rate of cooling when you turn off the power. What do readers think?

October's teaser

By now I have a mental picture of many frustrated *EA* readers deciding to take up goat roping or window dressing – anything other than electronics! After all, if a simple three resistor problem is beyond you, what's the use?

Relax, oh patient and sorely tried reader – a minor transposition of a voltage value created an impossible problem. The circuit should have had the 35V value across R2, not across the parallel combination of R1 and the 500 ohm resistor.

I have received a number of letters stating the problem is impossible, letters I initially rejected. It wasn't until the solution appeared in print that a reader phoned, suggesting the error. Upon checking, I soon confirmed what all problem posers fear most, an error in the original problem. My most humble and contrite apologies.

The following letter is typical of some that I have received, and I'm sure I'll get lots more before this errata appears. The most upsetting thing is that the question is such a good one. Errors are a part of life, but why in such a classic problem? Still, I suppose goat roping has its moments too!

I believe your problem involving two circuits on page 158 in Information Centre (October '89) can't be solved.

Two resistors in series across a supply as shown will divide the voltage in the ratio of the resistors, so if a load (voltmeter?) is introduced across one of the resistors, the resultant voltage across that resistor will be, at most, what it was before. The total of the two measured voltages can't be greater than the supply. As 28 + 35 is greater than 49, there is no solution, unless you allow negative resistors in this DC circuit. (G.C., Bentleigh, Vic).

Yes, G.C., what you say is correct. No matter how you look at it, the voltage across R1 can't be more than 21V (hangs head in shame). It is in fact 14V, and the 35V should have been across R2.

Another correspondent (B.M., Ormond, Vic.), also believed that at least one of the resistors has a negative value, and then suggests that as no polarity of the supply is given, that there are four possible solutions to the problem. Well, I don't know about that, but certainly a negative resistance value is the only possible solution to the circuit as published.

However a third contributor provides some history on this question. As I mentioned before, I found the problem in an unfinished letter dated 1951, that my father (a PMG employee at the time) was writing to his brother. I was still playing with blocks in those days, and I am now grateful to find information concerning the source of the question.

I noticed with interest your 'problem' in the October '89 issue. This jogged my ageing memory, and I think this question caused quite a deal of controversy in the 50's. It was a problem posed in the Senior Mechanics paper of the (then) PMG department – now Telecom. The question was put that if a voltmeter with an internal resistance of 500 ohms was placed across R1 and R2 in turn and read 28V and 35V (14V in fact) respectively (for a supply of 49V), determine the resistor values. (D.G., Mooroopna, Vic)

The letter continues, by describing that in those days, the standard PMG test instrument was a meter with a sensitivity of 100 ohms/V, referred to as a 'No.4 Detector'. It had two voltage scales, 0-5V and 0-50V and three current scales, 10mA (its highest sensitivity), 50mA and 500mA. The instrument was made by Master Instruments in Australia and was a copy of a meter used by the British Post Office. As D.G. further explains:

The meter had no resistance scale and it was very common to see field 'mechanics' (now technicians) have a 4.5V battery strapped to the meter and connected in series with it. By setting the meter to its 5V scale, the combination became a pseudo ohmmeter. The only calibrations were for the 0-50 scale and experienced mechanics all knew that a good reading, when looking back into the old manual magnet exchanges, should show around 15 on this scale. Many a fault was found this way. I started with the PMG in 1939 as a junior mechanic and still have in my possession a working model of one of these meters.

Z80 versus 6502

Returning to contemporary technology, here's a letter that may incite some controversy:

I am currently studying a microprocessor course that teaches the Z80 microprocessor. However, the teacher keeps saying that this micro is inferior to the 6502. I cannot see why, but then I don't know much about either of them (yet). I respect the teacher's opinion, but wonder why the Z80 is so popular if the 6502 is really the better of the two. What do you think? (S.B., Maroubra, NSW)

I have noticed over the years that computer buffs often hold opinions that verge on the fanatical. Which programming language, what computer, what microprocessor is best – just ask a computer buff and he'll tell you, at the same time telling you what's wrong with all the alternatives.

Being totally objective (of course!), I agree with S.B.'s teacher. To me, the 6502 is the sports car and the Z80 is the 'Yank tank', complete with all its bells and whistles. I'm not sure if the following letter is from a Z80 devotee, but it offers some interesting points:

In reference to your question posed in the September issue, and the solution that appeared in October, I agree that XOR A is an efficient way to clear the Z80's accumulator. However it also sets the flags, which may be undesirable. As well, SUB A has the same execution time *and affects the flags, though somewhat differently.*

However, the OR A instruction is not useless, as it is a good way of testing the contents of the accumulator without altering them. The AND A instruction behaves in a similar fashion, but seems not to be as popular as the OR A instruction. The other 'useless' instructions are also a good way of filling in time within a program, to create a time delay for example. (B.M. Ormond, Vic).

Nicad projects

A couple of minor points have arisen concerning the Nicad Charger (*EA*, July 1989) and the companion Discharger (September 1989). As the designer I not only need to accept responsibility for any errors, but can answer queries on the circuit with (hopefully) some knowledge.

A mistake brought to our attention concerns the overlay diagram for the Discharger (page 119, Sept '89). The zener diode ZD1 is shown with the wrong orientation. The photo of the prototype has the correct orientation, and the mistake is obviously a drawing error we didn't spot.

The next two points concern the Charger and seem to involve component tolerances. First here's a letter from a constructor who describes his findings:

I recently constructed the NiCad Charger described in the July 1989 edition. I experienced trouble with the timing circuit, which proved to be the pulse output from IC3b. The high voltage on pin 7 (the half wave signal from the rectifier) was barely rising over the reference voltage on pin 6.

After checking the values of the various components in the circuit this did not seem unreasonable. It would seem that either you were lucky with the tolerances or I was unlucky. Changing R17 to 6.8k and R18 to 12k placed the top of the waveform midway between the high and low states of the pin 6 reference. Changing R12 and R13 would have achieved the same result. (G.S., Irymple, Vic).

I remember that this section of the circuit was the most critical, and I experimented for some time before settling on the values shown in the circuit. The critical aspect of this section concerns the way in which the unit ceases charging after the selected time delay has expired. This is achieved by changing the reference voltage to IC3b, causing the input pulse at pin 7 to become less than the reference. The effect is that the output of IC3b will be maintained at virtually zero volts.

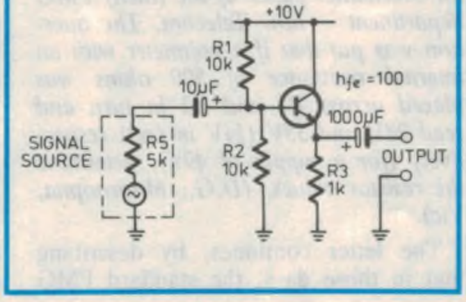
Changing resistor values to clean up the output of IC3b is fine, providing you also confirm that the output pulses cease when the timer has run its course. There is no simple answer to this one, although I am surprised that component tolerances are proving broad enough to create this problem. However, so far only one reader has mentioned this as a problem, so perhaps he was just unlucky.

The second point concerns LED3 (Charge indicator), which a constructor claims does not completely extinguish in his unit when the unit enters the trickle charge mode. His modification is to add a signal diode (1N914 or similar) in series with LED3. That is, connect the anode of the added diode to the anode of D8 and the cathode to the junction of R23 and LED3.

I experienced no problems with this section of the circuit, and can only assume that not all brands of 339 op-amp ICs behave in the same way. In this case the output voltage of IC3d appears to be remaining sufficiently high to cause LED3 to be slightly forward biased, causing a small current. The addition of the suggested diode will overcome this problem. This variation between brands of 339 ICs may also explain the problem described previously. I used a Fairchild brand in the prototype, although I would have expected other brands to perform in an identical manner. That's ICs for you as, like people, some are born more equal than others!

What??

This month's question is a tad mathematical. As you know, the output impedance of an emitter follower amplifier is low, often enough to drive a fairly low resistance load. For the circuit shown, use reasonable approximations to calculate the output impedance of the circuit. By the way, it is a lot less than 1k!



Answer to last month's What??

The circuit shown last month is a BCD to Grey code converter. The beauty of the circuit is the low number of components, and it uses the multiplexers (or data selectors) in a 'folded' configuration to produce the desired codes. The output code sequence is: 000, 010, 011, 001, 101, 111, 110 and 100. This sequence is for an input code of 000, 001, 010, 011, 100, 101, 110 and 111. Notice how the output code only ever has a one bit change between any two adjacent codes, even between the first and the last.

Other BCD to Grey converters use gates, resulting in a rather bulky circuit layout. However, using a multiplexer, as in the question, will give increased noise, which could cause problems in high speed circuits. But it works, and if you need a BCD to Grey converter, this circuit may provide the answer.

NOTES & ERRATA

TV DERIVED FREQUENCY STANDARD

(July, October 1989): In the overlay diagram for the oven PCB, on page 118 of the October issue, the E and B connections are shown transposed for the MJE/TSB3055 power transistor connections below the board. The connections should read C-E-B, from left to right. Also both series base resistors, to the right of C7 and near the bottom RH corner of the board, should be shown as 4.7k.

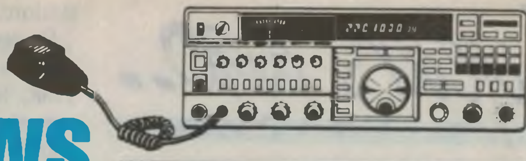
SIMPLE DC VOLTAGE REFERENCE

(October 1989): Noise reduction capacitor C3 should preferably be a metallised polyester or mylar type, as any capacitor leakage will directly effect the stability and long term accuracy. A 0.22uF greencap will probably be the largest that can be fitted in physically, but should be quite satisfactory. Also trimpot RV1, if used, should preferably be a cermet type for stability.

COMPACT SUB-WOOFER ENCLOSURES

(September 1989): The 150mm driver used in this project came from Altronics, under the catalogue number C3055. It appears that the more recent stocks of this driver may exhibit different characteristics, which don't suit the published enclosures. To test for the correct unit, check that the free-air resonance is around 37Hz – the drivers which are unsuitable will resonate at a significantly higher frequency (more like 50Hz). (File: 1/SE/68).

Amateur Radio News



NSW microwave field day

The WIA's NSW Division held a Microwave Field Day at its transmitting centre in Dural, on Sunday November 12. Although the weather was variable, with a few showers to dampen proceedings, around 60 people turned up to make the event a success.

Highlight of the day was commissioning of the new VK2RWI 23cm repeater (1281.750MHz), built by Bob Clark VK2YOD around two Yaesu transceivers generously donated by Dick Smith Electronics. At the official ceremony, NSW WIA president Roger Henley VK2ZIG expressed appreciation to DSE's representative Chris Ayres, who also presented the WIA with a cheque for $500 to assist with expenses at the Games & Hobbies Expo.

Amateurs displaying 2.3GHz and 10GHz microwave equipment at the field day included Lyle Pattison VK2ALU, Bill Cox VK2ZAC and Dick Norman VK2BDN. A display of microwave components was also provided by Ray Biddle, VK2DB.

Historian seeks info on NSW pioneers

Jo Harris VK2KAA, official historian of the NSW Division of the WIA, is gradually compiling a database of amateur radio history in VK2. The work is well advanced, with a great deal of information on early hams and their activities, but as with any such work there are lots of 'missing links' and gaps.

As a result, Jo would be very interested to hear from both hams themselves, the relatives of deceased hams, or indeed anyone else who can provide information on amateur radio activities in NSW over the years. Notes, pictures, log books, press clippings, old equipment – all are welcome. She can be contacted through the NSW Division, PO Box 1066, Parramatta 2124.

Amateur radio at Games & Hobbies Expo

A large display promoting the diverse activities and satisfactions of amateur radio was organised by the NSW Division of the WIA, at the 'Games 89' show at the Sydney Showground in October. Many affiliated clubs and organisations were involved, including the Gladesville Amateur Radio Club (GARC), the Australian Amateur Packet Radio Association (AAPRA), the Australian Ladies' Amateur Radio Association (ALARA), the International Amateur Radio Club (IARC) and WICEN (NSW) Inc.

The display included video demonstrations of club activities (including Novice instruction), live demonstrations of on-air voice contacts on HF, VHF and UHF, live ATV and packet radio demonstrations, RTTY and mobile demonstrations as well as static displays of current and historical amateur radio equipment and amateur achievements.

A brochure explaining the benefits and satisfactions of amateur radio was handed out to interested visitors. The brochure also listed all radio clubs affiliated with the WIA's NSW Division, with contact names and phone numbers to ensure that those wishing to enquire further will be able to do so.

The basic idea of the display was to emphasise the many interesting facets of modern amateur radio, and encourage those looking for a rewarding hobby to give it consideration.

EA reader's trip to Asia

Electronics Australia reader Andrew Gibbons made a donation of magazines to the International Radio Listeners' Club in Bangladesh, in response to the appeal published in this column for August 1989. Only a couple of months later he found himself on a one-month trip to Thailand, India and Bangladesh, at the invitation of the newly-formed Bangladesh branch of the International Amateur Radio Network (IARN).

The highlight of Andrew's trip was to be attendance of the International Amateur Radio Emergency Communications Conference, planned for Dhaka in December, as representative of IARN Australia.

In 1990, IARN hopes to launch projects in Vanuatu, Kiribati, Bangladesh, China and the Israel territories of Gaza and West Bank. Details are available from Sam Voron VK2BVS, (02) 407 1066.

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.

January 1940

Television Certain: Sir Ernest Fisk, in an article headed 'Radio and Things to Come', writes as follows:

I have sat in a London flat and watched international tennis being played at Wimbledon, 10 miles distant. Members of my family, in a home in a London suburb, watched the arrival at Waterloo Station of the King and Queen returning from Canada. Plays, ballets, fashion parades and other performances can be seen and heard by means of television at various distances.

Since the outbreak of war the London television service has been closed, but the new and partly experimental service in New York is still operating.

Let us avoid technicalities and scientific explanations, while I assure you that the day will come when every home will have an apparatus enabling its occupants to see and hear events, first at short distances, later at great distances and eventually from all parts of the world. At the same time, I must warn you not to expect this to happen suddenly.

Commercials on 40m Amateur Band: Most experimenters and transmitters are aware that the 1938 International Telecommunications Conference, held in Cairo, decreed that the 7200-7300kc. section of the 7Mc. amateur band be shared between the commercials and the experimenters, with the proviso that this particular regulation was not to apply to America.

Our friends the 'Yanks' were in high glee over this proviso until a few European broadcasting stations started operations prematurely, and the 'W's' had it very forcibly brought home to them just how much QRM these stations could cause.

Secretary Warner, of the ARRL, had quite a lot to say about it in August 1938, but during April 1939 he found out that the BBC was building two 100kW stations to operate on 7240 and 7260kcs. In July 1939, it was feared that the advent of foreign broadcasting stations in the shared section of the band would drive the weak (?) American CW stations out altogether.

January 1965

Citizen's Band – Chaos or Control: From both sides of the Atlantic comes news of the 'chaos' being caused by the small 'Citizen Band' transceivers.

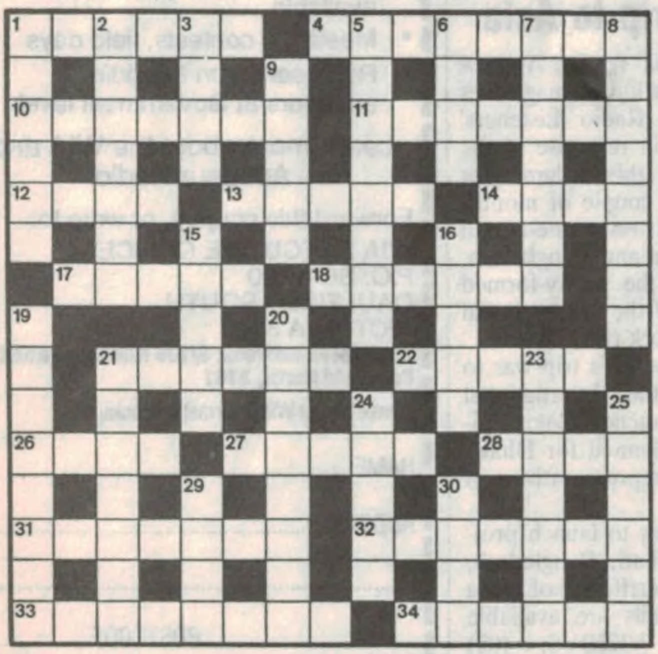
In the USA the Federal Communications Commission is cracking down on abuses, and may forbid use of the wavelength if new regulations do not produce results. Originally intended for personal and business communications over short distances, the band is now used mostly by hobbyists who jam the channel with chatter.

In England the Association of Public Address Engineers, while making it clear that they do not wish to see a Citizen's Band type of permit in the UK, feel that licences should be issued for the used of 27Mc. units on a professional basis.

EA Crossword

Across

1. Flash device. (6)
4. Unit for measuring resistance. (8)
10. Not brought to desired frequency. (7)
11. Wrongly determine an interval. (7)

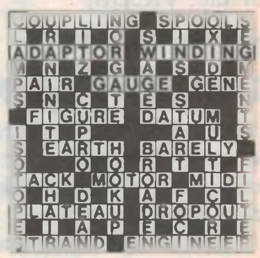


12. Current events are measured in ---- time. (4)
13. Prize-winning EA project: car interior light ----. (5)
14. Raise off ground. (4)
17. Said of unrecorded tape. (5)
18. Switch off burglar alarm. (6)
21. Reproducer. (6)
22. Pleasurable pastime such as kit construction. (5)
26. Variety of meson. (4)
27. Name of kind of key. (5)
28. Audio accessory. (4)
31. Copying conversation in calls. (7)
32. Messages in communication system. (7)
33. Storage medium in a computer (4,4)
34. Room for recording. (6)

Down

1. Fourier series help form ---- waves. (6)
2. Type of file. (3-4)
3. Region of frequency spectrum. (4)
5. Communication system used by amateurs. (3,5)
6. Antenna mount. (4)
7. Isotope of hydrogen. (7)

DECEMBER SOLUTION



8. Unit of exposure to ionising radiation. (8)
9. Brand of electronic typewriter. (5)
15. Cuts lightly. (5)
16. Major brand of 21 across. (5)
19. State of mutually unsuitable devices. (8)
20. Again brings component into correct positon. (8)
21. Circuit that limits waveform. (7)
23. Gave a compact account. (7)
24. Rocket used to launch spacecraft in 70's. (5)
25. Reverberate. (2-4)
29. Emanation from the Sun, the solar ----. (4)
30. Scottish inventor of a mechanical condenser. (4)

EA marketplace EA marketplace

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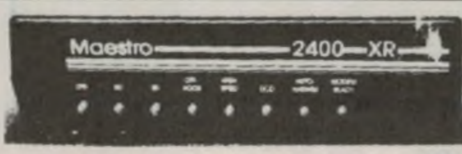

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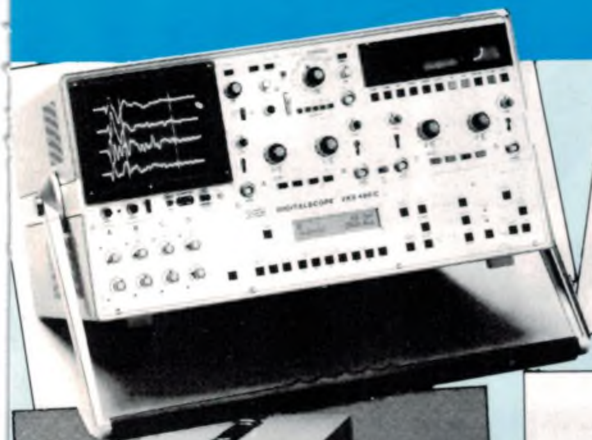

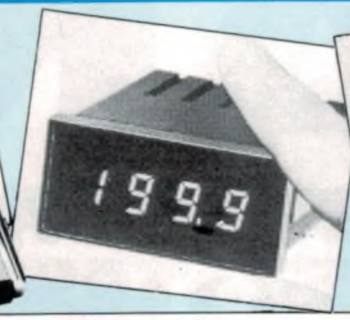

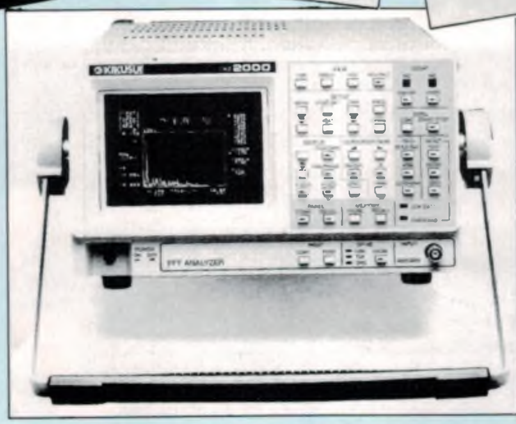

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