ELECTRONICS · TECHNOLOGY INNOVATION

NOVEMBER 1989

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Cover photograph courtesy of Commodore Amiga.

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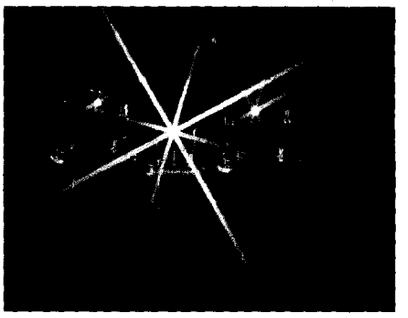

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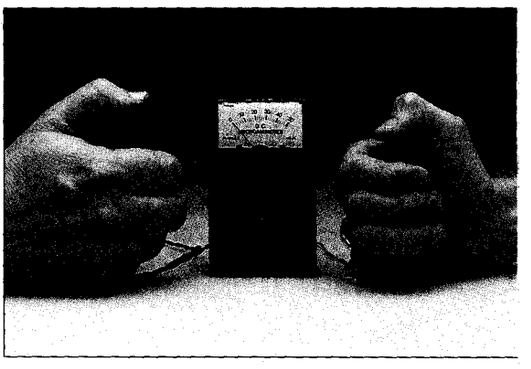

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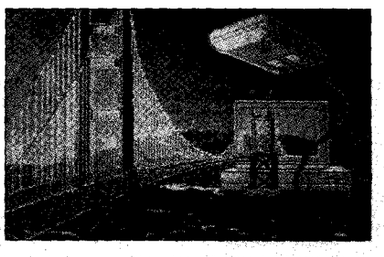

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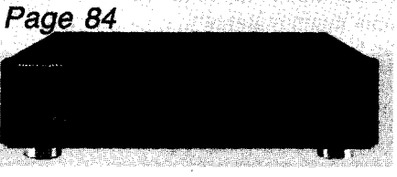

Page 110

Introducing

STA-TEMP™ Soldering System

The First Innovation in Hand Soldering In 30 Years

OVERVIEW
Metcal's STA-TEMP Soldering System eliminates the defects which can occur during hand-soldering. Because the STA-TEMP System solders quickly and more consistently at 600°F than conventional irons do at 750°F and higher, it prevents thermal damage and cold solder joints.

GENERAL DESCRIPTION
Each STA-TEMP tip cartridge contains a small, powerful heater which has been designed into the tip itself. This configuration allows the heater to respond directly to the connection by delivering power on demand. Each METCAL heater is self regulating, so it delivers just the right amount of power to bring the connection to the optimum temperature. Direct POWER, not high temperature, gets the job done.

***Eliminates Lifted Pads, Board Measling, Overheated Components**

***Eliminates Electrical Damage**
The STA-TEMP System is fully shielded and grounded.

***Needs No Calibration**
The tip regulates its own temperature. The system needs no calibration to ensure compliance with design specifications.

***Exceeds Military Specification Requirements:**

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Fig.1

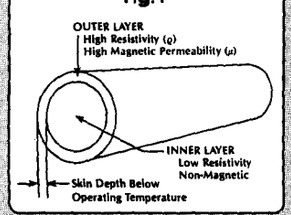


Fig.2

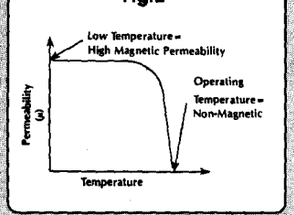


Fig.3

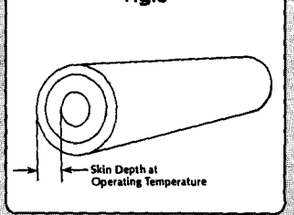
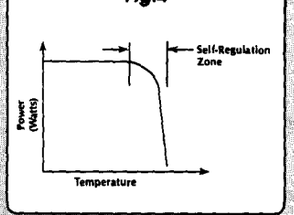


Fig.4



HOW DOES IT WORK?
The "heater" is a laminate of two metallic layers. The outer is a magnetically permeable material with relatively high electrical resistance, the inner a non-magnetic material with low thermal and electrical resistance. The power source supplies a high frequency alternating current which flows near the surface of the laminate due to the "skin effect" phenomenom. When the heater temperature is below its operating temperature, this skin effect causes most of the current to flow in the outer, high permeably layer. **(fig.1)**. Since this layer also has a relatively high resistance, considerable heat is generated by the current. As the temperature increases **(fig.2)**, the magnetic permeability decreases (due to the Curie phenomenom) allowing most of the current to flow through the low resistance inner layer, thus dramatically reducing resistance and heat generation **(fig.3)**. At the design temperature, heat generated and heat used by the tip are in balance and the temperature is maintained at ±2°F. When the temperature of the self-heating tip assembly is reduced by a thermal load, heat generation instantly increases to maintain temperature **(fig.4)**. This process is inherently reversible and provides the industry's first high power, precision, self regulating temperature source.

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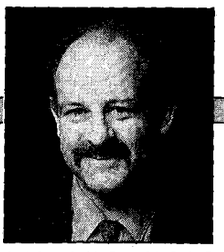

KIM BUCKNOLE

ETI's winning ways

The generous support of 3 leading companies enables ETI to offer you the chance to win some magnificent prizes over the next 3 months.

The T & M Division of Philips Scientific & Industrial has provided an outstanding pair of instruments that exemplify the Fluke/Philips alliance – a Fluke 45 Dual Display Multimeter (with battery option and case) and a Philips PM 3335/001 50 MHz Digital Storage Oscilloscope. Subscribers have the chance to win this exciting T & M package from the Fluke/Philips alliance on pages 18-19.

Marconi Instruments became a NSW registered company earlier this year and acquired a new head office. (See the profile in this issue.) They are offering their remarkable 1 GHz "smart" probe (and power supply) in a competition on page 34. We intend bringing you a review of this instrument in the near future, but, in the meantime, all ETI readers have a chance to win one courtesy of Marconi Instruments.

Marantz continually launches leading edge consumer electronics products, and has kindly presented the newly released CV-55 Video Player unit. Louis Challis has reviewed the CV-55 on page 110 and on page 119 all ETI readers have the opportunity to win the latest from Marantz.

Plus ça change, plus ça même chose

ETI opened this, its eighteenth year, under the editorship of Jon Fairall. You may recall his parting editorial, The Final Track, March, 1989, when he left for "other, although not necessarily greener, pastures". Amongst Jon's legacies was the current format of the magazine which commenced with the September 1988 issue.

Ros Bromwich took over with the April issue. Unknown to any of us her October issue editorial was her last. ETI is a voracious consumer of time for editors and Ros' young son Thomas needs his mother's attention. The legacy of Ros' short tenure is the annual ETI Industry Awards.

Jon and Ros will maintain their connections with ETI and I hope to publish contributions from both in the next few months.

In May, a name for many years synonymous with ETI resurfaced. Not only the name, but also the familiar face, of Roger Harrison appeared on the cover and imprint of the magazine. ETI welcomed Roger's distinctive touch and style back to its pages as Electronics Editor.

ETI's banner used to include the legend *Australia's Dynamic Electronics Monthly*. As you can see, even now the only static thing in the ETI editorial office is the carpet.

The publisher has now appointed me editor and manager. I share the sense of excitement expressed by Ros in her April editorial.

In tandem with Roger, I will seek to offer you a magazine with a balance of features, news, reviews and opinions. The emphasis, as ever, will be on electronics and the application of electronics in many varied technological fields. ETI's traditional concerns will remain to the fore.

Appointment

It is with great pleasure that ETI announces Louis Challis' appointment as Contributing Editor – Hi-Fi and Audio Products. Louis has made distinguished contributions to ETI since its inception. He is, quite simply, the most respected and authoritative writer in his field. ETI cherishes his unrivalled expertise and experience and his continuing support.

Computing in ETI

Recognising that so many of you own PCs, use them at work and are involved in purchasing decisions in your employment about both PCs and other computers, software etc, we have decided to start a new section entitled Workstation. We will endeavour to cover areas relevant to your interests at home and at work. We open with a story on computer animation by the winner of the recent Ausgraph competition, which reveals the possibilities if you can master your tools with sufficient dedication and perseverence.

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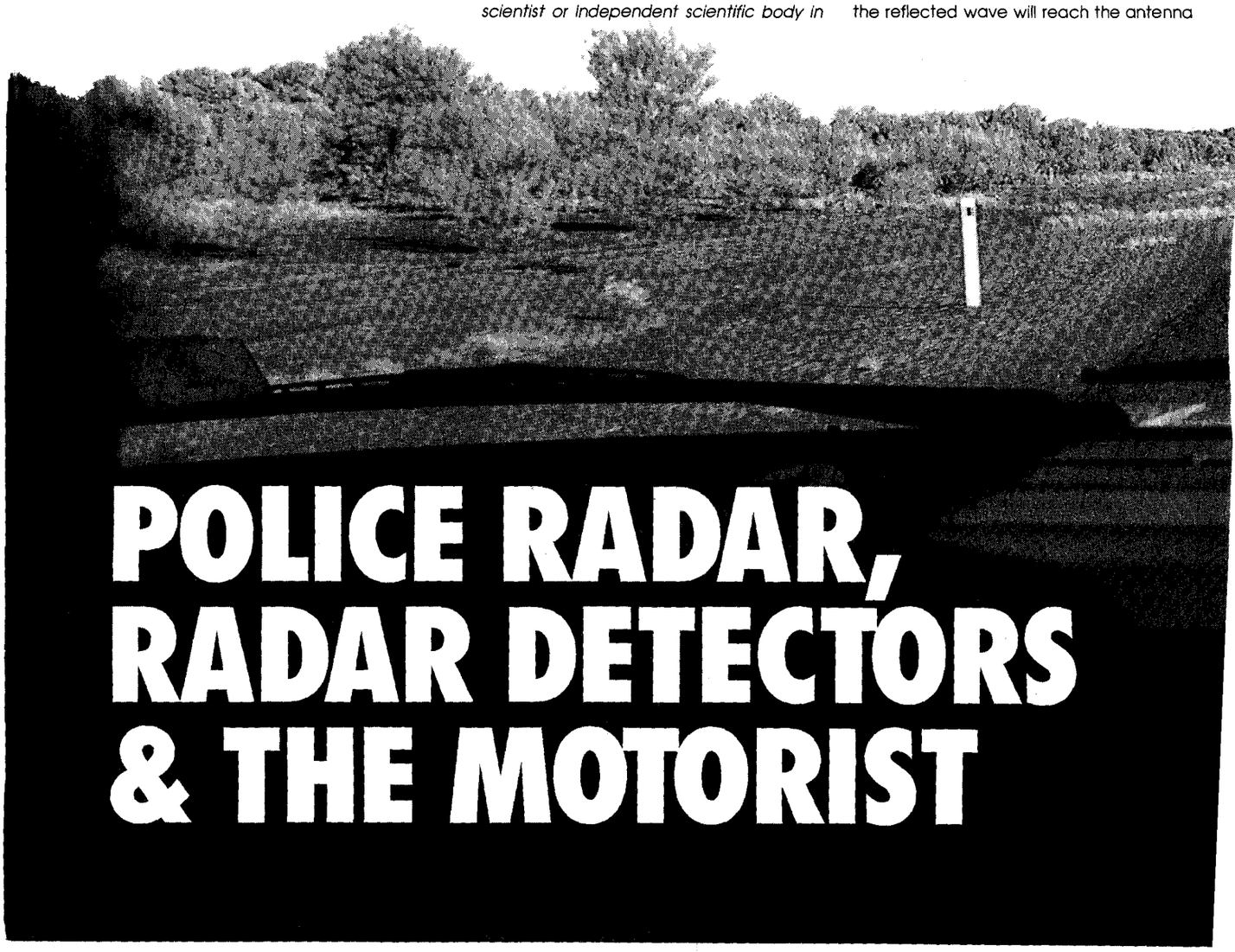
TECHNOLOGY

Are police radars sufficiently accurate and discriminatory to be classed as a scientific instrument? Are they fair to the motorist? Are radar detectors effective? Do they make better drivers? We examine the facts, the faults and the fallacies.
By Roger Harrison.



POLICE RADAR, RADAR DETECTORS & THE MOTORIST

Police radar has come under fire over recent years in newspaper motoring columns, motoring and trucking magazines, on radio and television programs. Some attacks have been largely groundless, based on ignorance and centred on emotive issues – such as the revenue earning role of police radar patrols; others have brought the issue of the radar units' accuracy into question (albeit on a superficial level). There have been few articles on the subject in technically-oriented publications, more's the pity (see the bibliography at the end of this article).

Speed violation bookings issued by police to drivers caught by a radar patrol have been challenged in the courts over the years, and some of these challenges have been successful, some not. Many successful challenges have been based on technical grounds. On the experience of certain challenges, police operating procedures have been changed in the past.

But, in an effort to head-off such challenges, the police departments in each state have been successful in having their radars declared as scientific instruments which means that a reading is *prima facie* evidence in court. They have been declared scientific instruments *despite the fact that no scientist or independent scientific body in Australia has been prepared to support that declaration!*

Thus, it is now next to impossible to successfully challenge a radar speed violation ticket. This strongly confirms suspicions voiced over the years that radar patrols have a primary role as a revenue earner.

Before we get into the larger questions, let us review the basic principles of how police radars work, the different types, how they are used and the circumstances where erroneous readings might arise.

Police radars, the basics

All police radars take advantage of the *Doppler Effect.* Ever noticed how, for example, a train whistle, of constant pitch or frequency, is high in pitch as the train approaches you, drops sharply as it passes you, then is lower in pitch as it recedes? This is the Doppler Effect.

Now, take a radio wave reflected from a relatively large, moving object – as is the case with these radars. The signal radiated is of constant frequency – so many wave crests pass from the radar's antenna per unit of time. The signals are reflected back to the radar's antenna, which is shared by the receiver. But if the object is moving *towards* the radar unit, the same number of crests of the reflected wave will reach the antenna

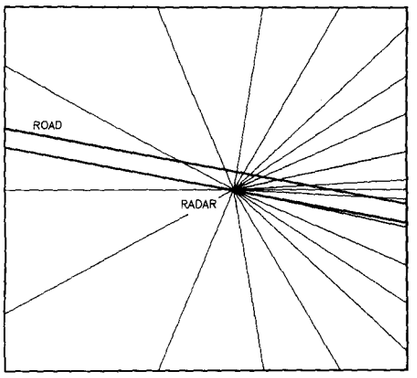


Figure 1. A police radar will send its signal in all directions, not just down a narrow corridor. The density of lines here are an indication of the strength of the beam. It weakens as you move clockwise and anticlockwise away from the main direction, which is to the right. The whole area from the radar outwards is bathed in signal — stronger in the direction of the beam and weaker away from it. Some objects even well away from the main beam direction may return a stronger signal than those within the radar's defined beamwidth.

in *less* time. Thus, the *frequency* of the reflected wave will appear to be *higher* than that transmitted. The difference between the transmitted and reflected frequencies is called the *Doppler shift*.

Similarly, with an object moving *away* from the radar, for the same number of crests transmitted, the number received after reflection will take *more* time and thus the reflected signal will appear to be *lower* in frequency.

Police radars emit a continuous signal, at least for the period during which measurements are taken. They are not pulsed as aircraft radars are. Such radars measure the time difference between the transmitted and reflected pulses to ascertain the distance between the radar and the target.

The antenna on a police radar beams the transmitted signal, the beam being aimed in an appropriate direction so that vehicles pass through it. Now, contrary to what you might believe, the antenna actually radiates some energy in all directions. Figure 1 illustrates. Here, the radar is aimed to the right, at an acute angle across the road. The density of lines in the illustration are an indication of the strength of the beam. Thus, it weakens as you move clockwise and anticlockwise away from the main direction to the right. The whole area from the radar outwards is bathed in signal – stronger in the direction of the beam and weaker away from it. It doesn't have a beam like a pencil, as a laser does, but something more like a leaky garden spray. The antenna leaks signal in all directions away from the main beam.

As an example, take a lighthouse. When the beam is pointing directly at you, you see a very bright light. As it sweeps around away from you, the light intensity drops very sharply, but *you still see some light as the beam sweeps all the way around.* Or take the case of a garden spotlight. Directly in front, the light is at maximum brightness and it weakens towards the sides.

The lines in Figure 1 continue to infinity, they don't stop somewhere. Objects struck by the radar's transmitted signal will return a signal, regardless of their direction from the radar – even from above it. The radar's receiver may or may not pick up the returned signal, depending on the receiver's sensitivity.

An antenna's beamwidth is characterised by the angle between the directions where the signal falls to half the intensity of that directly in front of it. The signals picked up by the radar's receiver, even those returned from more or less directly within the beam, will vary markedly in strength. So the

decrease in signal strength at the points defining the beamwidth actually becomes meaningless in real terms. Some objects even well away from the main beam direction may return a stronger signal than those within the radar's defined beamwidth.

It is a fallacy to believe that only objects within the radar's beamwidth are picked up by the radar.

There are two ways of deploying a radar to measure the speed of vehicles passing along a road: *down the road* and *across the road*, also referred to as slant radar. These are illustrated in Figure 2. In both cases it is clear that the radar is pointing at an angle to the direction of travel of vehicles travelling along the road, whether they are travelling towards the radar or away from it.

A variation on the down-the-road situation is the mobile radar, which is used within a moving patrol vehicle to measure the speed of oncoming vehicles.

The radar will measure the rate at which a vehicle moves directly towards or away from it, not the actual speed the vehicle's travelling at in the direction it is going. This relative speed is known as the radial speed. From simple high school trigonometry, the speed the radar sees is the vehicle's actual speed times the cosine of the angle between the radar beam and the direction of the vehicle's travel. Refer to Figure 3. For down-the-road radars, the angle here is quite small, a few degrees. The cosine of a small angle is a little less than 1, so the radar actually reads a speed somewhat less than the vehicle's actual speed. This is called the cosine error. Down-the-road radars ignore the error in practice. In the case of across-the-road radars, they are set up to point across the road at a known angle (25 degrees to the direction of travel, in NSW at least) and the electronics of the unit takes account of the cosine error.

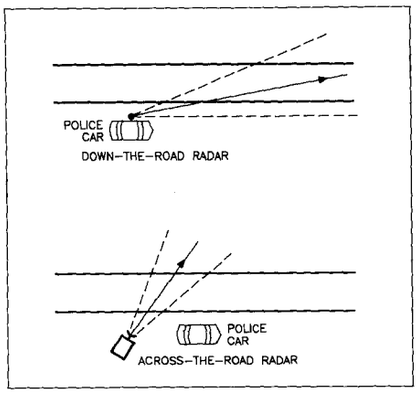


Figure 2. How the different police radars are deployed. At top is the down-the-road type (Digidar, KR-11 and KR-10), and below it is the across-the-road, or slant, radar (Fairey).

The technology employed in police radars is of two general types, as illustrated in the accompanying panel. The frequencies used are 10.5 GHz (10,500 MHz) and 24 GHz, respectively known as X-band and K-band (actually, Ku-band). Some X-band radars use 10.7 GHz.

The significant thing about them is that they simply mix the transmitted frequency and the frequency of all returns and, in the simpler units (Digidar and KR types) pass on only the difference between them. The simpler radars cannot tell whether a vehicle is coming towards or going away from it. Only the South Australian manufactured Fairey slant radar has the technology to do this (see accompanying panel).

Accuracies quoted by the radar manufacturers are generally +/−1% of reading plus +/−1-2 kph. Operational accuracies are similar and police directives to operators which we have sighted permit a tolerance of some +10% on radars'

Police radars — how they work

All police radars are based on a microwave Doppler module which consists of a waveguide horn antenna and a short length of waveguide with an oscillator and mixer coupled into it. The oscillator provides the transmit signal and the Doppler-shifted return(s) mix with a little of the oscillator signal, providing the difference between them at the output of the mixer. The Doppler shift on X-band signals (10.525 GHz) is in the order of 20 Hz per kph, while on K-band (24.150 GHz) signals it is around 45 Hz per kph. So the mixer output is an audio frequency.

These Doppler modules are directly akin to the homodyne receivers of the 1930s (for those that remember them), or direct conversion receivers of more recent decades.

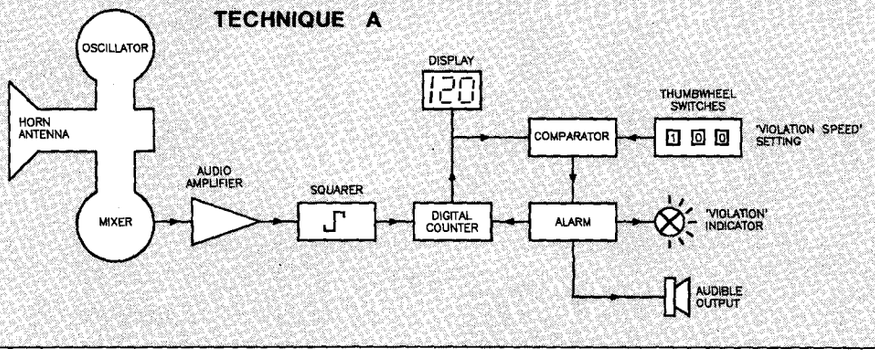
There are two basic techniques employed to convert the Doppler return of a radar into a speed reading. Technique A, shown in the block diagram here, takes the audio output from the Doppler module, squares it up and passes this to a digital counter – which is rather like a digital frequency meter.

This counts the zero crossings of the squared signal during a time window of around 50 milliseconds, and six consecutive windows are tested for consistency of result. If they're not consistent, the reading is thrown out. If they are consistent, the counter displays the result. This is compared to a violation speed setting and if the reading exceeds this, an alarm sounds and the displayed speed is locked.

This system is used in fixed (or static), roadside radars, such as the X-band Digidar.

Technique B, shown in the second block diagram here, takes the output from the Doppler module, amplifies it, splits the signal and passes it through a non-inverting and an inverting stage to two gates – A and B. A swept-frequency audio oscillator drives the gates whose outputs are summed. The swept oscillator starts at a high frequency and sweeps down in pitch. As it does, it beats with the Doppler returns from the Doppler module. The speed display will lock on to the highest pitch return which the swept

TECHNIQUE A



violation speed settings. So, in 60 kph zones, the radar's violation speed setting will likely be set on 66 kph, in 80 kph zone, on 88 kph, in 100 kph zones, on 110 kph. The only exception seems to be for 110 kph zones, where the tolerance limit is 120 kph.

Vehicles as a radar target

Back in 1981, we cooperated with Dr Godfrey Lucas, an acknowledged radar expert and head of Sydney University's Air Navigation Group of the School of Electrical Engineering, in conducting a comprehensive series of measurements of the radar cross-section of a wide variety of vehicles. The vehicles ranged from various trucks, through common sedans and wagons, to sports cars and a motor bike. The results of this historic test were tabulated on page 16 of the March 1981 issue of ETI.

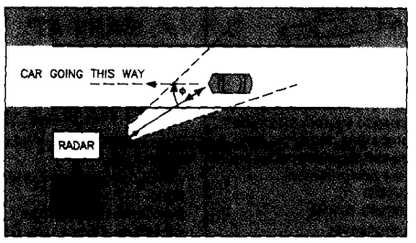
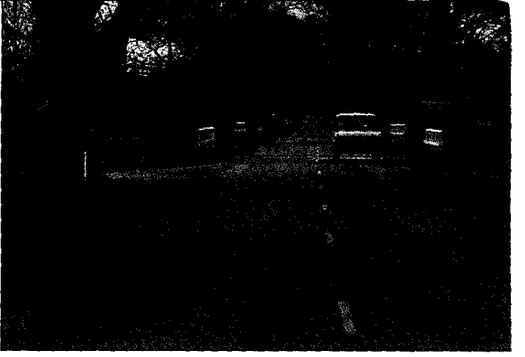


Figure 3. The radar reads that component of the vehicle's speed along the line between the radar and the vehicle, which is somewhat less than the vehicle's actual speed because of the cosine error. Down-the-road radars ignore it, across-the road radars take it into account.

The amount of signal reflected by any vehicle depends in a complex way on its size, shape and the conductivity of the materials from which it is built. It is *not* related in any simple way to the vehicle's physical cross-section. While the physical cross-sectional areas of the vehicles tested varied by about 10 to 1, their measured radar cross-sections ranged over almost 5000 to 1 (front-on) on X-band and 170 to 1 on K-band. When comparing front-on (or approaching) radar cross-sections with departing (rear-on) figures, the maximum ratio was 13,500 to 1, which is important as we shall soon see.

There were a few more surprises. For example, the front-on X-band radar cross-section of a Peugot 505 is *smaller*, by a factor of two, than a Honda motor bike! Even a Mazda RX7 sports car had a larger radar cross-section than the Peugot.



Fallibility

Once a police radar is set up for operation, the only variable is the radar cross-sections of the vehicles encountered, and thus the comparative strengths of the Doppler returns.

With only one vehicle in the field of view of the police radar, all is well. Problems arise when there is more than one vehicle in the radar's complete field of view.

With radars employing Technique A (see panel), e.g: the X-band Digidar, the unit locks on to the vehicle providing the strongest Doppler return – *which may not be the closest vehicle* – and ignores returns from any vehicles which are less than 75% of this strength, according to Dr Lucas. Worse, it does this no matter which way the vehicle is travelling. Where another return is between

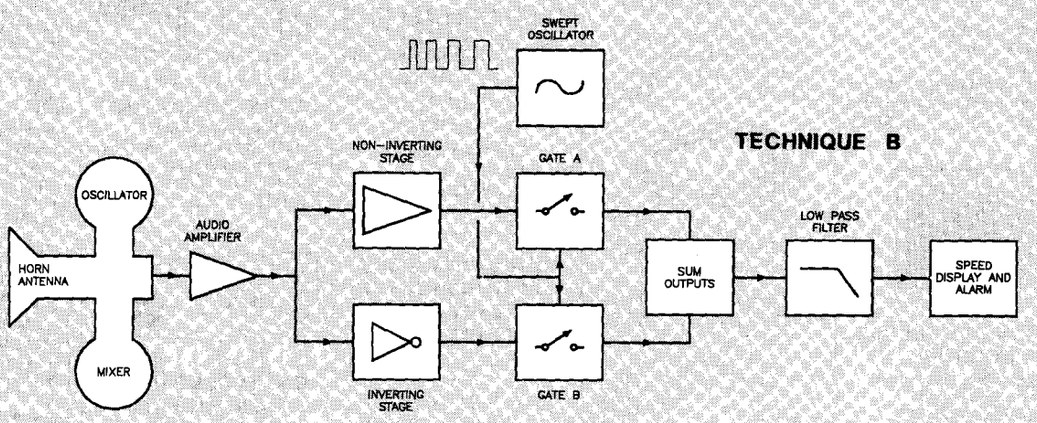
oscillator encounters. Thus, this system looks for the fastest target.

It's rather akin to a spectrum analyser. It may view the spectrum or any part of it by moving the local oscillator suitably. Thus it can be armed with much more information about the environment within the radar's field of view. It can look for the fastest vehicle by seeking the highest frequency component in its range; it can deduct the speed of the vehicle in which it may be mounted from that of the target, allowing it to be used from a moving car. It is rather a shame that the design does not allow it to search for other vehicles, of which it is easily capable, so that it might alert the operator to this situation.

This system is used in the mobile radars (KR-10 and KR-11).

Dr Godfrey Lucas reports that, in recent years, Doppler modules with a second mixer have become available. The two mixers are separated by a quarter wavelength in the waveguide which, by properly combining their outputs, enables the elimination of either the approaching target returns or the receding target returns, which Lucas says is a significant advance in the technology for static, roadside radars. Only the Fairey across-the-road radar has adopted this technology.

The horn antenna systems in X-band radars typically have beamwidths of 20 degrees (at the half power points). It will have an effective field of view of at least 40 degrees (that is, around twice the beamwidth). On K-band radars, beamwidths are typically 10 degrees. The Fairey slant radar has a beamwidth of 4 degrees.



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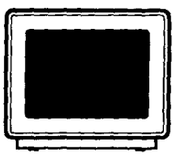

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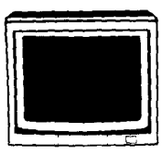

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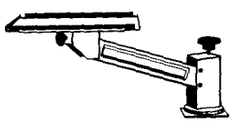

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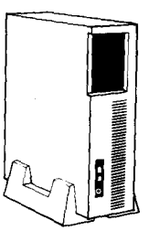

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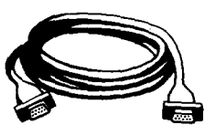

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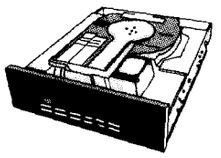

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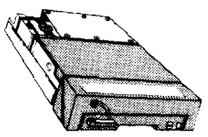

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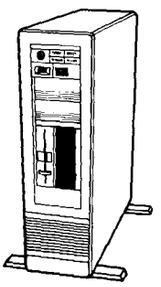
COMPUTERS



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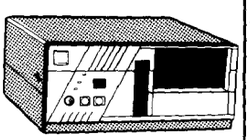

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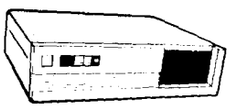

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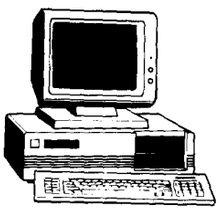

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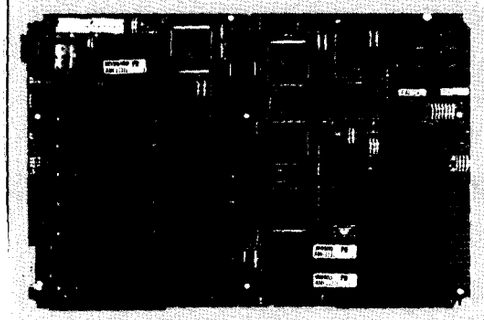

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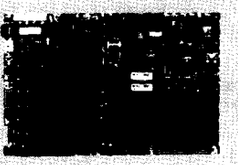

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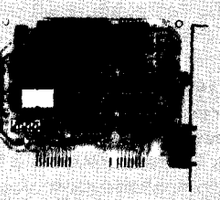

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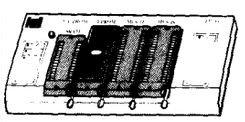

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75-100% of the strongest, these units indicate an error and will not show a reading.

So, in situations where there's light traffic, radars using Technique A will display the speed of the vehicle with the strongest return. *But there is no way the operator can tell which vehicle this may be!*

Consider this situation: a Mazda RX7 is seen coming towards the radar at a distance of 50 metres. Further behind it is a Kenworth truck. The comparative radar cross-sections of the two vehicles is, from Table 1 reproduced on page 16 of the March 1981 ETI article, 0.005 and 14.58 respectively. The truck would return a stronger signal. From the mathematics of radar (the radar equation), the truck would return a signal of the same strength as the Mazda from 374 metres away. The radar would likely be reading the speed of the truck from around 300 metres away. If it were exceeding the speed limit and the Mazda, a racy-looking sports car, was not – guess who'd be booked? Even if the police operator observing the traffic was required to estimate an erstwhile offending vehicle's speed, with a radar being a declared scientific instrument, there's no onus to provide corroborative evidence as there was previously.

If the Kenworth truck was travelling in the opposite direction, the situation is worse. From the rear (departing), it has a comparative radar cross-section of 40.5, which means its Doppler return will be the same as the Mazda's when it's 474 metres away. Its return will likely exceed the Mazda's, the radar locking onto the truck's speed when it's around 380 metres away. Would a police observer necessarily see the truck at such a distance?

With an across-the-road radar, like the Fairey, problem situations also arise, despite its technological advantages: it has a very narrow beamwidth and the electronics checks for a steady signal strength to suppress returns from vehicles passing through at the edges of its field of view where the return will vary markedly in signal strength because of the rapid variation in the radar antenna's field here. In addition, it can suppress returns from either receding or approaching targets.

However, because of its narrow beamwidth, it strongly illuminates areas well beyond the road on which it is set up. Take the case illustrated in Figure 4. Here, the speeding vehicle may not be seen by the operating officer, obscured by a building, shrubbery or whatever. It may not even be obscured – the officer's attention is on the road in front of the radar after all. The radar may ignore the vehicle coming from the right, and will read instead the speed of the vehicle on the other road which is within the main beam and giving a steady return.

This situation may be rare, but remains a possibility, nonetheless. What about vehicles travelling on a parallel road not too far distant?

Problems with valid readings also arise with mobile radars. These read the converging speed of the return from oncoming vehicles, and also the background return from the road to read the patrol vehicle's speed, then subtract these to get the speed of the target vehicle. When the two vehicles are alone on the road – no problem. However, Dr Godfrey Lucas points out that the radar will give valid readings when there is more than one vehicle in the radar's field of view. In the worst case, he says, the officer will continue to get a reading when there is traffic moving in the same direction as the patrol vehicle!

Lucas also points out that the mobile situation is more prone to errors than with static, roadside radars and the mobile operator has very little time to make any checks.

Dr Lucas' conclusion is that police radars are quite accurate when there is only a single target vehicle on the roadway, but "...where there is more than one target vehicle there is always doubt as to which vehicle that radar has acquired."

That's pretty damning.

Remedies

Firstly, photo-recording radars, which have been around for some 20 years, would provide pretty good corroborative evidence

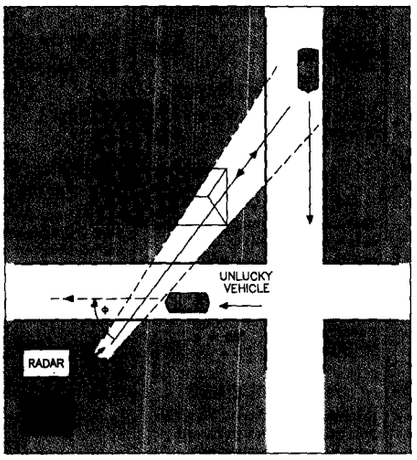


Figure 4. A problem situation for an across-the-road radar.

of correct operation and a valid reading. The authorities, however, refuse to consider photographic evidence citing it would be an administrative nightmare. They may also have to invalidate numbers of bookings, losing revenue. Tsk, tsk. Why aren't red light cameras an administrative nightmare?

Secondly, the radars' electronics could be redesigned to improve the amount of information available to the operator. Such as: providing a warning when there are multiple target returns present – a trivial problem, according to Dr Lucas. Distinction between approaching and receding targets would also improve matters. The Fairey can do this, so the technology is available.

Just because the legislators in each state and territory have been hoodwinked into declaring police traffic radars as scientific instruments doesn't mean they are infallible. Far from it, as you can see. But it means that a court must accept the radar evidence as being infallible. You cannot challenge it.

This is nothing short of a travesty of justice. It should not remain so. The technological means of remedying the situation is available now and there is little excuse for delaying a remedy. Otherwise, radar patrols truly are a revenue earner, whatever other law enforcement role they may have. It would be better that they be scrapped altogether if there remains any question of fallibility, and amphometers substituted.

Radar detectors

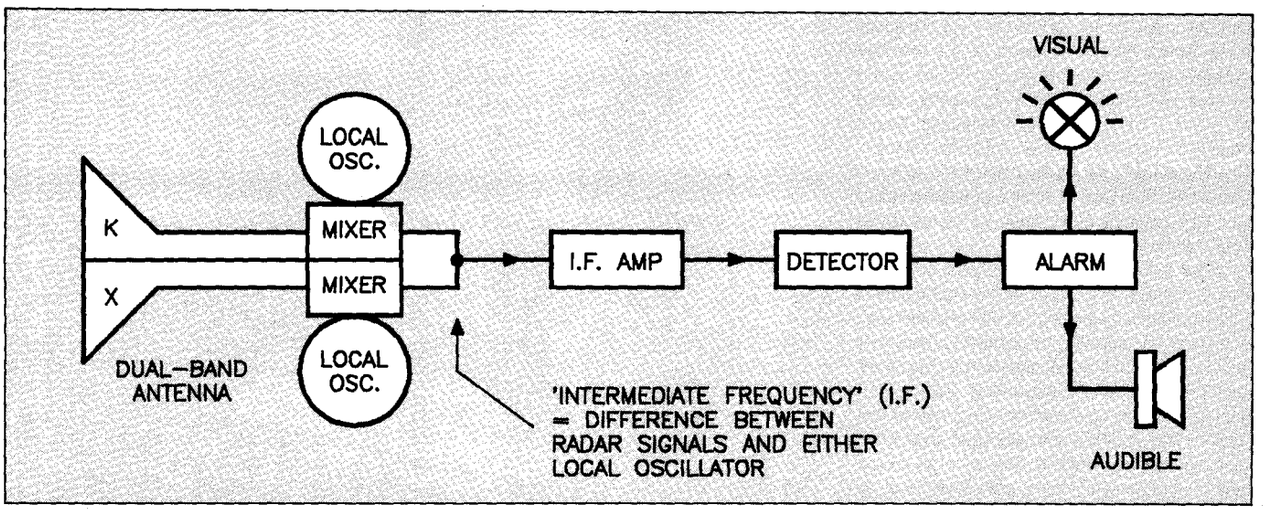
A radar detector is basically a wide band microwave receiver which turns on an alarm when it receives a signal. Both audible (speaker) and visual (light) alarms are usually included, so it emits a beep and turns on or flashes a light when a signal's received.

Early radar detectors were little more than microwave crystal sets! Today's radar detectors are rather sophisticated superhet receivers, just as in your FM receiver, TV set or bedside clock/radio. And, like them, there are models which are more sensitive than others, types with different frequency coverage and models of differing quality.

Figure 5 shows a general block diagram of most radar detectors. The superhet technique is used because it provides the best obtainable sensitivity. The dual-band antenna and front end provide coverage of both the X and K bands used by police radar. Because some radars use a slightly different X-band frequency – 10.7 GHz instead of 10.525 GHz – some detectors these days make provision for reception of the extra frequency, even though the X-band receiver will detect it (but not at full sensitivity). Such units are referred to as tri-band detectors.

Police radar shares the X and K bands with other equipment, in particular, automatic and remote-control door opening equipment and Doppler burglar alarms (which pick up the movement of a person within its vicinity). It is impossible for a radar detector to discriminate between these and police radar signals. Such equipment is widely installed in built-up and metropolitan areas and so false alarms are experienced.

Many radar detector manufacturers provide a switch for city and highway mode operation. This switch lowers the gain of the I.F. amplifier for city mode, to reduce the incidence of false alarms, as most of this equipment operates at lower powers and within more confined areas or further from



the road than police radars.

A detector's alarm can be triggered when it is overloaded with RF energy from a nearby source that may be well removed in frequency; by a CB rig in the vehicle, for example. The better detectors include a means of suppressing false alarms from such interference. Detectors will also pick up the local oscillator from other radar detectors, and some manufacturers include circuitry to avoid false alarms from this source, too.

Some police radar units only have the transmitter turned on to make a reading when the operating officer sees a vehicle he judges is exceeding the speed limit. And it only need be turned on for a very short period, making detection very difficult. Yes, it *is* a ploy to avoid detection.

Mobile radars may be operated with the transmit signal suppressed until the operator wishes to make a reading, a small residual signal providing the patrol speed from returns from the road. If a roadside radar is set up to measure the speed of receding traffic, your detector has to rely on receiving the lower strength radiation from outside the main beam.

To accommodate these situations, a lot of development has taken place in recent years to greatly improve the sensitivity of radar detectors. All this notwithstanding, a radar detector is never going to give adequate warning in every situation.

What about range – how far away can you detect a radar trap in operation? Manufacturers make various claims on this question, without giving details of the conditions under which the claim applies. In reality, it will vary enormously because it is dependent on so many variable factors: the location of the radar, whether it's static (roadside) or mobile, the intervening and surrounding terrain, the location of roadside buildings, the amount of other traffic on the road, the manner in which the police radar is operated, etc. The range of a detector cannot be simply stated.

Figure 5. General block diagram of a radar detector. As most police radar units operate in the X or K band, the dual-band antenna and mixer/oscillator front end provides reception on both bands. An incoming signal mixes with the relevant local oscillator, the mixer output selecting the difference between them — the intermediate frequency (I.F.). This is a lower frequency where it is easier to provide lots of stable gain in the I.F. amp. This is known as the superheterodyne technique, or superhet for short. After amplification a detector determines if a signal is present and triggers an alarm which gives both visual and audible indication. The gain of the I.F. amplifier can be varied by a switch to change the unit's sensitivity for city and highway use. Some radar detectors, to improve performance, convert the incoming microwave frequency down several times: a receiver with two conversions is called a double conversion superhet, with three conversions, a triple conversion superhet.

The transmitted signal from a police radar may be received directly if there is clear line of sight between the radar and your detector. However, the transmitted signal may be scattered or reflected from objects near and far – buildings and structures beside the road, other traffic moving down the road, etc. This will create a complex pattern of reflections with areas of strong signals and areas where there are weak signals. Remember, also, that the radar transmitter leaks signal in virtually all directions (see Figure 1).

As a guide, with a highly sensitive detector, you might expect to pick up a roadside (down-the-road) or oncoming mobile police radar from some 5 km away on a freeway or highway, under the right conditions, but 1 km would be more usual. Claims of ability to detect radars "...up to 13 km away..." would be hard to substantiate. I'm not saying it's impossible, but certainly it would not be usual. In the city, you'd be lucky to detect a down-the-road or oncoming mobile radar from more than 1 km away; more usually you'll only get 100-400 metres warning. For obvious reasons, across-the-road radars are more difficult to detect.

At any time, if you're alone on the road (no other vehicles within visible distance), keep your ear on your radar detector, your speed on or below the limit and your eyes peeled. With other traffic around, be alert to the behaviour of other drivers, the condition of traffic going the other way and don't pass if you have to exceed the speed limit by even 10%.

Brands, models & prices

Both fully-imported and locally-assembled radar detectors are available. Cobra, Escort, MicroEye, Micronta, Passport, Super Snooper, Uniden and Whistler are some of the major brand names on the market. Prices range from a low of around $199, right up to $599. As with most things "...ya gets whats ya pays for..." Higher-priced units have more features and functions, but not necessarily more sensitivity, which is probably the most important specification.

If you're looking around for a detector, attempt to find out the quoted sensitivity specification if you can – which is NOT the range. It will be quoted in dBm (decibels referred to one milliwatt). A value less than –100 dBm (i.e, 93 dBm), is not good. A value exceeding –110 dBm is desirable. Generally, there will be some difference between X-band and K-band sensitivity figures, X-band being favoured.

Many of the detectors available are single-piece units, designed for mounting on the stem of your rear-vision mirror, a sun-visor or

Police radar

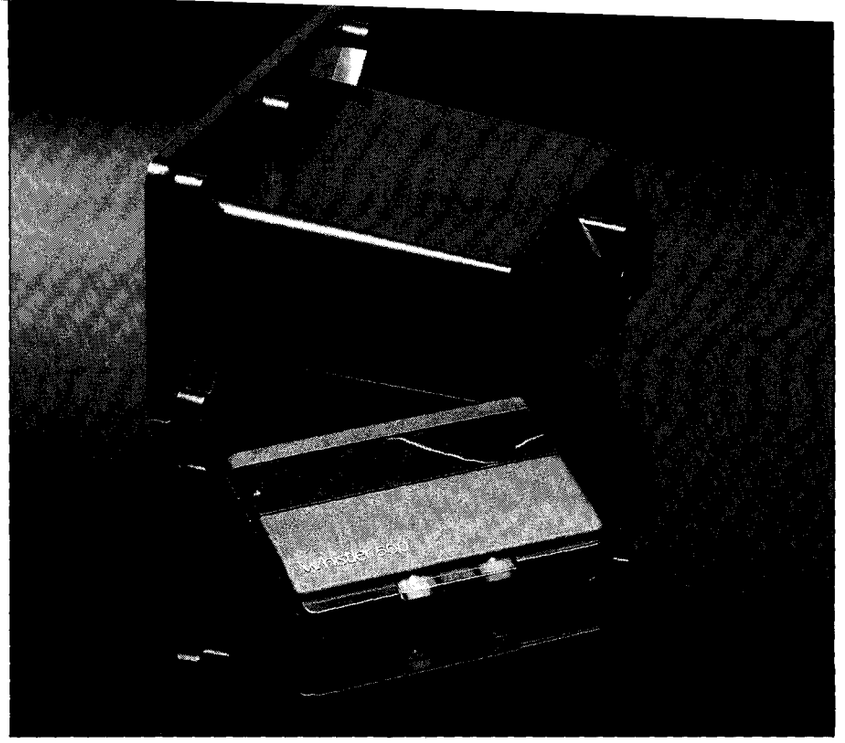
the dashtop. While convenient, it's not ideal for maximum sensitivity because the window provides some attenuation and the proximity of the roof/window joint provides some scattering of the signal, reducing signal strength under some circumstances. Nevertheless, single-piece detectors can be quite effective and they are at least placed at a high point on the vehicle which improves their forward view.

Other detectors are two-piece or three-piece, having one or two antenna/receiver units remotely mounted from the alarm unit. This allows positioning the antenna/receiver at the front of the vehicle, within the front grille (in the case of a two-piece unit) or, with two front-ends, one up-front and one at the rear of the vehicle (you can get shot from behind, too, you know!). Some single-piece units available are front and rear looking, note. All the detectors available are powered from the vehicle's 12 Vdc battery supply.

By way of illustration, let us have a look at a few models available on the market.

The basic detector in the Cobra range is the model RD3100. It is a dual-band (X and K) detector with loudspeaker and LED alarm, and a false-alarm indicator. The audible alarm has a volume control. It comes with dashtop and visor mounting hardware and Dick Smith lists it at $299.

Creative Electronics distributes the Whistler brand radar detectors. There are five distinct models in the range – the W200, W400, W500, Q2000 and Q4000. The latter three are available in several alternatives to suit different specific applications or states, yielding 11 models in the range. Whistler's basic detector is the model 200. It is a dual-band unit made to mount on the passenger sun visor. Creative Electronics says it will not pick up the old box radar units in use in South Australia and Queensland and adds that it has approximately half the performance of the W500, Q2000 and Q4000. The 200 is recommended for cars, not for trucks.

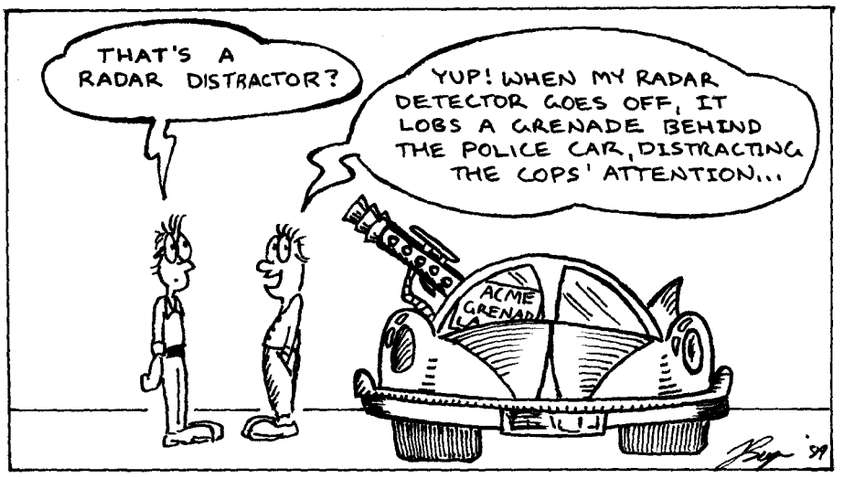


The Whistler 500 is a two-pieced remote radar detector.

The Whistler Q4000 is the top-line model, of which four different units are available. The basic 4000 is an X-K unit reputed to exceed the performance of many similar competing units. It is front and rear looking and provides both audible and visual alarms. When a signal is encountered, the audible and visual alarms report with a Geiger counter-like warning, increasing in rate in proportion to the increasing signal strength (i.e: as you get closer to the radar).

The Whistler 4000LR is recommended for truck drivers and professional drivers, incorporating improvements to detect the instant on and slant radars, amongst other things. It is suited for use in all states except S.A. and Qld.

The 4000 is also available in a K-band only version (4000K), recommended for Victoria and NSW as the use of X-band radars is diminishing. A tri-band version



Radar jammers

Let me say at the outset, radar jammers are illegal. But that doesn't mean to say that you can't buy them!

There are several types around which use different techniques to confuse the radar.

One type employs an oscillator which transmits a signal using a frequency modulated oscillator. The modulating signal is noise and thus the oscillator jumps around the band more or less at random, providing the radar receiver with a strong, confusing signal. The radar's counting circuitry gives up on such signals as it is unable to take a valid reading.

This is the 'brute force and bloody ignorance' (BFBI) technique. Then there are intelligent jammers. These receive the signal sent out by the police radar and transmit a strong signal in response, this signal corresponding to a vehicle travelling at a speed within the speed limit. Such a signal is likely to be much stronger than any vehicle Doppler returns. Such devices are known as transponders.

(4000T) is also available. The basic 4000 retails for $549, the others for $579.

Super Snooper Australia, a subsidiary of Sydney-based Autoworld International Marketing, distributes six models. There are two dash-mount models (D4000 and D6000), a two-piece and three-piece remote model (C5001), and the Coyote – a new dash mount model.

Snooper's top-line model is the C5001. It employs a triple superhet receiver, dual-band (X and K) front end, volume control on the loudspeaker alarm, Geiger counter type alarm indication, front and rear detection and a city/highway switch. It retails for $549. The D4000 dash mount model was recently reduced from $459 to $419 and the Coyote is the new budget model, priced at $369.

Most auto accessory outlets carry radar detectors, as do many specialist electronics retailers. Of the latter, the Dick Smith Electronics group of stores and the Tandy chain, both with outlets around Australia, carry various models, as does communications specialist Captain Communications, a Sydney-based retailer with outlets in Brisbane and Melbourne. ETI

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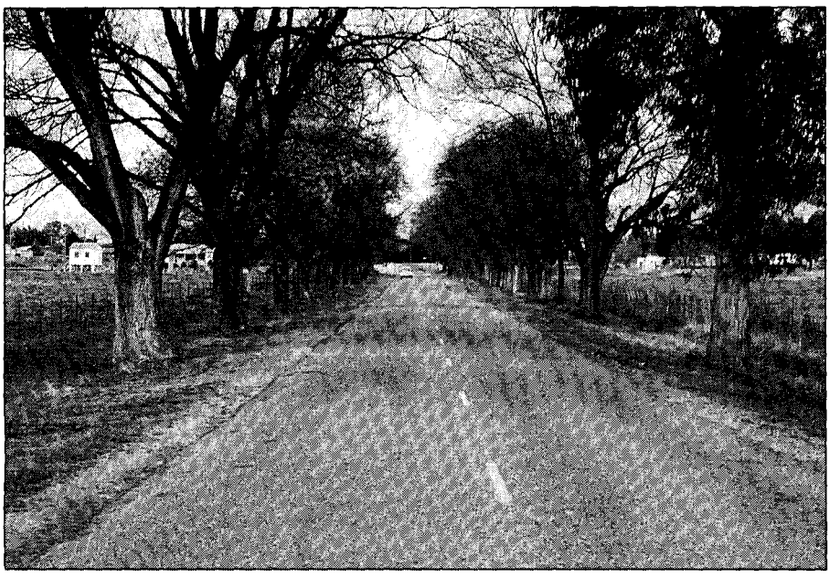
HOW TO BEAT RADAR? YOU CAN'T!

By Brian Woodward



A beaut spot for hidden radar traps. The road is entering town, there's a 60km/h sign coming up and plenty of roadside furniture to mask the radar trap.

Of all the reasons for speeding, pleasure, in my opinion, is the only one that should be defensible in a court of law. Provided people can prove to the court they were driving safely and can clearly display they have the skills to control a car, pleasure should mitigate as a reason for exceeding the speed limit.

Being late, angry or lacking concentration and missing the speed limit signs are all inexcusable – racing another driver even more so.

The speed limits on our roads are there for the simple reason that driver education is poor. If you compare the age related accidents of people driving cars and flying planes a staggering discovery is made. In a car, the rate of accidents is quite low for a very short period of time when the driver is still inexperienced and has caution based on nervousness. Then self-confidence grows exponentially. Unfortunately, the formal gathering of skills stopped the day that person received their licence, so self-confidence quickly becomes over-confidence.

Joy of life

The natural joy of life and the daredevil tactics necessary in a group pressurised by peers causes many young drivers (significantly, male, young drivers) to take risks they cannot correct – risks based on speed, distance and space judgement, drink and drugs.

For Australians aged between 15 and 24 there are three times as many deaths from road crashes as from the next largest cause of death, suicide. In 1986, 1040 Australians in this age group died on the roads. In the seven years following 1980, 25,180 Australians died on the roads.

Those who survive have progressively fewer accidents until hitting the lowest level around mid-life. It then starts to rise again as an absence of formal training and failing reflexes contribute towards older-age related accidents. Even so, road crashes are the single largest killer of Australians aged under 45, killing 1300 more than heart disease and 500 more than cancer. In 1986, 2150 Australians under the age of 45 died from road crashes.

In an aircraft, however, younger pilots are generally the safest. Why? Simply because a driver's licence is a right, a pilot's licence is a privilege. And, also, because training to become a pilot includes extensive attention to the social responsibility of the task. Drink, drugs and foolhardy behaviour are all covered far more seriously and effectively.

No votes

There are no votes in driver training. It takes a strong government to acknowledge the unbelievable social and financial cost of the road carnage and do something about it – something that is unpalatable in the short term.

Japan is one of the few countries which did take tough action. Driver training became the major priority and Japan dramatically reduced its road death toll over the past 20 years.

Instead of fixing this problem, the Australian solution is to punish the wrongdoer, and radar is an increasingly used weapon in the police armoury.

As a matter of interest, Australia's death toll has fallen in real terms. In 1963, 2598 people died on our roads. In 1987, 2767 died, yet the population had increased 48 percent and the vehicle population had risen by a staggering 185 percent over this period. The improvement is due to far superior vehicle dynamics (Australia is one of the few countries where all new cars are fitted with radial ply tryes), vastly improved vehicle passive safety legislation and improved roads.

No significant changes to driver training have taken place. Tougher police action has also, probably, contributed to the reduction.

The harsh reality is that we all speed from

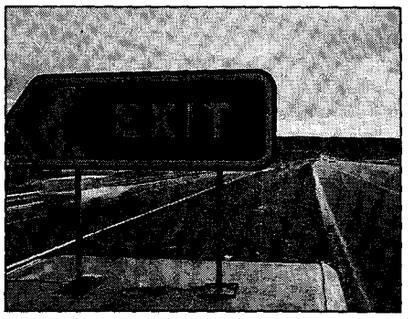
time to time. There can hardly be a person who has not cruised in a 60km/h zone at 75-80km/h surrounded by cars all travelling at that speed. 110km/h freeways usually have a right lane filled with cars travelling 125km/h. And the 80km/h urban freeways in Sydney, in particular, seem to consist entirely of cars travelling at 110km/h.

Lesson One

Lesson One is beating the radar. First, consider the philosophy of the police in using radar to trap motorists. If it is placed where speeding is dangerous, few speeders will be found. The vast majority of drivers will have slowed if road conditions are not safe. Also, where radar is most likely to be needed, the road conditions are so bad that the radar trap itself would just be one more hazard.

So, radar traps are invariably placed where exceeding the speed limit by 20 or even 100km/h represents less increase in risk than on a dangerous stretch of road. This has the desired effect. Plenty of revenue is generated to pay for the expensive equipment and (more importantly) the public relations effect is electric.

A person who is booked on a stretch of road that could be safely driven at 250km/h and given a ticket is likely to bitch and whinge to anyone who'll listen long enough. The result is raised public awareness of the use and effectiveness of radar traps and a subsequent heightened awareness by that driver.



Watch the speed limits on freeway exits. These are the most favoured locations. Slowing from 120km/h to 90km/h feels like you're standing still when, in fact, you're still likely to be travelling at $120 plus four points.

So, the basic rule here is that you'll most likely encounter police radar just as you've started along a stretch of road that looks like it could be fun. Think along these lines and you can't go too far wrong.

What to do

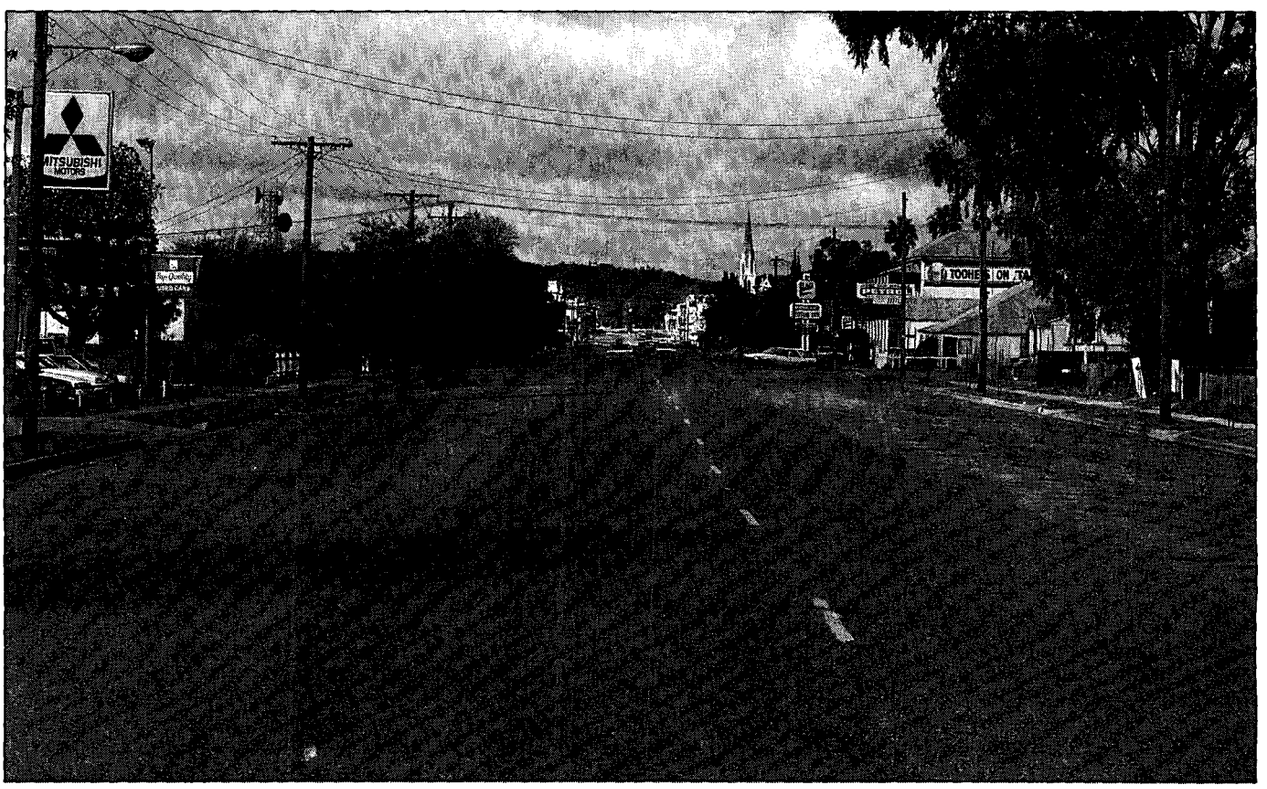
What do you do if you realise you've just been zapped or if you spot a radar trap? Brake. Make sure you check the rear mirror and then bring your car well within speed immediately. There is no law against reducing speed and it will make not a jot of difference to the radar gun if your car nose is down in braking or simply maintaining speed.

Don't ever sit close to other cars on a freeway in the hope they'll mask you if zapped. If you're close enough to be masked, you're too close to stop.

Two factors are vital. If you collect a ticket as a result of radar and you feel you've been wronged, contact your motoring organisation's legal department. Don't simply pay up and shut up. Radar is not without its failings. The police should show you the radar unit's readout with the speed at which you were clocked locked on the screen. If it isn't, complain and state that you intend to dispute the matter.

Secondly (and here's the higher moral ground) if you drive intelligently you should have no problems with radar traps. Take a defensive driving course to brush up your skills – and learn a lot you didn't know you don't have!

Ideally, the best way to beat the radar is to keep within the posted limits. That isn't always possible, so, if you do stray, do so with intelligence, caution and sincere moral justification. eti



A nice, wide, country town road posted at 60km/h and plenty of places for a radar trap to hide — behind the trees or amongst parked cars.

Instant-on radar:

How it works. How to defend yourself.

Instant-on radar – sometimes called "pulse" radar – has been around for years. But it's being used more frequently now as radar operators try to defeat detector users. Here's how it works.

First things first

Ordinary radar and instant-on radar use exactly the same type of radar beams. In fact, most radar guns can operate either way. It's just a matter of which buttons the operator pushes.

How ordinary radar works

In an ordinary radar trap, the radar gun is aimed at traffic and it continuously transmits a beam of radar waves. The effective range for the radar to "see" your speed is less than a kilometre for most cars, longer for trucks.

How radar detectors work

A radar detector is a radio receiver tuned to radar frequency. A high-performance radar detector is sensitive enough to pick up the radar waves before you drive within speed-measuring range. It's as simple as that.

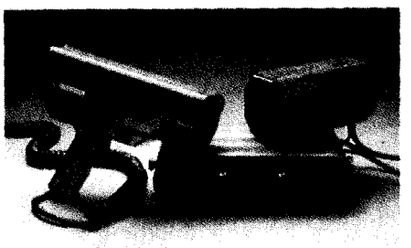
How instant-on radar works

The instant-on radar is set up just like an ordinary radar trap. The only difference is that the gun doesn't transmit until the operator pushes a button. So there is no radar signal for a radar detector to find.

Then when you're within speed measuring range, the operator triggers the beam. Hence the term "instant-on". The radar reads your speed within a fraction of a second, too quickly for a human to respond.

Your only hope

Because instant-on radar is faster than your reflexes, your only defense is to identify it before you are within its range. You must



The Kustom Signals HR-12 and KR-10, two of the many radar units that can be operated in an instant-on, or "pulse" mode.

detect it when the operator zaps the traffic ahead of you. For this, your detector must reach out for distant radar signals.

You're looking for a weak radar that lasts only a few seconds. Finding even one such "pulse" is cause for alert. Finding a series of them, each stronger than the previous one, indicates you're approaching an instant-on radar trap that's picking off traffic ahead.

Same old strategy

Identifying instant-on radar before you come in range is the only defense today, just as it was when we first introduced Escort. That's why our warning system, used on both Escort and Passport, tells you both the strength of the signal and the length of it. You need to know both to defend yourself.

Nothing but the truth

Our warning system indicates signal strength two ways: by a meter for a visual check, by a variable-rate beeper if you prefer to listen. The length of the signal is indicated by the duration of the alert. Knowing signal strength and signal length of every radar encounter is the only way to find instant-on radar before it finds you.

Escort and Passport are the most effective radar-warning instruments available. But don't take our word for it.

In 1987, *Car and Driver, Popular Mechanics* and *Roundel* each published independent tests of radar detectors. And each gave us the highest ratings. Call toll-free and we'll send reprints of the complete tests, not just excerpts or quotes.

We're as close as your phone

Passport and Escort are available exclusively through selected agents. If you are unable to purchase from our dealers due to your location you can order direct. If you're not entirely satisfied within 30 days, return your purchase. We'll refund your money and shipping charges.

To order call toll-free. Orders in by 3.00 pm Eastern Standard Time go out the same day by courier and we pay the shipping. Overnight and same day delivery can be arranged for a small fee.

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How Radar Works – ENGINEERS REPORT

The report explains in simple language the principles and limitations of traffic radar. It also outlines documented errors that can cause radar to give incorrect readings. Every motorist should know these facts. Call now and one of our staff will be happy to take your details and send you our free report.

**Australian Whistler not tested in the above mentioned tests.* *Radar receivers legal in all mainland States.*

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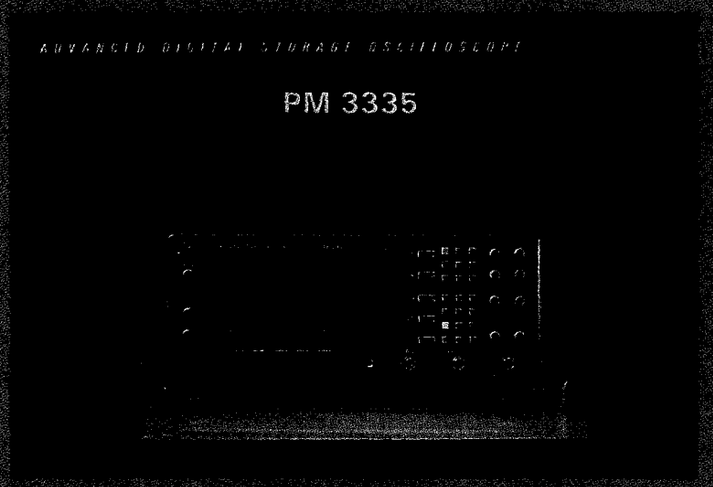


ND WIN TOGETHER

Industry News

Radio Frequency Systems Pty Ltd has appointed the Communication Division of Hills Industries Ltd as their Queensland agent. Hills will be handling the complete range of RFS products, and the Celwave range of products which complement the RFS equipment.

In addition, RFS has appointed Claude Lucas as Senior Salesman in NSW. A qualified engineer with many years' experience in the communications industry, he will be responsible for customer service throughout the state.

★ ★ ★

After over 20 years in the computer industry, Mr Robert Sterling, 39, has been appointed general manager of Wyse Technology's Australasia region. The area covers Australia and New Zealand.

Mr Sterling has had senior positions in sales and marketing management with companies like Datascape International, and Bell and Howell. Most recently, he was involved in launching the Computer Additions Division of Lionel Singer.

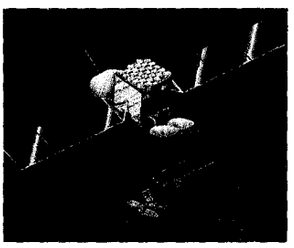
He was given the prestigious Marketer of the Year Award for 1988 from the Australian Computer Society.

★ ★ ★

NSD Australia has announced that it has added Rockwell Semiconductor Products, a Division of Rockwell International, to its current product line.

Coinciding with this is the appointment of Howard Hathaway as Product Manager for National Semiconductor and Rockwell Products by NSD Australia. Mr Hathaway was previously with Rockwell Semiconductor.

Space age link up for Jamboree-On-The-Air



Artist's representation of the three AUSSAT satellites, seen against the Milky Way. The last (top) will be launched this year. Inter-city links for the Jamboree-On-The-Air will be made via either of the first two which are in geostationary orbit over the equator to the north of Australia.

LATE in October every year, Scouts and Guides across Australia and around the world talk to each other via the airwaves, with the help of amateur radio operators who make their stations available for the event.

The purpose of the event is to further young people's knowledge of radio communications and each other and to foster national and international friendship by means of radio communications.

The Jamboree-On-The-Air (JOTA) has been running for 32 years, since the inaugural event in 1957. Radio amateurs have provided and operated the stations allowing Scouts and Guides to talk to each other in countries around the world by special dispensation of communications licensing authorities in all participating countries.

In 1987, a couple of radio amateurs employed by AUSSAT, Australia's government-owned satellite communications company, conceived the idea of providing a link for JOTA between Perth and Sydney via one of our geostationary satellites situated 36,000 km above the equator. This link used amateur radio equipment operating on the 144-148 MHz band at the AUSSAT ground stations (Major City Earth Stations) in Perth and Sydney, passing audio to and fro via spare speech channels on the satellite system.

It was a great success, and a first for the event. For the 1988 JOTA, the system was expanded to include Melbourne, Brisbane, Canberra and Darwin.

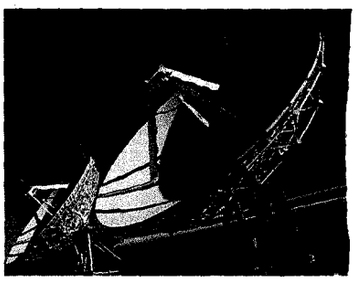
The system used simplex communications; that is, one station talks while the other listens, and then they swap. However, the AUSSAT system is set up for duplex, or two-way communications, just as in a telephone conversation, which meant that the AUSSAT system was being underutilised.

The 1989 JOTA AUSSAT link-up has been organised by Laurence Adney VK2ZLA, Senior Satellite Network Controller at the Sydney Major Earth Station, Michael Dower VK2ENG, Telemetry Tracking & Command Engineer, also at the Sydney Earth Station, and Neil Fallshaw VK2XNF, Principal Systems Analyst with AUSSAT in Sydney. Laurence Adney and Neill Fallshaw were involved in organising the earlier JOTA AUSSAT link-ups.

For this year's JOTA, on Saturday 21st and Sunday 22nd October, links into the AUSSAT system are being provided at Sydney, Perth, Brisbane and Melbourne in Australia, and Auckland in New Zealand – a first. AUSSAT's Auckland station is the latest in the system. Another first for the link-up this year, is full duplex operation between Perth and Sydney.

Radio transceivers will be placed at, or linked to, the AUSSAT Major City Earth Station in each capital to provide a terminal. Each terminal will use a pair of frequencies – one for transmit and a separate one for receive.

Sydney will have three terminals, or transceivers, Perth will have two and the others will



View of the dishes at the Perth AUSSAT Major City Earth Station.

The Sydney AUSSAT Major City Earth Station, located at Belrose, a northern suburb. Sydney will be central to the whole JOTA link-up around Australia and across the Tasman to New Zealand.

all have one transceiver each. Each terminal will be linked via the AUSSAT system to another terminal in another capital city. In Sydney and Perth, all the terminals will not be operated at the same time.

Two of the terminals in Sydney will operate on the VHF 144-148 MHz (two metre) band, and the remaining one will receive on the 70 centimetre (430 MHz) band and transmit on the two metre band. In Perth, one terminal will operate on two metres, the other, 70 cm and two metres.

The Icom IC3210A dual-band 70 cm/2 m transceiver. Two of these have been loaned by Icom to provide full duplex (simultaneous talk & listen) facilities at Perth and Sydney for this year's JOTA.

Split frequencies are used on two metres to allow repeater-type operation, with the transmit and receive frequencies 600 kHz apart. One of the Sydney terminals will use the Terrey Hills repeater, VK2RMB, receiving on 146.875 MHz and transmitting on 146.275 MHz. The Brisbane terminal will use the Mt Glorious repeater, VK4RQT, receiving on 147.300 MHz and transmitting on 147.900 MHz. Frequency details for the other terminals were not available at the time we went to press.

New soldering technology

A REVOLUTIONARY soldering tool technology which uses a unique heating method has been introduced to the Australian electronics industry.

The system uses high frequency current to heat the soldering iron tip. It exploits the skin effect in which high frequency currents flow near the surface of a conductor, causing heating of the conductor, and the Curie Effect, exhibited by magnetised metals which lose their magnetism above a well-defined temperature, regaining it again below that – known as the Curie Temperature.

The heater in these soldering irons is a laminate of two metallic layers. The outer one is a magnetically permeable material with high electrical resistance, the inner a non-magnetic material with low thermal and electrical resistance.

An HF current is supplied to the heater and this flows near the surface of the laminate owing to the skin effect. When the heater is below its operating temperature, most of the current flows in the outer, high permeability layer. As this has a high resistance, considerable heat is generated.

As the temperature increases, its permeability decreases due to the Curie Effect allowing most of the current to flow through the low resistance inner layer. This dramatically reduces the heater's resistance and reduces

the heat generated.

At the design temperature, heat generated and heat used by the tip are in balance and the temperature can be maintained within plus/minus two degrees (F – 1.11 degrees C).

When the temperature of the tip is reduced by thermal loading (loss of heat into the joint), heat generation immediately increases to maintain tip temperature. It is thus self-regulating, and for this reason has been dubbed Self-Regulating Skin Effect technology.

Invented and developed by US company Metcal, of Menlo Park in California, soldering irons using this technology have wide application in the electronics industry, particularly where high reliability and productivity are demanded.

Full details from CLC Agencies, 51 Armitree St, Kingsgrove, NSW 2208. ☎ (02) 750-5224.

ON FREQUENCY, WITH HY-Q INTERNATIONAL

This 20 year old Australian company has successfully spread its wings around the globe to become a world leader in the supply of quartz crystals, filters and oscillators. Roger Harrison reports.

Hy-Q International is the collective name for a group of companies dedicated to the manufacture of products for frequency management in electronics and communications equipment – quartz crystals, crystal filters and crystal oscillator modules.

Quartz crystals are widely used in electronics where stable oscillators of an accurately known frequency are required, and in frequency filters where well-defined bandwidths are required centred on standard frequencies, specific frequencies or covering a specified bandwidth.

Originally manufactured from natural quartz, these days the quartz used in crystal manufacture is cultured and grown in special autoclaves.

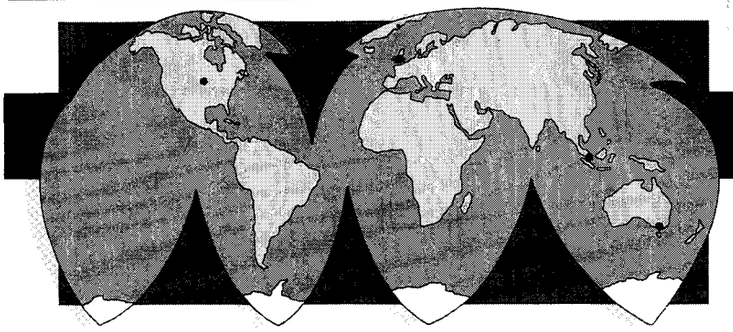
Quartz crystals, once exclusively used in the radio communications industry, now find wide application in other areas too – such as computing hardware, digital electronics and consumer electronics equipment.

Foundations

The parent company of Hy-Q International was formed in Australia in 1969 by a group of crystal engineers determined to build a company where excellence of product and reliability were the prime considerations. This has been, and remains, the cornerstone of the group policy and has resulted in growth from a single company with twenty-five employees in 1969 to its present level of four companies spread over four continents around the world employing a total of three hundred and fifty people.

Production facilities are located at Frankston, Australia, Singapore in Asia, Cambridge, England and Cincinnati, Ohio in the USA. Each location has its own marketing,

The main production facility for the group is located in Singapore enabling Hy-Q to offer large volume requirements of professional



The Hy-Q International Group is Australian-based with four companies spread over four continents around the world.

class crystals, filters, oscillators and temperature compensated crystal oscillators (TCXOs) at competitive prices.

In addition to the manufacturing unit, the Australian plant is the administrative headquarters of the group.

Products

Hy-Q International manufactures a considerable range of quartz crystals to satisfy applications requiring standard frequencies and tolerances, as well as manufacturing crystals to order. For example, the Hy-Q range of AT-cut crystals covers the frequency spectrum from 1 MHz to 200 MHz. They can supply these in a range of no less than 27 different holder styles, including plug-in and solder-in leads.

In filters, Hy-Q can supply a comprehensive range on the standard IFs of 10.7 MHz, 16.9 MHz, 21.4 MHz, 45 MHz, 70 MHz and 90 MHz that predominate in FM transceiver applications. In addition, they have filters for HF applications on 1.40 MHz, 1.60 MHz, plus 5.0 MHz and 9.0 MHz filters for SSB applications, along with special filters centred on 35.0 MHz and 45.0 MHz for AM/FM VHF applications. Filters can be supplied in up to 14 package styles for both chassis and printed circuit mounting.

The company's temperature compensated crystal oscillator (TCXO) modules, developed in recent years, have gained particular renown as they suit application in new generation synthesised radio telephones. They don't have the bulk or cost of a packaged oscillator and exhibit a performance that betters that available from a crystal compensated by a thermistor-capacitor network.

Development

Hy-Q's Australian plant is responsible for development of production engineering techniques and equipment with support from Singapore.

The design function for new products is located in Cambridge, England, which boasts a fully-equipped laboratory supported by groups in Australia and Singapore.

Hy-Q is investing heavily in equipment and engineering expertise to meet the escalating demand for high reliability and close-tolerance crystals which are required to meet the tighter frequency controls now necessary in radio communications equipment which has to operate in increasingly congested frequency bands.

The company has, in the past few years, invested considerable funds in the updating and improvement of production test equipment for both crystals and filters. Hy-Q says this investment will maintain them as a world leader in the supply of reliable crystals.

Hy-Q International (Australia) Pty Ltd is located at 1 Rosella St (PO Box 256), Frankston, Vic 3199. ☎ (03)783-9611.

Sealed lead acid batteries

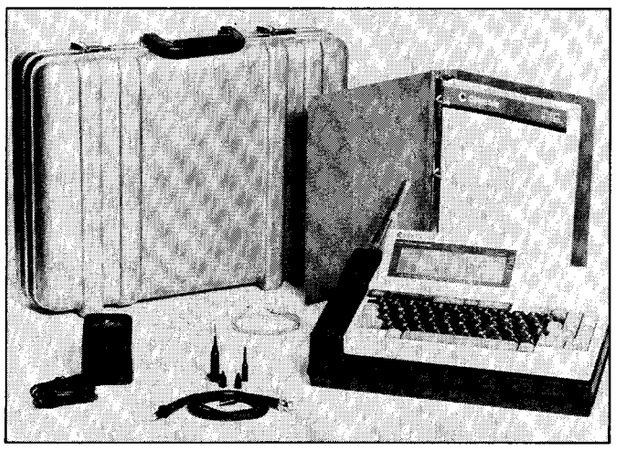
VELTEK Pty Ltd stocks a range of sealed lead acid batteries manufactured by Panasonic. Designated type LCR, they have voltages of either 6 or 12 volts, and capacities to 120 amp-hrs.

Manufactured with the highest power density of any battery in general use, these batteries can be charged and discharged in any position and have deep discharge recovery and charge acceptance, Veltek says.

The expected float life at room temperature of these LCR batteries is about eight years. The range includes the batteries most used in the fire protection and security industries.

Further information is available from Veltek Pty Ltd on ☎ (03) 808-7511, or in Sydney on ☎ (02) 599-1900.

READER INFO No. 274



Audio analyser ▲

THE IVIE PC-40 computer controlled audio analyser is said to be a complete acoustic analysis system capable of making a variety of measurements both quickly and accurately.

Supplied with an illustrated manual, ac adapter and carrying case, the IVIE features 20 non-volatile memories for storing or accumulating data. It also has parallel and serial outputs.

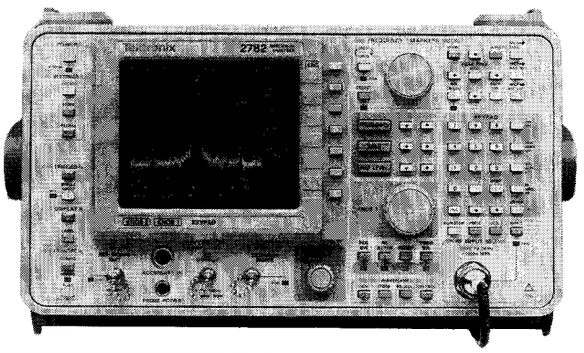
It is user programmable in BASIC and has a typewriter-style keyboard. Its LCD screen is adjustable and has a display range of up to 64 dB with resolutions of 1, 2 or 3 dB per step.

Able to display two or more curves at once, the screen has selectable octave, 1/3 octave and weighted 1/3 octave displays. The C-40 is capable of making a number of 1/3 octave measurements and storing them in memory.

Accessories include the IE-2P precision preamplifier and a choice of the 1133 free field response microphone or the 1132 random response microphone. Both are laboratory quality condenser mics.

Further details are available from Karl Seglins at Amber Technology, Cnr Skyline Place and Frenchs Forest Road, Frenchs Forest NSW 2086. ☎ (02) 975-1211.

READER INFO No. 275



New microwave spectrum analyser ▲

THE new 2782 Microwave Spectrum Analyser from Tektronix offers a range of features. It has a coaxial range of 100 Hz to 33 GHz with fundamental mixing to 28 GHz which reduces internal conversion losses and results in gains in sensitivity and improved stability over other methods.

It also has resolution bandwidths from 3 Hz to 10 MHz, simplifying frequency searches and monitoring. At the high end of 10 MHz resolution bandwidth increases speed on wide spans and enhances spectral purity for demodulating signals.

At the low end, 3 Hz, resolution bandwidth improves close-in spur, sideband and phase noise measurements.

The device also has 100 dB display dynamic range, and substantial improvements in phase noise and sensitivity performance over other spectrum analysers.

Instrument and measurement setup is done through a combination of dedicated function keys, on-screen menus and assignable function knobs. Often-used functions are assigned to front-panel keys, with those less-used or optional functions available through the menu system.

All menu layers appear at once on the screen in an overlaid format that makes menu position obvious.

The 2782 fully supports ATE needs with total programmability of every function and control. Further supported by two GPIB interfaces, the 2782 can be controlled by the ATE host as well as a secondary controller for other instruments.

For further information contact Tektronix Australia Pty Ltd, 80 Waterloo Road, North Ryde NSW 2113. ☎ (02) 888-7066.

READER INFO No. 276

Our mistake

In our Test & Measurement feature, Part 2 in the September issue, we spoke of the Huntron Tracker power-off test instrument on page 35. However, we incorrectly attributed ECQ Electronics of Queensland as being the distributor, when in fact it is Nilsen Instruments of Melbourne. ECQ do sell the Huntron, which they obtain through Nilsen who have the exclusive agency in Australia. ECQ were the previous distributors.

PCB relays

POTTER and Brumfield (USA) has expanded its RK relay product range to include ac coil pc board (PCB) relays. The series now provides a unique combination of features on ac coil, PCB terminals and VDE spacings.

Relays with dc coils from 5 to 110 V, and ac coils from 6 V to 250 V, can be obtained in both unsealed plastic dust cover or immersion cleanable plastic sealed case versions.

The relays are said to be ideal for general purpose electronics controls or systems, energy control circuits, machine tool controls, appliances, door opener and security applications.

Further enquiries should be directed to Tecnico Electronics, 11 Waltham Street, Artarmon NSW 2064. Telephone: ☎ (02) 439-2200.

READER INFO No. 277

Pocket monitor

THE Pocket T1 Monitor from International Data Sciences Inc of the USA is a hand-held unit that can be used as a high impedance in-service T1 link performance monitor.

It may also be used as a terminated out-of-service DS1 transmitter performance monitor.

In the first function, an active link can be monitored for various errors and alarms without removing the link from service. This enables the user to determine network degradation and isolate its source before a major failure occurs.

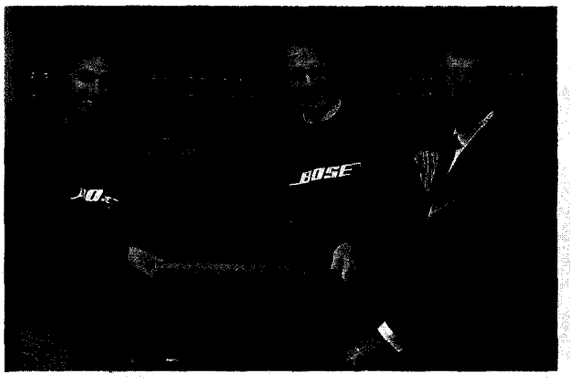
In the terminated mode, the Pocket T1 Monitor acts as a terminated receiver for error detection, alarm transmission verification, or framing type determination of a DS1 transmitter.

Other uses for the product include examining the T1 link for bipolar variations, framing errors, CRC-6 Errors, RED alarm, YELLOW alarm. BLUE alarm, or loss of carrier.

It is available in a battery-operated pocket-sized unit and also as a rack-mount unit for permanent installation.

More information is available from the Dindima Group Pty Ltd, PO Box 106, Vermont Vic 3133. ☎ (03) 873-4455.

READER INFO No. 278



BOB WINS BEST FROM BOSE

BOB Brunner is pictured here accepting the Bose 901 System offered to subscribers in May, June and July issues. With him are Des Williamson (left), Bose's Victorian Manager, and Federal Publishing's Victorian Manager, Bob Barrett (right).

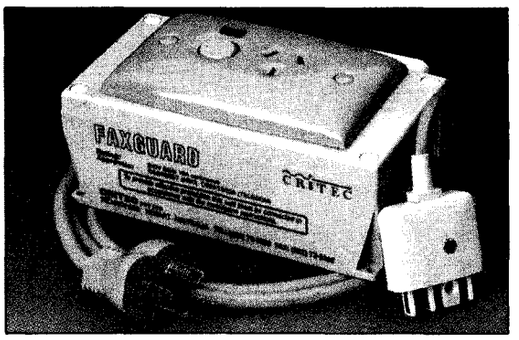
Faxguard

THE Critec Faxguard is a lightning and power surge protection device for fax machines which can be installed by users. The first such device to combine protection for power and telephone circuitry in a single unit, it has in-house lightning impulse generators.

Powerline filtering is combined with transient suppression to bring transients inside the fax's safety zone.

This is also the case with the telephone line protector which can take up to a 6000 volt/3000 amp surge and reduce it to under 80 volts on a 50 volt-working circuit, preventing any damage to equipment.

The telephone line protector is apparently able to limit lightning overvoltage to less than 80 volts without affecting ring current or dial impulses which can exceed 180 volts in normal operation.



For more information on this product, contact Critec Pty Ltd, GPO Box 536F Tas 7001. Telephone: ☎ (002) 73-0066.

READER INFO No. 279

One switch module, eight functions

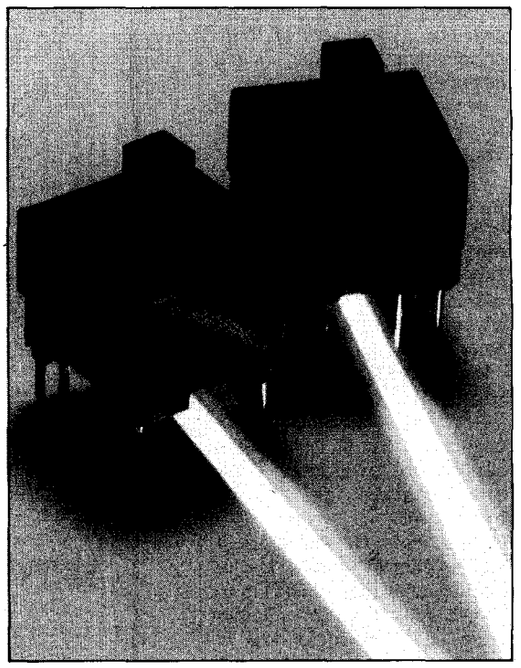
THE multiple contact arrangement in the Danish Unimec 1500-series switches allows them to perform any one of eight different switching functions – yet the switches are still small enough to fit into standard 15mm keyboard matrixes.

By incorporating two normally-open contacts and two normally-closed contacts, the switches allow switching function to be determined exclusively by the PCB layout.

Available with alternate or momentary actions, the 1500-series switches also feature self-cleaning contacts which ensure low contact resistance.

Rugged construction provides lifetimes in excess of 1.5 million cycles for the momentary action version. Contacts in the standard switch are silver plated, but a version with gold plated contacts is available for dry-circuit switching. Unimec 1500-series switches are not limited to low-level switching – they have a load rating of 6W dc or 9W ac – and can switch currents as high as 250mA and voltages up to 120V.

Fitted with standard or customised keycaps, 1500-series switches feature 1.8mm of keytravel and an actuating force of 2N. They can also be fitted with lever-toggle actuators and MEC's standard range of switch bezels which can incorporate optional LEDs.



For more information contact: MEC A/S, PO Box 26, DK-2570 Ballerup, Denmark.

READER INFO No. 280

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• 80 x 3 1/2" - Lockable
C16038.....$16.95

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C16042.....$9.95

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• 120 x 5 1/4 "- Lockable
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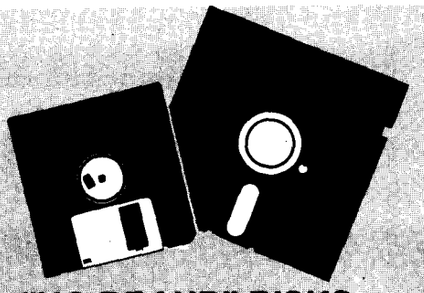
The above postage rates are for basic postage only. Road Freight, bulky and fragile items will be charged at different rates.

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

VISA MasterCard



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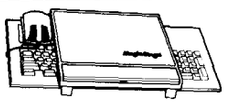

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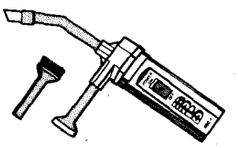
A working bench for your Mouse.
•High quality ABS plastic and anti-static rubberised top
•Stationary holder
•Includes pull-out shelf for Mouse
•Dimensions: 280 x 260 x 25mm
• Fits over keyboard
C21080.....$24.95



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Use it to clean:
• Computer keyboards
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• Attaches to the top of your monitor
• Put your copy right where you need it spring clip to hold paper
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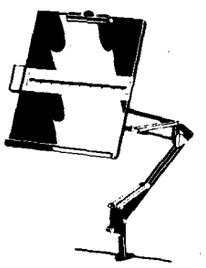
C21065.....$14.95



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• Adjustable arms allows easy positioning
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• Flat metal base
C21060.....$39.95

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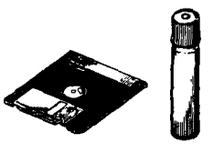

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It only takes a minute amount of dust, dirt or magnetic oxide particles on your drive heads to cause problems: errors, downtime or an expensive service call. Regular use of a head cleaner will keep your drive free of trouble causing dirt and help kleep your system up and running. these disk cleaners are simple to use, and include cleaning solution and instructions.
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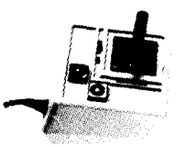
C12560.....$6.95
• 5 1/4"
C12555.....$6.95

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

APPLE* IIE & IIC SERIES COMPATIBLE JOYSTICK

These joysticks have adaptor connectors to suit the Apple II, IIc, IIe and II+ computers. Features include selectable "spring centring" or "free floating". Electrical trim adjustments on both axis, 360° cursor control and dual fire buttons.
C14201.....$49.95

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QUICK MOUSE
MICROSOFT* COMPATIBLE

• Auto-selection and auto-transfer between mouse system PC mouse mode and Microsoft serial mouse mode
• Microsoft Serial Mouse and Mouse System compatible
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• Optical rotary encoder
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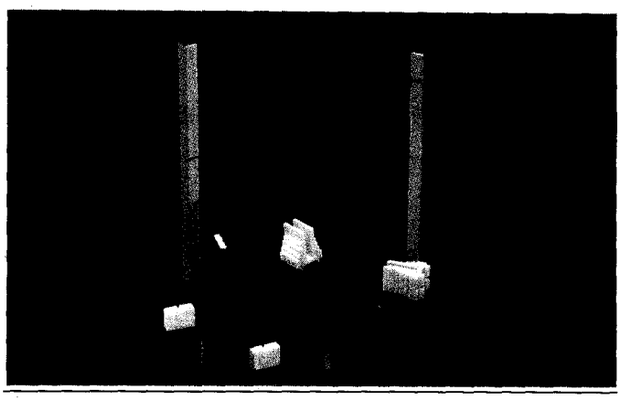


Ferrite phase shifter ▲

FOR phase shifter component applications, such as phased array antennas, the design engineer's choice is generally between ferrite or active device elements to achieve the desired phasar action. In many cases ferrite is preferred.

Trans-Tech's ferrite materials are claimed to provide excellent performance, consistency, quality and cost-effective price. Being able to shape materials through powder compaction, isostatic pressing, tape casting and extrusion, together with diamond machining capability, assures precise internal and external geometries.

For further information contact Benmar International, GPO Box 4048, Sydney NSW 2001. ☎ (02) 233 7566.

READER INFO No. 281

Rack mounting LCR bridge

PRISM Electronics has added the 6459 rack mounting LCR bridge to their range of benchtop instruments. Oriented to OEM and systems applications, it occupies a two-unit high slot in a 19" rack and is available with front or rear panel test connections.

The device offers 0.1% measurement accuracy of L, C, D and Q at test frequencies of 100 Hz, 1 kHz and 10 kHz. Primarily intended for remote operation the instrument has full talk/listen facilities via both IEEE-488 and RS-232 interfaces.

Other features include four terminal measurements, 2 V dc bias for electrolytic capacitors and a Zero C facility to offset stray capacitance in external test fixtures.

Component test leads with Kelvin clips or SMD tweezer style probes and menu driven software for the logging and analysis of the results on a PC are among the accessories available.

For further details contact Parameters Pty Ltd, Centrecourt, 25-27 Paul Street North, North Ryde NSW 2113. ☎ (02) 888-8777.

READER INFO No. 282

New VHF & UHF handhelds

BOTH the new IC-2SA VHF and IC4SA UHF handhelds from Icom offer 48 memories, and can operate from their own NiCads or from a 12 volt external dc source.

Other features include Set and Private modes to tailor-make critical settings; Priority Watch for monitoring a certain frequency while the operator is elsewhere, and a number of scanning functions.

There is also a built-in programmable clock with timer functions; auto power-off and battery saver functions; dial selection for quick QSYing and a programmable offset for odd-bod repeaters.

The IC-2SA covers the full 2m amateur band (144-148 MHz) while the IC-4SA covers the 430-440 MHz sector of the 70 cm amateur band. Both feature an aluminium diecast and moistureproof design and a flexible antenna.

More information is available from Duncan Baxter at Icom, on ☎ (03) 529-7582

READER INFO No. 283

New tester for CSMA/CD networks

A portable tester for various functions in CSMA/CD networks has been developed by Siemens. The device can be used for all LANs to IEEE 802.3 consisting of coaxial or optical segments, or mixtures of the two, provided they are interconnected through repeaters.

As well as the network functions and data traffic, it can also test the physical topology of the network. It is used for transport layers 1 and 2a according to the ISO 7-layer mode.

Consisting of a transmitter and receiver for data packets and a receiver for collisions and heartbeat, the unit can test for breaks, missing terminating resistors or transceiver taps which have not been properly installed.

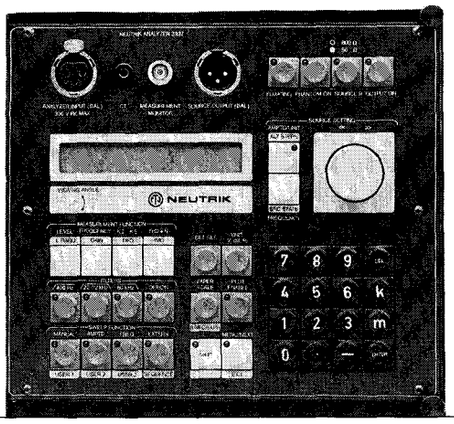
The CSMA/CD procedure to IEEE 802.3 enables the unit to test the whole LAN beyond the boundaries of the segments, transceivers, repeaters and transceiver cables.

Two of the units together can test the electronics of a transceiver, its transmission receiving, heartbeat and collision functions.

Externally generated signals can be fed in through a dedicated BNC connection, and an oscilloscope can be connected to evaluate network events on-line, such as bit error rate and jitter.

More information is available through John Green, Communications Network Department, 544 Church Street, Richmond Vic 3121. Telephone: ☎ (03) 420-7640.

READER INFO No. 284



All in one analyser

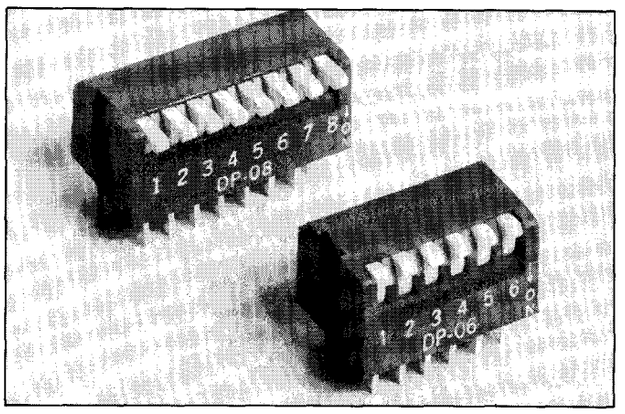
THE Neutrik Analyser 3337 offers fast and accurate measurement, displaying analyser and oscillator data on a liquid crystal display.

Featuring great sweep and test sequence potential, it stores complete setups in non-volatile memory with immediate pushbutton control. Functions include autocalibration, auto-ranging, auto-tuning and auto-nulling.

The product can be linked to the Neutrik Mainframe 3302 to generate hard copy records of pre-programmed swept measurements like frequency response of level, distortion vs frequency, vs time, vs amplitude, and so on.

More information is available from Karl Seglins at Amber Technology, ☎ (02) 975-1211.

READER INFO No. 285



DIP switch series

THE DP/DPL Series (Piano DIP) manufactured by Diptronics Manufacturing Inc has a mechanical life of 5000 operations a minute per switch and an electrical life of 2000 operations a minute per switch.

With an operational force of 400g +/– 200g and a non-switching rating of 100 mA, 50 Vdc, they have an SPST circuit with switching of 50 mA, 24 Vdc.

The series has a normal open contact system with low contact resistance, no contact failure and is self-clean on the contact area.

Further information may be obtained from Adilam Electronics Pty Ltd, Suite 7, 145 Parker Street, Templestowe Vic 3106. ☎ (03) 846-2511.

READER INFO No. 286

PLD programmer

Designed to program devices like PALs, IFLs, GALs and EPLDs, the SE4971 Programmer can program data which has been downloaded in JEDEC format for logic circuits designed on PCs or AT workstations.

Data can be loaded from PLD design tools like ABEL, CUPL, PALASM and AMAZE. This is achieved through translation formats which are provided, including JEDEC. A total of ten are provided as standard.

Packages such as SOPs and PLCCs are accommodated by socket adapters. This ensures the SE4971 will be able to cope with the arrival of new devices and avoid obsolescence.

The device also provides programming algorithms, and has an in-built editing capability which simplifies fuse data and vector data modification.

The SE4971 can be externally controlled by a serial interface (RS-232C) or a parallel interface (Centronics). This provides remote control and printer output.

Available from Alfatron, Unit 5, 14 Jersey Rd, Bayswater Vic 3153. Telephone ☎ (03)720-5411.

READER INFO No. 287

Vicom gets the Bird

VICOM Australia Pty Limited has been appointed as an Australia wide distributor for the USA-based Bird Electronics Corp.

Bird is a pioneer in the engineering and manufacturing of a broad spectrum of RF coaxial test instruments and custom design components. The company's instruments have become the industry standard language with such names as The Bird (Model 43 wattmeter), Thruline (directional wattmeters), Termaline (loads and absorption wattmeters), Tenuline (coaxial attenuators). One of the main products is the model 43 wattmeter. This has a frequency range of 0.45-2300MHz, and a power range of 100mW-10kW using Bird plug in elements. The model 43 is housed in a rugged diecast aluminium case and the meter is shock mounted.

Trade enquiries for Bird equipment can be made to Vicom's branch offices throughout Australia.

READER INFO No. 289

Programmable precision voltage source

THE DCS 5900 from Prism Electronics is a programmable, multi-channel voltage source with up to six fully programmable channels.

Each channel can be programmed from the front panel or via the IEEE-488 interface over the range −25 V to +25 V with 1 mV resolution. It maintains output accuracy of +/− 1 mV for load currents up to 5 mA and temperature variations of +/− 2 degrees C.

The device comes housed in a 3U high 19" rack mounting case. Every channel is scanned once a second by an internal DVM, and the IEEE-488 bus can read the output voltages.

Further information is available through Parameters Pty Ltd, Centrecourt, 25-27 Paul Street North, North Ryde NSW 2113. ☎ (02) 888-8777.

READER INFO No. 290

Clip-on heatsinks

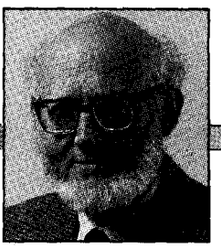
A new range of clip-on heatsinks from Redpoint, known as the F750 range, is said to offer high performance while remaining light and small to suit TO220 packages.

The PF750 version has integral tags and solderable finish. This allows for flow-soldering them to PCBs. The PF751 is black anodised with integral tags which can be used for mechanical attachment. Without tags, the PF752 is attached using the integral spring clip only.

The F751 and PF752 have thermal resistance ratings of 20° C/W and 23° C/W respectively. The PF750 solderable version has thermal resistance at 20° C/W.

More information is available from Clarke and Severn Electronics, ☎ (02) 437-4199.

READER INFO No. 291



JOHN COULTER

THE PROOF OF THE PUDDING

The current inquiry by a Senate Select Committee into agricultural and veterinary chemicals arose out of the 1987 problems experienced in Australian beef exports; moreover, Australians, as well as foreign consumers of Australian food, should expect and receive high quality food with the lowest possible level of chemical and radioactive contamination. By Senator John Coulter.

In general, Australia has a reputation as a source of low chemical residue food. Our food exports received quite a fillip following caesium 137 contamination of a large part of Europe from the Chernobyl nuclear fire. This clean reputation is something that should be jealously guarded.

But the inquiry into agricultural and veterinary chemicals has brought out, once more, the marked difference between scientific and legal "proof" and the political difficulty of interpreting the difference. This complexity has also been illustrated by the recent suggestion that the Federal Government may compensate those Australian servicemen involved in nuclear tests at Monte Bello and Maralinga who have developed either leukaemia or multiple myeloma.

The Royal Commission, under Mr Justice McClelland, has already reported on this matter and that report is one of the few which properly understands and explains the scientific evidence and interpretation. There is general acceptance that the first step in the transformation of the normal cell into a malignant cell involves a mutation in a single cell. A mutation is a permanent, heritable change to the DNA so that the mutant cell and all its progeny will continue to carry this change; a number of malignant or oncogenes have now been identified.

The first step is damage to one of the DNA strands. This might be brought about by a chemical or by radiation. The chance that this damage will occur is a function of the intensity of exposure. This is one reason why it is generally accepted that there is a linear relationship between exposure and likelihood of genetic damage and that there is no threshold dose below which there will be no effect. But the damage is not the mutation. Every cell contains two complementary strands of DNA and every cell contains a very effective DNA repair mechanism. The damaged strand is faithfully repaired by copying from the undamaged strand in the overwhelming majority of cases. Occasionally a mistake is made, the DNA is repaired but the wrong sequence results. This wrong sequence is the mutation and it is passed on to all daughter cells.

There is nothing unique about the DNA in any particular cell in our bodies; each cell carries the same sequence. It follows that radiation or a chemical will not exclusively target particular cells or organs. Some cells will exhibit a higher incidence of mutation and cancer because they are exposed to a higher concentration for physiological reasons. For example, radioactive iodine will be taken up by the thyroid gland more than in other tissues. Intake of radioactive iodine 131 will therefore cause more thyroid cancers than cancers elsewhere but it will not exclusively cause thyroid cancers. Similarly, smokers show a higher incidence of lung cancer because the lung is exposed to a higher concentration of the cancer causing agents in tobacco smoke. But these agents are excreted in the urine causing an increase in bladder cancer and lesser amounts of cancer occur elsewhere in the body.

Turning to Maralinga, it is possible to predict the number of extra cancers that could appear in that population given certain levels of radiation exposure. It turns out that even if the whole population which served at Maralinga was exposed up to the allowable limit, the number of cancers over and above those that would have occurred spontaneously, while not inconsiderable, would be lost within the natural variation of this background cancer.

> ***'Radiation or a chemical will not exclusively target particular cells or organs'***

Given that small cancer increases cannot be statistically proved, or just as importantly, disproved, how should governments respond to claims for damage? The usual legal mechanisms provide no help. It is absolutely impossible for an individual claimant to establish that his particular cancer was caused by radiation exposure. If the theoretical application of known dose/response relationships indicates that there is a 5% chance that his cancer was caused by radiation, a court would correctly find that "on the balance of probability this cancer was not caused by radiation".

Such a finding clearly disadvantages the 5% whose cancers were indeed so caused. But it would be ridiculous to compensate every Maralinga serviceman who develops cancer if 95% of them would have appeared without that exposure. The third possibility is equally nonsensical – compensate every case to the extent of 5%. The Government's present proposal to compensate cases of leukaemia and multiple myeloma is completely arbitrary. The former tends to be one of the earlier cancers to appear; but a sequence of different cancers has been observed in the Hiroshima and Nagasaki survivors and young girls who painted the luminous dials of watches with radium in the 1920s continue to show an increased incidence of bone cancer throughout their lives.

Politicians must ensure that exposure to carcinogenic agents is prevented or kept as low as possible. In the latter event those exposed need to be informed about the level of risk involved and their exposure must be acceptable to them. The compensation problems can only be properly addressed if risk is accepted prospectively not retropectively. eti

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Senator John Coulter is the spokesman for the Australian Democrats on Science and Technology.

WIN A MARCONI PROBE

VALUED AT $2610

Win a Marconi 1GHz Active Probe. Precision performance over the widest dynamic range.
That's right! Enter this competition and you could be the proud owner of a Marconi 2388 1GHz Active Probe. Prize comes complete with power supply and is valued at $2610.

The Marconi 2388 active Probe features:
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ETI/Marconi Probe Competition
Federal Publishing Company
Freepost No. 4,
P.O. Box 227,
WATERLOO, NSW 2017

Marconi
Instruments

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PHONE: .....OCCUPATION:.....

What frequency range does the Marconi 2388 Active Probe have on all HF to UHF applications?.....
.....
.What make an model scope or spectrum analyser would you use the probe with if you won? .....
.....

CONDITIONS OF ENTRY

1. The competition is open only to Australian residents whose entries are received prior to last mail 31st January, 1990. Employees of the Federal Publishing Company and Marconi Instruments Limited and their families are not eligible to enter.
2. South Australian residents need not purchase a magazine to enter but may enter only once by submitting a hand-drawn facsimile of the entry coupon along with their name and address to: The Federal Publishing Company, P.O. Box 227, Waterloo, NSW 2017.
3. The prizes are not transferrable or exchangeable and may not be converted to cash.
4. The judges' decision is final and no correspondence will be entered into.
5. Description of the competition and instructions on how to enter form a part of the competitions conditions.
6. The competition commences on 26th October, 1989 and closes with the last mail January 31, 1990. The draw will take place in Sydney on 5th February, 1990 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian on 8th February, 1990 and a later issue of this magazine.
7. The prize is: One only Marconi 2388 Active Probe complete with power supply. Valued at $2610.

MARCONI INSTRUMENTS — A NEW AUSTRALIAN?

Marconi Instruments has much to celebrate this year, not least its incorporation in NSW as an Australian company. Kim Bucknole reports.

Marconi Instruments underwent naturalisation in April this year. In addition to its incorporation in NSW as an Australian company, Marconi Instruments P/L, 1989 saw its relocation to new premises in Lane Cove, NSW. As with many New Australians, there were strong Italian (and in this case English) antecedents.

The Mother Country

Marconi Instruments was founded more than 50 years ago as a joint venture between Marconi's Wireless Telegraph Company and E K Cole Ltd (remember EKCO brand radios and TVs?) The company's first products were signal generators and these have been the mainstay of the product line to this day.

At the end of the sixties, Marconi and its subsidiaries became wholly owned by G.E.C.

Marconi Intruments invests heavily in R & D – some 15% of T/O – resulting in numerous product releases.

In the UK, the company has 4 major operating divisions. These are:-

Instruments. Making packaged, bench top and portable instruments, especially in the RF, microwave and communications area.

Automation. ATE for commercial applications and a range of photo-plotters.

Test Systems. Customisation of instruments and ATE for military and large systems applications.

Simulation. Application of computer based solutions to real time training applications in both military and civil areas.

Marconi Instruments UK exports over 70% of its commercial products and has its own sales and marketing operations in France, Germany, Spain, USA and now, in Australia. There is also a technical support office in Hong Kong.

Recently, as reported in *ETI*, June 89, News Digest, Adret, the French synthesiser and signal generator manufacturer, was acquired and the company has undertaken a significant joint venture with Kikusui in Japan.

Australia

The Australian company does not mirror the UK company operations. Here, there are 3 main operating divisions – Instruments, ATE/CAE and Service.

ATE/CAE has expanded rapidly. With average system sales in the range $80,000 to $100,000, of necessity, the service division has had to change from a workshop repair facility to a maintenance contract operation.

AWA represented Marconi Instruments from the late 30s through to 1983 when GEC Australia took over, concentrating on the radio communications area.

Happy anniversaries!

I don't know whether modern-day directors, managers and staff of Marconi are given to celebrating anniversaries, but if they are, 1989 should be an endless round of commemorative events.

1899

1899 saw the formation of The Wireless Telegraph and Signal Company (which changed its name to Marconi's Wireless Telegraph Co. Ltd in 1900 and to The Marconi Company in 1963); the first wireless transmission from England to France, some 31 miles; the first ship-to-ship wireless communication involving 2 British battleships at 75 miles range; the acquisition of the famous Hall Street, Chelmsford premises; the first radio-equipped press boats which relayed the Americas Cup results to the New York newspapers (an event which is said to have led to the formation of the American Marconi Company, later to become RCA); the first sea rescue effected by wireless when S.S. R.F. Matthews collided with the Goodwin lightship.

1909

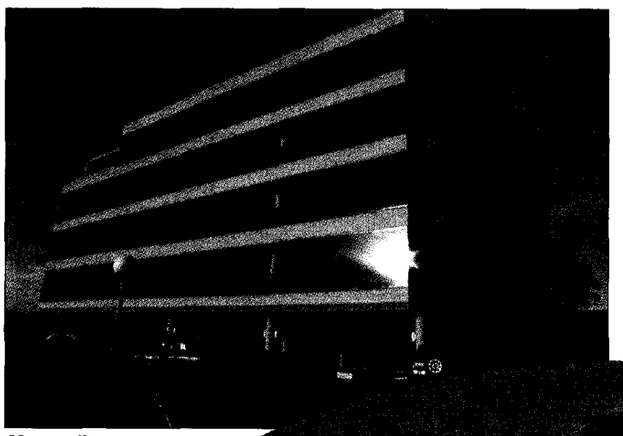
In 1909, Gugliermo Marconi was awarded the Nobel prize for Physics.

1919

In 1919, Marconi was Italy's Plenipotentiary delegate to the Paris Peace Conference, signing the Peace Treaties with Austria and Bulgaria. This year also saw the first east to west transatlantic transmission.

1929

In 1929 Marconi was created Marchese and nominated to the Italian Senate. That year saw the sale to RCA of the receiver manufacturing operation, the Marconiphone Company, which, via mergers, became EMI of which Marconi was later president. And I don't pretend this list is comprehensive!



Marconi's new Lane Cove, NSW headquarters.

Steve Turner, marketing anager, with the 24 Universal ion signal nalyser.

Founder, Guglielmo Marconi.

Products

Marconi's strengths have been in the radio communications business. For example, there are now over 300 2955 radio test sets in the field. Signal generators show similar penetration.

A number of products such as power meters, spectrum analysers and microwave counters now have defence stock numbers. And Marconi's base has been broadened into data communications and TV analysers. Marconi product is used by many notables including the Dept of Defence, Army, Navy and Air Force, Telecom, OTC, AWA, Philips, CSIRO, Ericsson and NEC.

Personnel

Instruments Division is headed by Rene Rysbergen, Automation by Kevin Walker and Service by Alan Stone. Marketing is handled by Steve Turner. Bill Glenn is the applications engineer for ATE. General manager is Daniel Restuccia. As with Marconi Instruments UK, the company relies on the engineering skills of its team and has sales engineers in Melbourne, Adelaide and Brisbane.

The new headquarters

Marconi Instruments Ltd UK managing director Dr C.S. Gaskell and Dr P. Bailey, director, International Business, were in Australia for the official opening of the new head office. Marconi Instruments may now be found at Level 4, 15 Orion Road, Lane Cove NSW 2066. ☎ 418 6044. eti

WHEN LIGHTNING STRIKES TWICE

TECHNOLOGY

This simple device will protect your telephone system, modem or facsimile machine not only from lightning strike, but also from internal damage from stray DC current.

Earlier this year, the people of Sydney moved out to their balconies to watch a spectacular lightning storm over the city. The storm moved on over the western suburbs, and everyone moved indoors and forgot about it. Well, most did until they got to work next day.

The following week, fax and computer retailers and their suppliers received a continuing stream of DNW (Does Not Work) calls from users of their faxes, modems and switchboards.

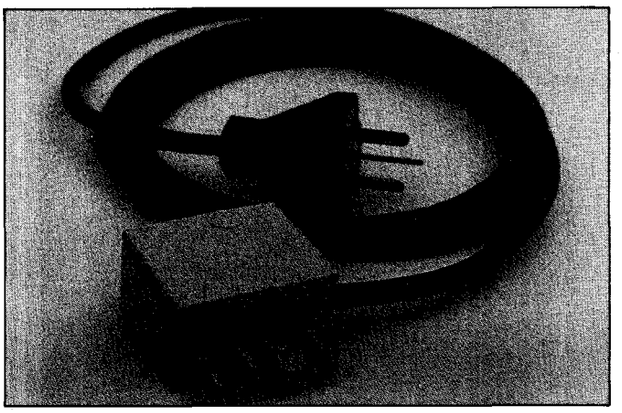
For some of the machines, a simple fuse replacement was sufficient, for others it was total unit replacement. What had happened? Many of the units were protected by some form of filter or power conditioner, so the damage had not come through the electricity mains. How had it happened?

The answer was high voltage strikes entering the telephone system and finding the nearest way to earth. This has been a perennial problem that has only made its way to the fore since the widespread installation of faxes. Until now it has been mostly seen as a problem for outlying areas of Queensland, Western Australia, and the lightning path on the western fringe of Melbourne.

But the rising incidence of mortality amongst facsimile machines has made those people who have suffered it first hand more aware of hazardous voltage problems across phone lines, and active seekers of a preventative device.

One quite simple device is now on the market with Telecom approval. The approval process took around two years, but the Telephone Safety Device (TSD for short) is now available.

Developed by Melbourne computer retailer Max Elliott (managing director of ABE Computers), the TSD sprung about three years ago from his company's development work in modems. "Modems that had tested 100% before leaving Melbourne were being returned from outlying areas with chips blown off," said Elliott. "One day I received three from around the same area in Queensland, all with the same fault. When I phoned the area I found that they had a lightning storm the night they all went down.



"I checked this out with some of the technical guys who were working on the modems and discovered some simple facts, and that the problem had been around for as long as there had been modems. The simple facts included things like the lack of any earthing on telephone lines, and that up to 50,000 volts could come in through a single phone line.

"It was then that we began work on the TSD, more to eliminate the problem on our clients' modems than anything else," said Elliott.

One of the first users of the TSD prototypes was Melbourne electrical contracting and engineering firm, R R Holland.

The company had streamlined its telex system by installing a PC-based telex eliminator which connected directly to the telex line. To protect the system from lightning strikes and spikes as well as other power glitches from the mains, the company installed a power conditioner between the electrical mains and the telex computer.

Consequently, the first time the PC telex system failed, a manufacturing fault was presumed and the machine returned to Sydney for repairs.

"The system operated properly for a couple of weeks, then we had a period when six telex cards blew in three months before we finally isolated the problem – stray voltage coming in via the phone line," said a company spokesman.

"Although the computer system was protected from spikes down the power lines, it was receiving power surges through the back door, jeopardising other equipment in the office via the phone lines.

"The last one must have been a massive spike as it physically blew chips off the board, and destroyed our newly installed fax machine.

"If any of the staff had been on the phone at the time they would have been injured too," the spokesman said.

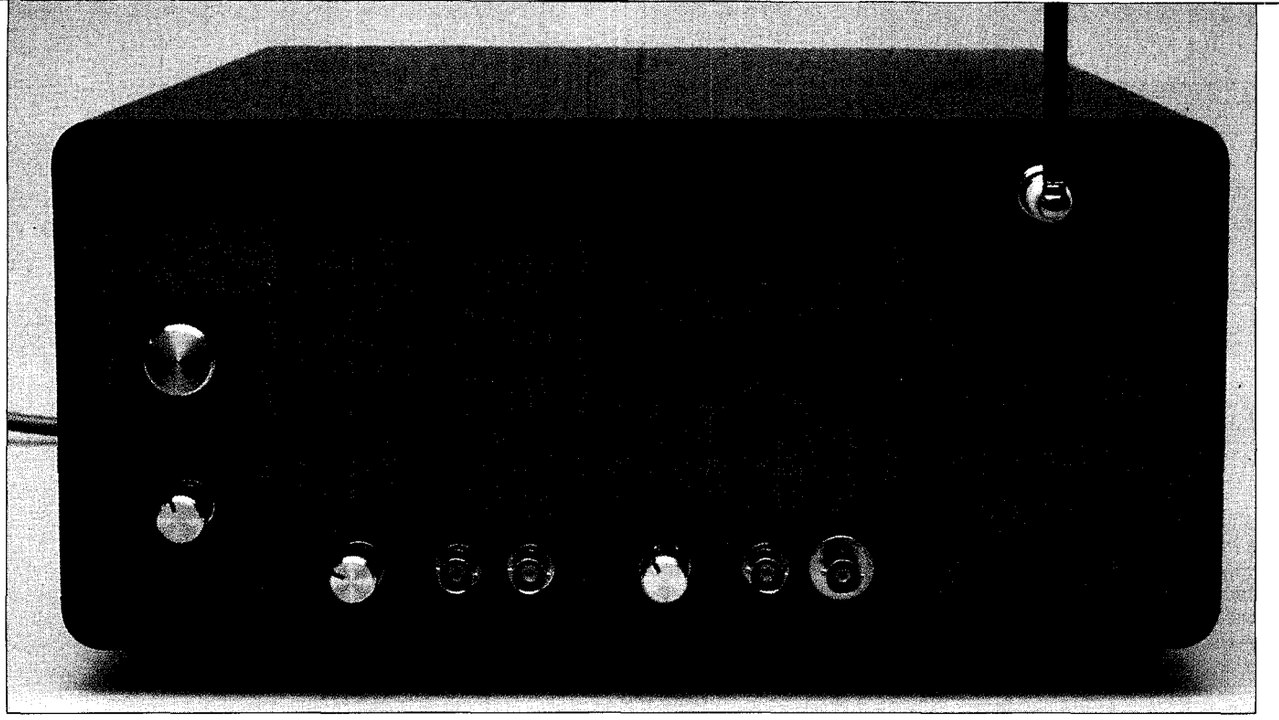
In September '87, the company installed one of the first Telephone Safety Devices from ABE Computers, and has not reported any major faults since then.

The TSD is a relatively simple Telecom-type plug which inserts directly into the wall plug. A phone, modem or facsimile machine plugs directly into it. A gas fuse automatically drains any excess voltage into an attached earth wire.

Max Elliott says he had an interesting case recently where a Telecom branch in NSW informed him that their fax line had been hit by a lightning strike which completely destroyed their three-month-old fax. "A $2500 machine was now worthless and they considered the $60 device as cheap insurance for the future," he said.

He said the Telephone Safety Device is not only for protection during lightning strikes but for everyday use.

"Lightning can produce more than 100,000 volts, but static electricity can build up to 20,000 or 30,000 volts – that's enough to blow most chips off the board. The static can build up naturally, or come from stray DC current from nearby tram or train lines. There may be no physical damage to equipment, but there can be internal damage that builds up from continuing small arcing," said Elliott. eti



RAMSEY COM3 COMMUNICATIONS SERVICE MONITOR

These days, test instruments need to be highly functional to justify their cost. The Ramsey COM3 is an interesting basic bench workhorse for radio communications. Reviewed by Roger Harrison.

INSTRUMENTATION

When it comes to servicing or testing radio communications equipment, what you need is speed, simplicity, speed, numbers and more speed. The productivity and profitability of any service centre, 'large or small', depends on speed of turnaround – time is money, the bean counter says. Factored into that equation is the cost to lease or buy any service equipment – frequency counters, signal generators, modulation meters, etc. If you work in, manage or own a service workshop or business, you'll know exactly what I'm talking about.

The Ramsey Electronics COM3 Communications Service Monitor is a combination service instrument that has clearly been designed with those criteria in mind. It is a no-frills, simple to operate, comparatively low cost instrument for use in the test and servicing of AM and FM radio communications equipment that operates anywhere in the range from 100 kHz to just less than 1 GHz – or, "dc to daylight", as they say in the trade. Although, the way things are going, that should read more like "dc to twilight" these days.

The makers have clearly set its specifications so that it will meet the necessary requirements to test or check the vast majority of radio communications equipment currently deployed in the commercial market. It is not designed for stringent type testing, but then Ramsey does not pretend that it could be used in this application. It is your basic bench workhorse.

The basic facilities

As Ramsey's brochure describes it, "... the COM3 is a lightweight, compact service monitor for testing AM and FM transceivers." Basically, the instrument comprises a modulatable RF signal generator, a specialised

audio (AF) signal generator, a receiver, a frequency counter and a modulation monitor.

It covers from 100 kHz to 999.999 MHz in 500 Hz steps. Standard CTS tones as well as a 1 kHz tone can be generated. The frequency readout is a seven-digit, seven-segment LED type which will display frequencies generated or received, CTS tone frequencies off-air, as well as being a general audio and RF frequency counter. Deviation of FM transmissions and carrier frequency error are displayed on a 20-segment LED bargraph.

The direct entry keyboard features a programmable memory capable of storing and recalling on command up to ten commonly used test set-ups.

Programmable offset keys simplify entry for duplex or repeater radios. Incremental step keys let you test a receiver throughout its band-pass frequency range.

The built-in frequency counter provides an instant reading on any transmitted frequency. The audio frequency counter features frequency multiplier circuits that generate fast, high resolution 0.1 Hz measurements with rapid count updates, Ramsey says.

The LED bargraph frequency error display provides accurate, highly visible frequency test data at a glance, says Ramsey, and is so prominent that readings can be accurately viewed and interpreted from across the shop, they claim.

Output levels can be set from 0.1 uV to 10,000 uV (10 mV), accurate to within +/– 2.0 dB according to the specifications. A pushbutton attenuator is provided, giving x10 steps.

The COM3 doesn't have to be connected into a transmitter to perform frequency checks. The in-built receiver boasts a sensitivity of 5 uV, allowing convenient off-air frequency checks, for example, from the base of a transmitting tower.

If the signal generator output is connected to a transceiver, inadvertently applied RF power is automatically switched to a jack on the rear panel that may be connected to an external load or watt meter.

The in-built CTS tone encoder generates all standard EIA sub-audible CTS tones in the 50-300 Hz range. The CTS tone generated by the COM3 is a synthesised sinewave with low harmonic content, to ensure an accurate reference, Ramsay says.

The instrument will modulate internal and external signals in AM or FM formats. (Internal modulation: CTS and 1 kHz. External modulation: up to 15 kHz).

The COM3 weighs less than 6 kg and measures 305 mm wide by 140 mm high by 356 mm deep. It is powered from the 240 Vac mains, and an optional rechargeable battery pack is available. For field use there's an optional cordura travel case featuring heavy duty construction, padded shoulder strap, and a large, zippered cargo pocket.

It is distributed by ACL Special Instruments in Melbourne, a company with a NATA registered laboratory, that specialises in test and measurement and in T&M instruments, particularly in the communications field. The Ramsey COM3 sells for $546.0 tax free, $633.0 tax paid. A standard 12-month warranty is offered.

Hands on

Operation of the COM3 is simple and straightforward. On power-up, it sets itself up in signal generator mode, 450.0000 MHz, 1 kHz FM modulation, 10 mV output.

Function selection is via membrane keys on the front panel. Each has a LED associated with it. They beep when activated and the LED lights. When set up, you can see at a glance from some distance away exactly what the instrument is set to do, as Ramsay claims – provided you're familiar with the front panel. The digital frequency readout is quite readable, even from six to eight metres away.

Setting a frequency from the keypad is swift and simple. There is no enter key; you just enter the frequency and press the required function (e.g. monitor FM), even if it's to remain the same. There's no cranking of band-select switches and spinning of tuning knobs – those days are gone!

If you're doing a lot of the same sort of service work requiring a common format, you can store the front panel settings in memory. Ah, salvation! You can store up to ten formats, which I guess is sufficient for many

eti NEXT MONTH

Power sources where mains is unavailable

Always look on the sunny side of life — so goes the motto of the solar power supply panel! This feature takes a look at how electric power is generated in remote areas or applications where mains is otherwise unavailable, covering solar panels, wind generators, motor generators and battery systems.

Build a quad antenna

The cubical quad has been a popular antenna with radio amateurs, and even CBers and shortwave listeners, for many decades. A locally designed and made low-cost hub makes construction a snack. With old Sol running at peak activity, the HF bands are hot with DX. Get amongst the action with our quad antenna.

Tips on measurement techniques

Murphy's law says: "No matter how carefully you measure something, you will get the wrong answer !" This short article, from Jack Middlehurst, is intended to help enthusiasts who want to develop their measuring skills to the stage where they instinctively have a feeling for how big their errors of measurement might be. Only the simple measurement of voltage, current and resistance is considered; you can get into quite enough trouble with these without wandering further afield into such things as frequency, impedance, phase angle, distortion etc.

Fast flash converter project

How does 150 megasamples per second impress you? Another technology demonstration project, it is a monolithic flash analogue-to-digital converter capable of digitising a 2 V (max.) analogue input signal with full-scale frequency components to 70 MHz into 8-bit digital words at a minimum 150 MS/s — on a Eurocard format board. Analogue inputs, outputs and clock input are standard 50 Ohm BNCs.

Harmon-Kardon HK550 VXI receiver reviewed

Harmon-Kardon, back on the market in Australia, is showing competitors a clean pair of heels in a few areas. We review this well-priced, well-made receiver, pitched at those who'd like to build their own hi-fi system around a tuner-amp — the versatile way to start without having to spend mountains of money.

service workshop applications.

The panel I found to be well laid out, and the instrument's operation quite intuitive, which makes it easy to learn how to use. I even successfully worked out how to store and recall a format without reference to the handbook.

I gave all the functions a workout, with the exception of the CTS tone facilities (I had nothing to use them on!). On a CRO, the audio generator outputs look quite clean and should be more than adequate in general radio communications test applications. The RF generator's AM modulation also looked good on the CRO. Harmonic output appears to be well down; judging from spot checks with a sensitive VHF/UHF receiver.

While there's a step attenuator and sort of calibrated variable output control on the signal generator's output, I would have preferred the addition of a small panel meter to allow reasonably repeatable output settings.

The COM3 is particularly aimed at FM test and measurement, including a receiver's 12 dB SINAD figure of merit (in conjunction with an audio millivoltmeter). No AM transmitter modulation measurement facilities are included, although I understand an after-market modification kit is available as an add-on.

The handbook is best described as perfunctory. It does, however, include complete circuit diagrams and component location drawings, so you've got a starting chance if you get caught out by that old saw "whatever happens to the breakdown man when the breakdown man's breakdown van breaks down?"

Summary

All in all, quite a nice piece of equipment. I wish I'd had something like it 20-odd years ago when I worked for Bail Electronic Services in Melbourne doing pre-sales testing and after sales servicing of receivers and transceivers. But then, I thought I was well off with the gear I had! Hindsight always has 20-20 vision.

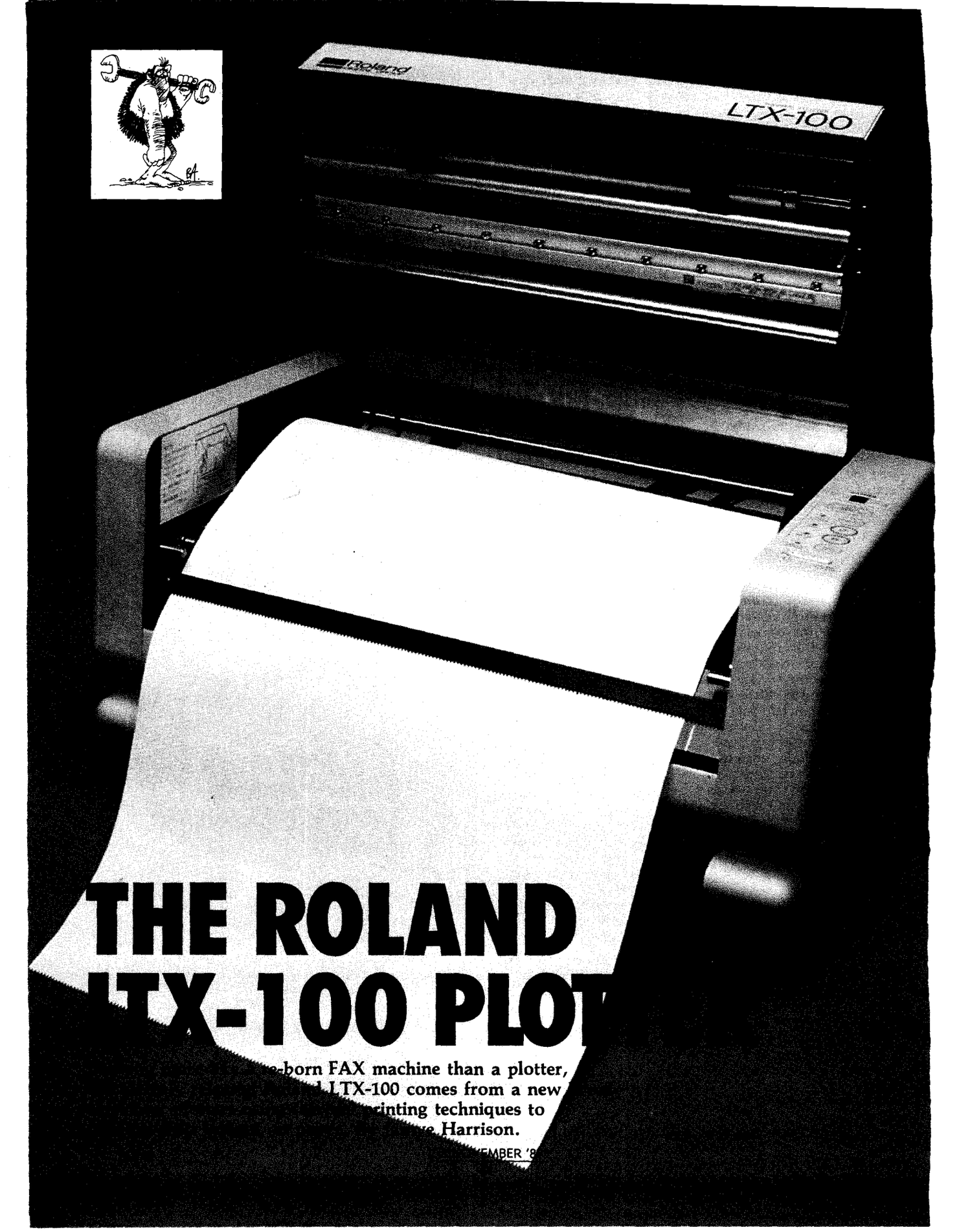
With test instruments, as with cars, it is so easy to buy something with more bells and whistles than you really need. Mag wheels, leather upholstery, electric windows and a 200 watt sound system won't make the car go any faster or use less fuel – they're just enjoyable facilities. It's the same with service instruments. The decision about what functions and facilities are really necessary to get the bulk of jobs done, versus what would simply be nice extras is a pragmatic one. Try a little thought experiment in choosing an instrument: imagine the company accountant looking over your shoulder (some of us don't have to imagine!). See what I mean?

The other problem is, there's not a lot of choice. If you want basic, no frills facilities, you're on a three-horned dilemma, stuck with something that's not up to the task, buying several instruments to fulfil the requirements, or getting a combination instrument that's more than you need (and more than you'd rather pay for).

The Ramsey COM3 fits comfortably between the over the top combo machine and the set of multiple instruments, comfortably shying clear of bottom-end devices with inadequate performance and limited facilities to cope with today's radio communications equipment. The COM3 is well-targeted, as they say. While it won't do everything required of, say, cellular radio telephone testing, it will cover the huge base of general radio communications equipment testing across HF, VHF and UHF. You could even use it for servicing car radios, pocket pagers and radio control equipment. It won't do what a spectrum analyser can do, but using an analyser for many of the functions the COM3 covers would be overkill.

If you're involved in the radio communications service business, the Ramsey COM3 deserves close scrutiny if you're currently looking around, or when you're next considering your test equipment budget. eti

Review unit kindly supplied by ACL Special Instruments, 27 Rosella St, East Doncaster Vic 3109. ☎ (03) 842-8822.



THE ROLAND LTX-100 PLOT

born FAX machine than a plotter,
LTX-100 comes from a new
inting techniques to
Harrison.
EMBER '8

Most plotters around at the moment are the pen and ink type. That is, the plotter essentially controls the movement of a pen, or pens, to create the image on a sheet of paper.

Many different methods of handling the paper and pens are used. The type of plotter for the computer-aided draughting system we use here at The Apogee Group is the sweet-lips type. A sheet of paper is pinched between a roller and two grip wheels at each end. The pen is held over the paper and moved along the x-axis (horizontally) along a rigid bar. Movement along the y-axis is achieved by the roller moving the paper.

The beauty of these plotters is that they produce very high quality output at a reasonable speed. Some disadvantages are that they are fairly noisy, especially in an office environment, and a new piece of paper needs to be loaded each time another drawing needs to be plotted.

Obviously, you get more features as the price increases – just like any other product. As the price rises in the plotter world you get a faster, more accurate plotter, perhaps one with multi-pen operation where pens of different thicknesses and colours are usable.

While the sweet-lips plotter moves the paper along one axis and the pen along the other, flat-bed plotters hold the paper still (and flat) and drive the pen along two axes. The disadvantages that apply to the sweet-lips plotter also apply to flat-beds, but flat-beds tend to be somewhat noisier.

The Roland LTX-100

The appearance of the Roland LTX-100 thermal plotter is quite unusual, so far as plotters go. It's about the size of a medium-sized fax machine, and definitely a squat, rectangular shape; it doesn't look like a plotter at all. I'm not being derogatory here, overall its appearance and functionality is quite pleasing.

One aspect which struck me almost immediately I put it on the desk was the plotter's overall convenience. Measuring just 410 mm wide by 260 mm deep by 180 mm high, the LTX-100 can quite comfortably sit on the end of one's desk. Most other plotters require their own floor stands and a whole lot more room. The paper is 297 mm wide and comes in 50 metre rolls.

The plotter is the usual beige computer peripheral colour. On the top face are five membrane-type push buttons denoted STOP/CLEAR, FF, LF, REPLOT and REPLOT COUNTER SET; I will discuss the operation of these later. A seven-segment display is located above the pushbuttons. This is used to display the number of copies remaining to plot. The Replot Counter Set key can be used to produce multiple copies.

Along the side of four of these buttons are four LEDs, indicating POWER ON, ON LINE, a BUSY LED to show when the unit is receiving data and a PLOT ENABLE LED indicating that there is data in the buffer ready to plot. Also on the top face of the unit is a switch which changes the unit's operation from a plotter to a printer.

The rear face of the unit has a more complicated appearance. The IEC power cable connector and power switch are located here. Dominating the rear face is a large heatsink.

Probably of more interest are two sets of DIP switches and the interface connectors. As with most printers, the DIP switches are used to set up the unit's default parameters. An explanatory sticker shows the different settings of the DIP switches and their associated parameters. It was quite wise of Roland to provide this attached to the unit itself; often, this information is included in the documentation which invariably gets lost after a month or two.

Two interface connectors are found on the unit as two modes of operation are available, serial and parallel – smart move, Roland. In plotter mode the unit can accept data in either serial or parallel format. However, in printer mode only the parallel port is used.

One last control on the back of the LTX-100 is a DARKNESS CONTROL knob. This can be altered to change the density of the output. I found it needed to be set at almost full darkness.

In operation

I used the LTX-100, in plotter mode, with AutoCAD v9.0 and, I am pleased to report, it performed favourably. The unit has a reasonably large buffer which traps the data and stores it, enabling the computer to dump its load and get on with the job much sooner. Once the buffer is full, or an end of file (EOF) code is received, the LTX-100 commences output. This produces a mild hum, kind of like a fax machine when it is receiving a fax. The noise produced by the machine is quite acceptably low, especially in an office environment. It contrasts greatly to the clatter of sweet-lips and flat-bed plotters.

The output is churned out the front of the unit and furled up on the desk in front. The Roland LTX-100 does not have a paper guillotine to chop the paper after each run. This is a pity as I would expect something in this price range ($3000-$4000) to include a guillotine, just as FAX machines in the same price range do. Cutting of the paper is facilitated by dragging the paper up against a serrated metal edge – adequate enough

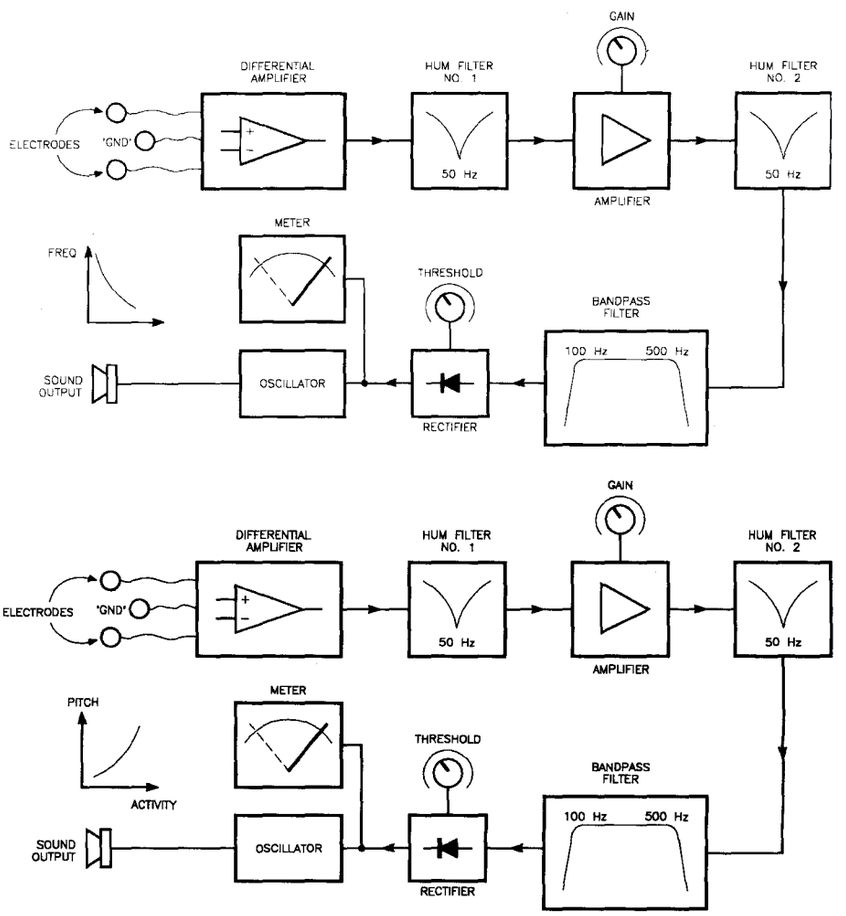


Figure 1. Typical LTX-100 plotter output (top) compared to the same from our Houston DMP42 sweet-lips pen and paper plotter (bottom).

Roland LTX-100

The Roland LTX-100 Thermal Plotter, reviewed by The Apogee Group for ETI.

Figure 2. Output from the LTX-100 in printer mode (emulating IBM graphics printer) from a file written with PC Paint.

I suppose.

I did have some trouble setting up the unit with AutoCAD. This was more a software problem than a deficiency of the unit. The User's Manual describes how to set up the LTX-100 for AutoCAD, including the DIP switch setting on the plotter. Unfortunately, the instructions supplied in the manual incorrectly showed the settings – while the accompanying text was correct, the diagram was not.

The Roland LTX-100, in plotter mode, has adjustable resolution, from 0.025 mm to 0.1 mm. The example shown here was an AutoCAD drawing output to the plotter with a resolution of 0.025mm. Next to it you can see the same drawing output on our Houston Instruments pen and ink plotter. As you can see there is a considerable difference in plot quality, more on this later.

We have also reproduced here some examples of output when the LTX-100 was in printer mode. While in printer mode the unit behaves like an IBM graphics printer – a common enough standard for installation on most software packages.

Figure 2 is an example of a simple disk directory printed straight from DOS using the ^P function. The type is of quite good quality, equalling most 9-pin and 24-pin printers in Near Letter Quality mode.

Recommendation

As I mentioned earlier, the most striking feature of the LTX-100 is its convenience. A new sheet of paper does not need to be loaded each time a drawing or file is output and it is fairly quiet compared to its contemporaries.

This convenience, however, does have an associated trade-off. The thermal paper is thin and fades with time, just like normal fax paper. If you want a permanent record of your output kept, a photocopy or bromide would need to be made. Also, the quality of the output in plotter mode, I think, is inferior to that of output from pen and ink plotters. I hasten to point out this is not a weak point of the plotter but characteristic of the technology involved. So, what is it good for?

As we have used a computer aided drafting system for quite a while now, I suppose a fair question, and a good test would be; "Would I use the Roland LTX-100?".

In short, yes I would. However I don't think it would be suitable for final plots to be used as plans, or to be reproduced, say in a manual. The LTX-100 would serve very well producing check plots. Around here, from one to six plots are required before a final plot is approved, the more complex drawings requiring more check plots. This can exact a heavy toll in plotter consumables – disposable plotter pens and paper.

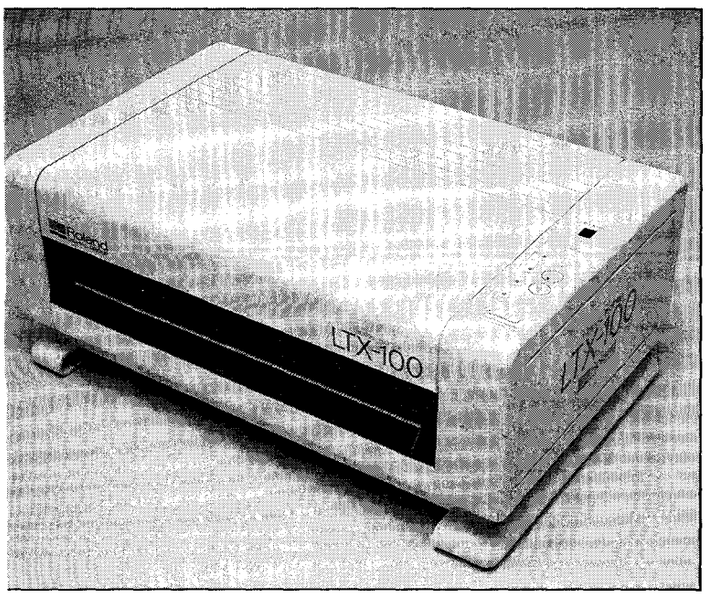
Using the LTX-100, the output would be ready more quickly, at less cost and more quietly than by using, say, a pen and ink plotter – probably the most important of these factors being the reduced cost of each plot.

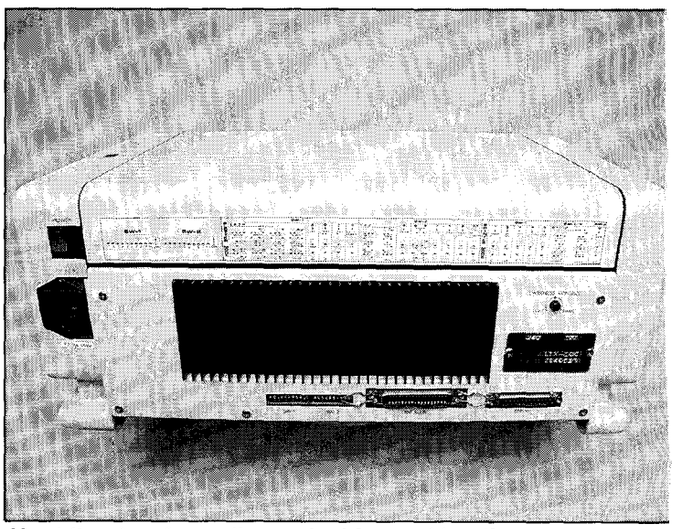
Conclusion

Priced at $3495 excluding tax, the Roland LTX-100 Thermal Plotter would make a welcome addition to an existing CAD system, or for any other system using plotter output. However, the factor to consider is what quality of output is required.

The rolls of paper (297 mm by 50 metres) cost $127 rrp for a box of six.

I am told that Roland will be releasing A1 and A0 size versions in the third quarter this year.





About the size of a medium – sized fax machine, the LTX-100 will sit conveniently and comfortably on the end of one's desk.

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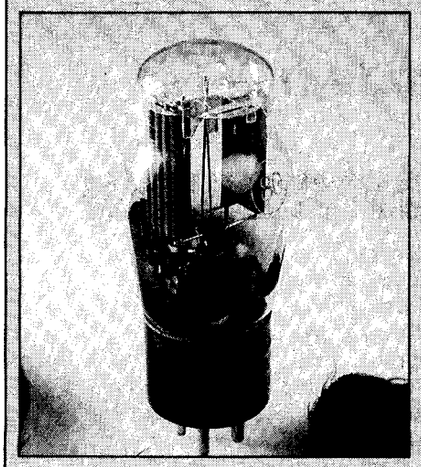
BUILDING BLOCKS OF ELECTRONICS

Power supplies

The majority of electronics equipment, excluding crystal sets and the like, requires a source of power. The power supply is thus a major foundation in any assembly built of circuit blocks. By Jack Middlehurst.



The most common valve rectifier in years past was the '80', a directly heated dual-diode, used as a full wave rectifier.

Power for electronic circuits is generally derived from two sources: batteries, and rectified ac. I shall discuss them in that order.

Batteries

The oldest of electronic equipment ran on batteries. The filaments of valves ran on what was called the 'A' battery of 1.5 V. This consisted of either a No 6 cell or many size F or size D cells connected in parallel. The high tension was called the 'B' battery of either 45 or 90 V, although some adventurous radios ran on 135 V. B cells were made of many size A cells in series. The grid bias was provided by the 'C' battery of −6 or −9 V, again made up of size A cells in series. Radios and amplifiers of the era could hardly be called portable. Later versions used lead-acid batteries for the filament supply, making them even less portable.

With the arrival of the transistor era, battery operated electronics grew enormously. These days, a great variety of electronic things are battery powered: tiny transistor radios, Walkman cassette players, ghetto blasters, calculators, clocks, clock-radios, you name it!

Figure 4.1 shows the symbols used for batteries. Testing batteries is easily done by measuring their voltage under load, i.e. while operating the equipment. If this can't be done, remove the battery from the equipment and connect a load resistor across the battery. If the expected current load on the battery is I mA and the battery voltage is E volts, select a resistor of

$$\frac{1000 \times E}{I \text{ Ohms}}$$

Each A, AA, AAA, B, C or D sized cell (nominally 1.5 V) in battery operated gear should read above 1.3 V. If the equipment uses rechargeable nickel-cadmium batteries, simply check that the voltage is greater than 1.1 V per cell under load.

It is important to realise that all batteries have a considerable impedance at radio frequencies, so they are usually bypassed with capacitors. All sorts of funny effects occur in battery operated equipment if these bypasses go open-circuit or lose their capacitance, so always check and, if necessary, replace them.

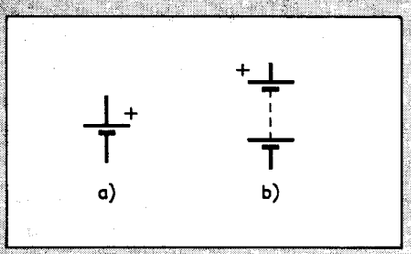


Figure 4.1. Symbols for batteries: a) a single cell, b) a high voltage battery having cells in series.

Rectifier circuits

Rectifiers are used for detecting AM signals and generating automatic gain control signals in radios, for restoring dc levels in TV sets, and for converting ac into dc in power supplies.

For single phase circuits, rectifiers come in half wave, full wave, bridge, and multiplier forms. With few exceptions multi-phase circuits are confined to power engineering so we will not discuss them.

Half wave rectifiers. Figure 4.2 shows the circuit of a transformer-coupled half wave rectifier. The larger the value of Cf, the smaller the ripple on the output voltage, Edc. If C is large and Rload is large, then Edc is approximately 1.4 times ERMS. For use at IF or RF, the transformer can be tuned as shown by the dashed capacitor.

The performance of the rectifier depends on the ratio of Cf to Rload; the higher this ratio the better. In most circuits the value of Rload will be designed so that the Edc is in the range 0.9 to 1.1 times ERMS. For AM detection, there is a compromise in that Cf has to remove the IF ripple but not remove any of the higher audio frequencies, so don't feel inclined to alter the value of Cf.

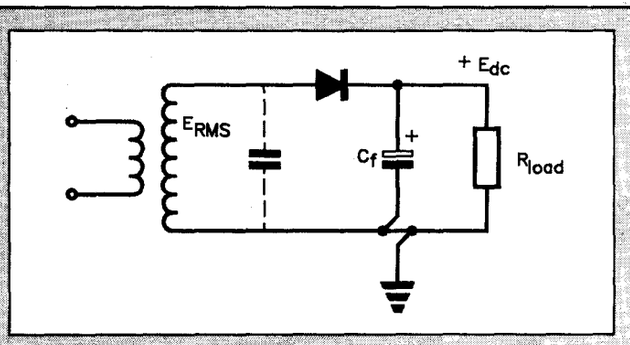


Figure 4.2. Solid state half wave rectifier.

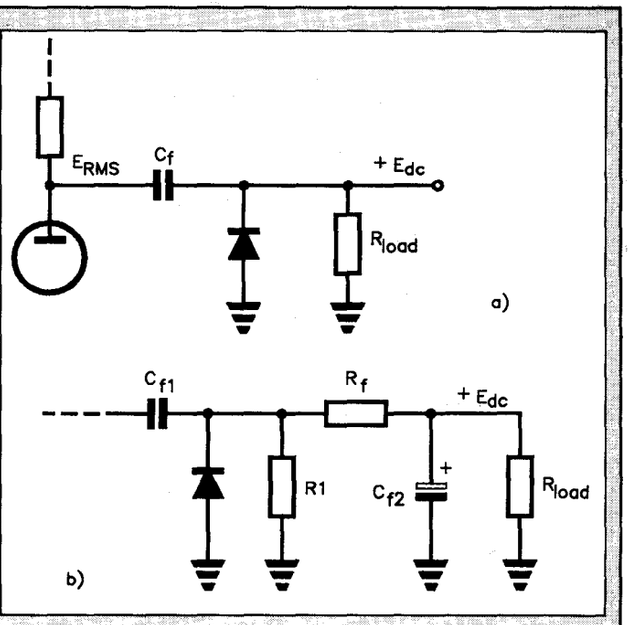
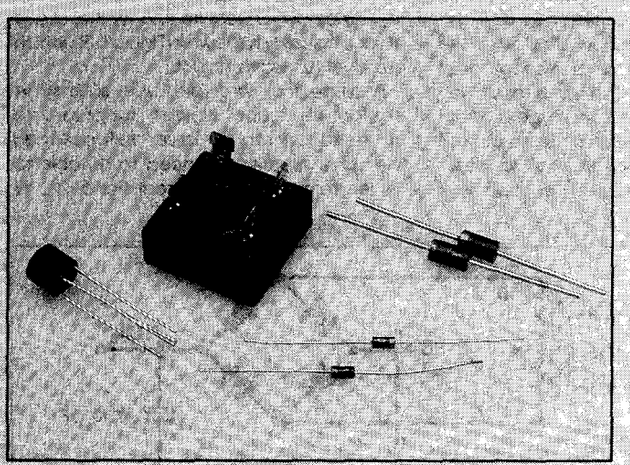


Figure 4.3. Indirect half wave rectifiers, sometimes called shunt rectifiers: a) without, and b) with secondary RC filter. If Cf goes low in value or open circuit, Edc is much lower than expected or specified. If the diode goes open circuit, no dc will develop.

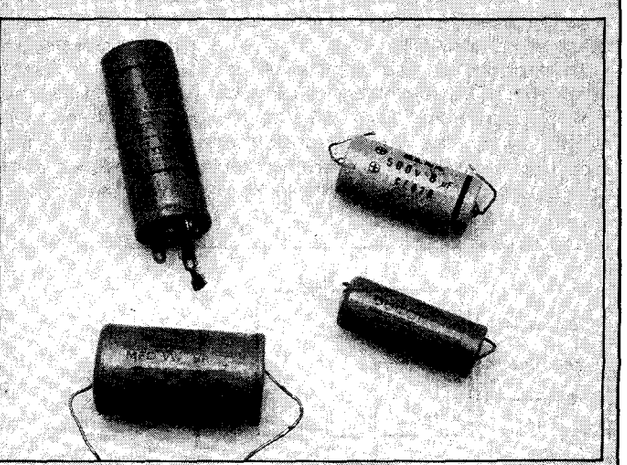
Reversing the diode reverses the sign of the output voltage. That is, with the diode pointing to the left, instead of +Edc at the top of Rload, there'll be -Edc. The efficiency of half wave rectifiers is poor, which is why they are rarely used for power supplies.

There are many occasions where a transformer is not available, so indirect half wave rectifiers must be used. A typical circuit is shown in Figure 4.3a. Again, if Rl is large, Edc should be about 1.4 times ERMS, and reversing the diode reverses the sign of the output voltage. Note that the filter capacitor is in series with the diode, and that no capacitor can be used across the load. If additional filtering is needed, the circuit of Figure 4.3b is used. R1 can be large (100k or more) and Rf becomes the load at the ac frequency, and Rf + Rload becomes the load at dc. Edc will be less than without the filter because of the voltage divider action of Rf and Rload.

Full wave rectifiers. With the advent of high powered audio amplifiers (i.e. 2 Watts instead of 0.1 Watts !) and the improvement in mains power distribution, mains derived power supplies were developed and valves designed to run on 250 Vdc and higher became common. Since it was no longer necessary to use batteries for the filament supply, sturdier filaments could be used. The filament voltage chosen was 6.3 Vac for most valves, except rectifiers which generally used 5 Vac. The transformers to provide these voltages rapidly became standardised and had a primary appropriate to the prevailing mains voltage (often 240 Vac) and three secondaries, 6.3 V, 5 V, and 385-0-385 V (that is, centre-tapped). This latter was sometimes 325-0-325 volts for lower powered equipment, and 425-0-425 volts for high powered.



A selection of solid-state rectifiers. Clockwise from far left: a small, printed circuit mounting bridge rectifier (type W04); a high current rating (40 amps) chassis-mounting bridge rectifier (type BR254); two high current, high voltage diodes (type 1N5408); and, in front, two low current, low voltage diodes (type 1N4002).



A selection of low value, high voltage capacitors encountered in valve power supplies. Values of 8 uF and 16 uF are more often encountered than 32 uF. Their voltage rating is a working voltage (expressed as VW — volts working), typically 450 or 500 volts; they will withstand a 10% higher voltage (called peak or surge).

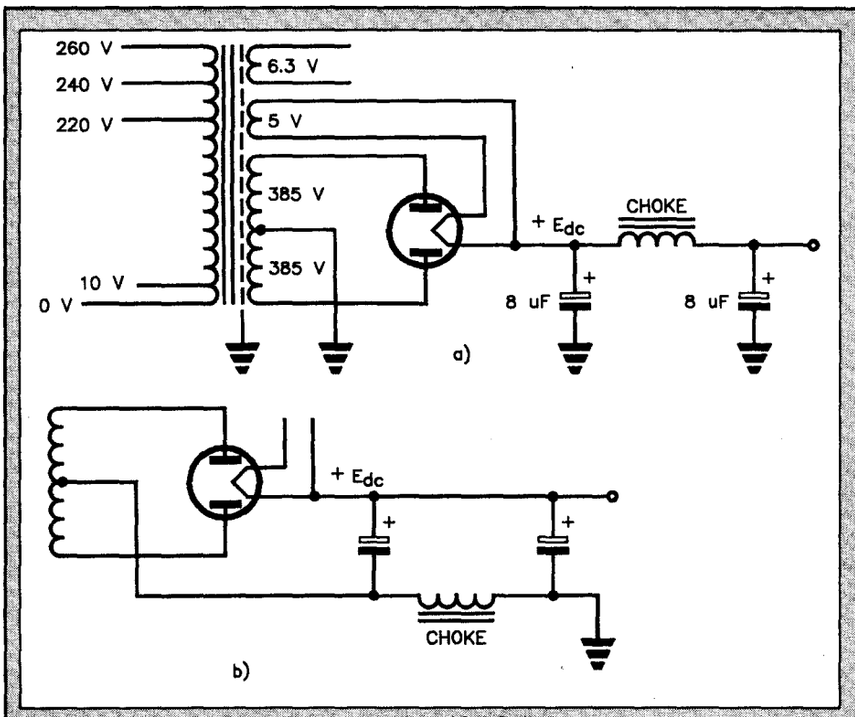


Figure 4.4. Typical valve full wave rectifier with LC filter.

The standard circuit for the full wave valve rectifier used for power supplies for radio and most amplifiers is shown in Figure 4.4a. Note the filter choke. Sometimes this would be an iron-cored choke, perhaps a little smaller than the mains transformer, or sometimes the field winding on the equipment's electromagnetic loudspeaker. Occasionally, to reduce the requirement for the choke's insulation to withstand the full high tension voltage, the rectifier circuit was rearranged as shown in Figure 4.4b.

The tappings on the primary of the transformer in Figure 4.4a are to allow for mains voltages from 210 to 260 Vac. The resistance of the main transformer secondary is usually ten to a few hundred Ohms and this, combined with the leakage inductance of the transformer and the voltage drop in the rectifier, means that the Edc falls quite markedly as more current is taken from the supply.

So when testing such a supply, with no load the high voltage secondary voltage will rise from its nominal 385 to 425 Vac and the Edc can climb to 600 V. Once the other valve filaments heat up and the valves start to draw current, Edc should fall to 350 V or less. With indirectly heated rectifiers (e.g. 5V4) the voltage rises slowly to about 350 V. Since the inductor (or loudspeaker electromagnet used as an inductor) often has a resistance of 1k to 3k, the final output voltage is about 250 Vdc. For many radios the load current was designed to be 60-100 mAdc total.

Because the power supply filter capacitors operate at high voltages they can store considerable energy. ***KEEP AWAY FROM CONTACT WITH THE HIGH VOLTAGE DC IN SUCH EQUIPMENT.*** Remember the rule of only using one hand when testing. An 8 uF capacitor charged to 350 Vdc can do you a serious injury! Remember also that the seemingly innocuous 5 Vac that runs the filament of the rectifier is connected directly to that first filter capacitor and is therefore at a *lethal* voltage.

The commonest faults with elderly equipment are loss of emission by the rectifier and loss of capacitance by the filter capacitors. If replacement of the valve presents a difficulty there is an old trick that can be used. If the rectifier is a bit 'tired', the mains can be connected to a lower tap on the primary. So if the mains is 240 Vac and is connected from the 240 V tap to the 10 V tap, all secondary voltages will be increased by about 4%. The increase in filament voltage increases the emission of the rectifier, and the increase in the secondary high voltage increases the dc output voltage as well. Of course, all this hastens the complete demise of the valve, but it can extend the life of the equipment long enough for you to find a replacement.

The efficiency of valve power supplies is poor, mainly because of the voltage drop across the rectifiers (about 80 V for the 5Y3), and the poor utilisation of the transformer. Modern power supplies such as that shown in Figure 4.5a use solid state rectifiers that have operating voltage drops of about 2 V maximum, but generally only a volt or less. It is common to use equal positive and negative power supplies since this makes the use of PNP-NPN transistor pairs easier, and many circuits use operational amplifier ICs (op-amps) which require it. A typical circuit of such a supply is shown in Figure 4.5b which is a dual full wave circuit.

Because they are used with solid state equipment, such power supplies are designed to produce lower voltages than the valve supplies but need to be able to generate much more current. For a 100 W

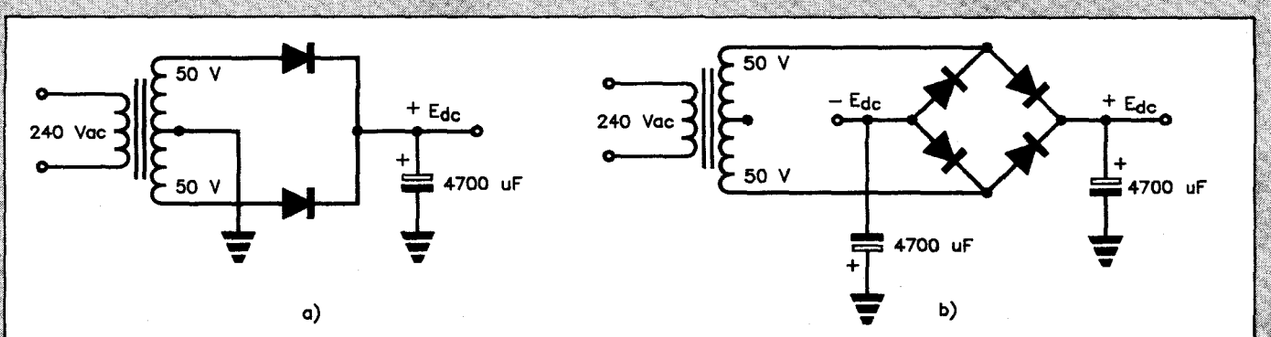


Figure 4.5. Solid state full wave rectifiers: a) single output, b) equal positive and negative outputs.

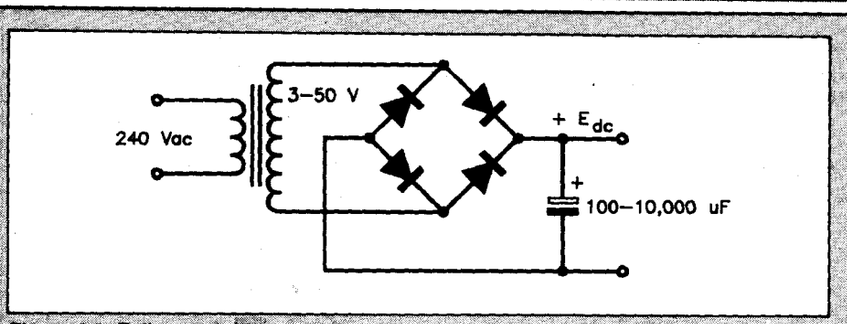


Figure 4.6. Full wave bridge rectifier.

amplifier, the output voltage would be + / – 40-50 Vdc with an average current of 2 A. This means that, for effective filtering, the filter capacitance has to be much larger than that used in valve power supplies, several thousand microfarads (uF) being common.

Modern amplifier designs have inherently good rejection of power supply hum, so additional filtering is not usually necessary. Since high inductance inductors to handle 2 A would be prohibitively large and expensive, if additional filtering is necessary, it is done using an 'active' block involving a high powered pass transistor and a feedback amplifier. It is also fairly common in low powered power supplies to regulate the output voltage using active devices. The circuit blocks necessary to do this will be described later in the series.

Bridge rectifiers. For a given power output, a power supply using a bridge rectifier uses the smallest and cheapest transformer and is the most efficient single phase rectifier system. The circuit is given in Figure 4.6. Even though the rectifier voltage drop is twice that of the full wave rectifier, only a single, untapped secondary winding is needed on the transformer.

The same remarks apply concerning the filter capacitor in this circuit as for the full wave circuit. Note that, although this circuit looks a little like that of Figure 4.5b, the rectifier connections are different, the transformer is not centre tapped, and there is only one Edc. This circuit is not used with valves because of the need for many filament windings which would have to be all insulated from one another.

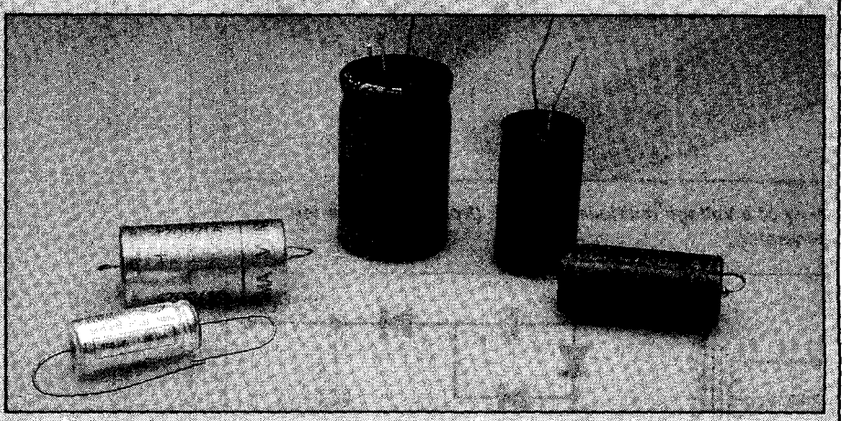
Voltage multipliers. Figure 4.7 shows the circuits of half wave and full wave voltage doublers. Both are common in TV set power supplies, and the half wave circuit is used in some TRF (tuned radio frequency) receivers as an AM detector. Edc falls rapidly with increasing current in both of these circuits. The half wave tripler and quadrupler circuits are shown in Figure 4.8.

In negative ion generators, Geiger counters and other high voltage equipment a special form of multiplier is used, the circuit for which is given in Figure 4.9. This is known as the 'Cockcroft-Walton' multiplier, after the two gentlemen who devised it to build the world's first atom smasher.

The multiplication factor of this multiplier must be an even number. At low load the voltage across each capacitor, except the first, is 2.8 times the RMS input voltage, so each capacitor must have a dc rating of at least 3 x ERMS. The voltage rating of the input capacitor need only be 1.5 x ERMS. Such multipliers have been used to produce well over 100 kVdc.

When replacing the capacitors in any of these circuits, it is essential to get both the polarity and working voltage of the capacitors correct, otherwise when you turn it on there will be a big bang!

In Figure 4.9, the value of each capacitor increases from the top of the diode-capacitor chain down, and for optimum efficiency these values must be strictly adhered to, but for an emergency repair, a



A selection of high value, low voltage capacitors encountered in solid-state power supplies. Those with a lead coming out each end — axial leads — are commonly called RT types; those with leads coming out one end are commonly called RB types.

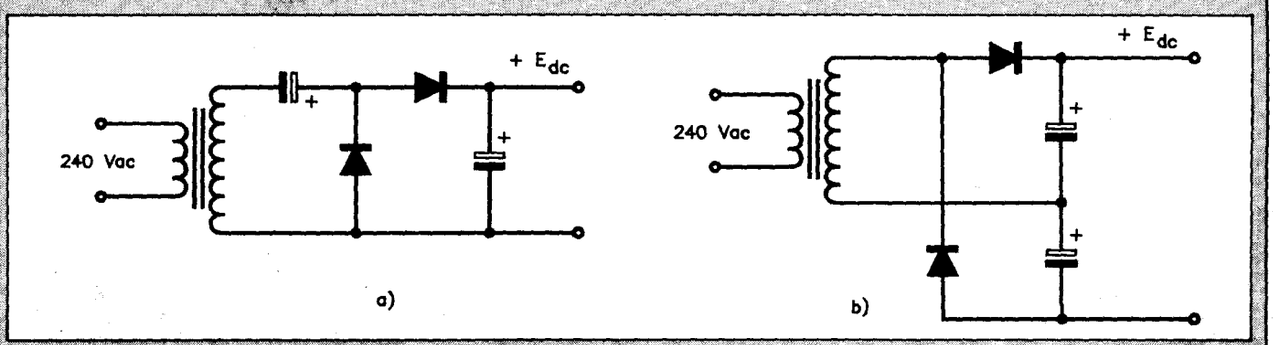
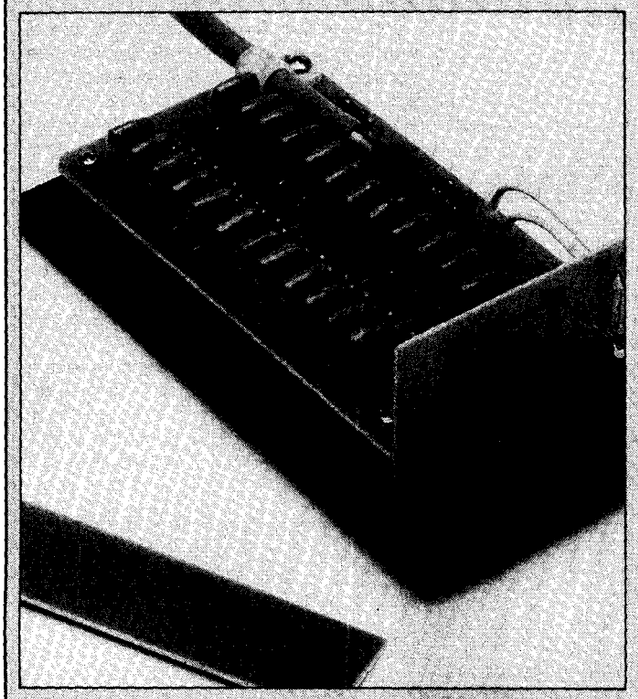


Figure 4.7. Voltage doublers: a) half wave, b) full wave.

value between half and twice the correct value can be used provided the voltage rating is 1.5 times the rating of the capacitor being replaced.

EXTREME CAUTION is necessary when testing these circuits. If you are not absolutely sure of what you are doing and are not also just a bit afraid, *don't touch the thing*. Insufficient knowledge and/or over-confidence can be fatal. Also, NEVER attempt to test the output voltage of the high voltage tripler in a TV set. There are special instruments for doing this that are designed to withstand the 30 kV involved and to protect the person taking the measurement. Remember that 30 kV can jump a 25 mm air gap, so you don't even have to touch it for it to get you!



View of a voltage multiplier rectifier (from a negative ion generator).

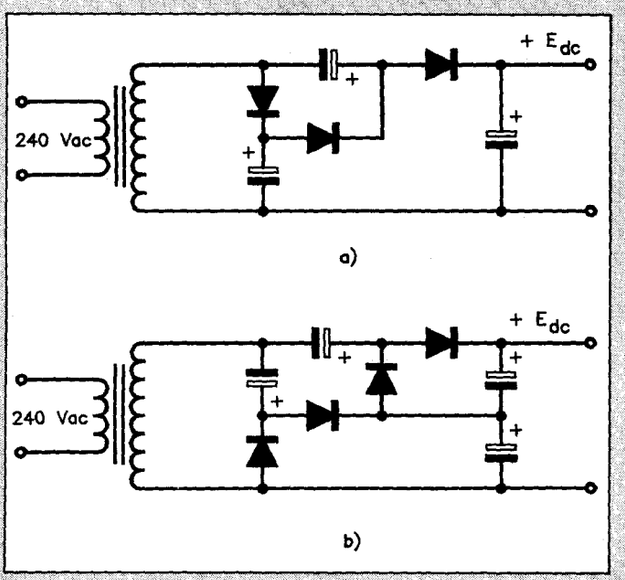


Figure 4.8. Voltage multiplier rectifiers: a) half wave tripler, b) half wave quadrupler.

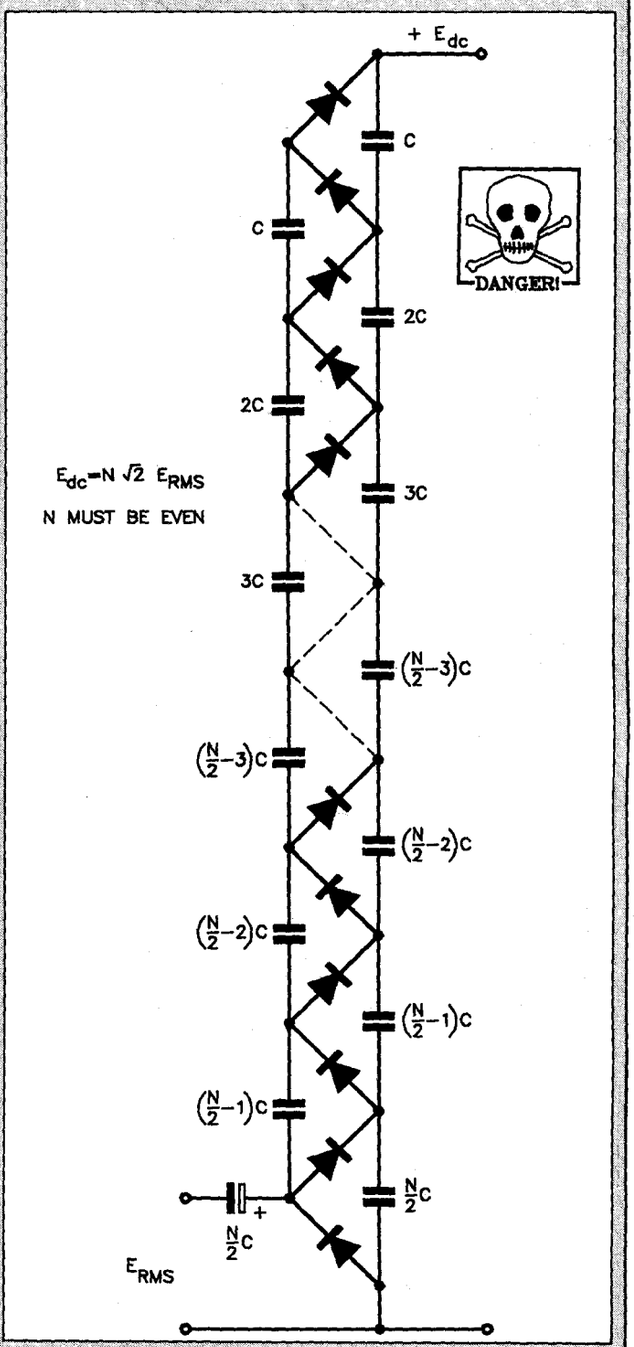


Figure 4.9. High voltage multiplier (even multiples only). This is the famous Cockcroft-Walton voltage multiplier, after the two British scientists who devised it for the first "atom smashing" machine.

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ARTHUR CUSHEN

RADIO NEW ZEALAND USES LATEST TECHNOLOGY

After 40 years of shortwave broadcasting with only two 7.5 kW transmitters, Radio New Zealand is being upgraded at last. By Arthur Cushen.

When Radio New Zealand moves up to 100 kW in January, it will have a new transmitter site, the latest technology in broadcasting, linked by remote control from the studios, and frequency range will only be in the higher shortwave bands.

It is more than 40 years since Radio New Zealand started on shortwave, using two 7.5 kW transmitters at Titahi Bay near Wellington. In September, 1948, the shortwave service commenced operation to the Pacific and Australia with a specialised overseas program.

In May, 1982, this operation ended and, since then, the shortwave transmissions from Wellington have been relays of the internal National program. After a considerable amount of lobbying from radio listeners and New Zealanders living overseas, and taking into account the failure of New Zealand to communicate to Fiji during the coup, the Government finally decided to upgrade the shortwave service at a cost of NZ $3 m with annual costs of NZ $1m.

The new shortwave transmitter will be installed just north of the Rangitaiki settlement on the Napier Taupo Road, in the centre of the North Island. The station is being funded by the Ministry of External Relations & Trade. A consortium of Radio New Zealand Engineering & Broadcasting Communications Ltd (formerly the Engineering Division of Broadcasting Services – part of the BCNZ) has carried out the design of the system and will install and operate the station. Every effort will be made to have the station completed in time to broadcast the Commonwealth Games early next year.

Radio New Zealand has a contract to provide the program and a new Radio New Zealand International division is being set up to produce these. The services will be directed principally to the Pacific Islands from the Cooks in the east to Papua New Guinea in the west. A series of news broadcasts will be directed to each of the principal island groups, some in the ethnic languages.

The 100 kW transmitter on order is being manufactured by Thompson CSF of France. It is of modern electrical design, recently re-packaged into one cabinet, and now includes a state of the art control and telemetry system operating through a standard RS232 computer port. It will be unmanned and will be operated from the studio in Wellington, reports Allan McQueen, development manager, Transmissions, of RNZ International. The transmitter is single sideboard capable and is the only transmitter offered with dynamic amplitude carried modulation as standard. It is fully frequency agile and will automatically tune to any frequency in the HF broadcast bands.

Dynamic amplitude carried modulation is a system designed to reduce power costs by reducing the carrier level transmitted to a level necessary for demodulation of the received signal. The operation of this system has been witnessed in Switzerland by Radio New Zealand staff. The system was operating on the Brown Boveri 500 kW transmitter and was able to reduce power consumption by between 25 and 40% depending on the program content. A number of international broadcasters are now retrofitting this system to older equipment to obtain the power savings.

The proposed antenna system will be implemented in two stages. For the present position in the sunspot cycle, coverage can be achieved in the next 4-5 years utilising frequencies in the 9-18 mHz range. For stage one, two 9-18 mHz antennas aimed at 325 degrees and 035 degrees true will be erected, fed either simultaneously through a power splitter or individually. Because of the time spread over the target area, the 035 degree antenna will be driven for the first 2½ hours of transmission, both antennas during the day and the 325 degree antenna for the last 2½ hours. For the second stage, similar antennas covering 6-12 mHz will be added.

At this stage there are no plans for adding an Australian service, but the building has been designed to accommodate a second transmitter, and sufficient area has been allowed for antennas directed to Australia and the Far East.

Although 100 kW is not a high power by world standards, the proposed service to the Pacific Islands – which are mostly one skip distances away – should give strong, reliable reception.

RNZ is looking forward to New Zealand having a worthwhile shortwave service at last. The old, faithful AWA 7.5 kW transmitters at Titahi Bay can then be gracefully retired as museum pieces!

The tentative schedule for Radio New Zealand International for the summer months when New Zealand is on Daylight Time is: 1730O-2005, 2245-0045, 0230-0630 all on 15485 and 17705 kHz; 0800-1105 on 9850 and 1178 kHz.

Shortwaves future

ANDREW Simon, the newly appointed executive director of Radio Canada International, recently reflected on what shortwave broadcasting means to a global audience.

Shortwave offers us something beyond the scope of any domestic newspaper, radio or television station, he said. It offers an instant window to the world.

From the letters Radio Canada receives, the station knows that shortwave listeners are intensely interested in the global community, and, in particular, how people in distant lands interpret and react to events. Consequently, shortwave users tend to be better informed than others in their community. For people living in countries where

information is controlled, shortwave may be the best means of learning what is happening, even within their own borders. In countries where information is freely available, shortwave is a favourite vehicle for travelling the world in search of additional facts and insights. It is this curiosity on the part of listeners that energises the station's work at Radio Canada International. Canada evokes exciting images, and the station tries to share these images with listeners, to portray the countless facets of Canada and bring listeners news and views about issues that affect us all, no matter where we live.

Andrew Simon said that his aspiration is to build on the tradition of credibility which Radio Canada International has already achieved, and to earn the appreciation of even more listeners around the world.

Radio Canada International has many transmissions in English, but those best received in this area are at 2100UTC on 15325, 17875 kHz; 2130 on 11880, 17820; 2200 on 9755, 11905; the relay through Australian Radio at 0300 on 11730 kHz and at 0400 on 15275 kHz. There is an English news broadcast Monday to Friday at 0515 and 0545 and this is now available on 6050, 6140, 7295, 9750, 11775 and 1522 kHz.

Radio Canada International supplies an excellent six monthly program schedule on request while visually handicapped listeners can receive a recorded version of the schedule on cassette. *Shortwave Listeners Digest* is popular worldwide and can be heard on Saturday 2105 and 2135UTC and on Wednesday 0405, compered by Ian McFarland.

Additional information is available from Radio Canada International, P.O. Box 6000, Montreal, H3C 3A8, Canada.

Around the world

GERMANY: Deutsche Welle is using the frequency of 13780 kHz for its morning broadcast to Australia at 2100UTC. This transmission originates from Julich in West Germany and is also carried on 9765 kHz. At the same time, two transmitters from Trincomalee in Sri Lanka carry the program on 9670 and 11785 kHz. The transmission time is 2100-2150UTC.

INDIA: All India Radio Delhi broadcasts in English to Australia, 1000-1100UTC on 11860 and 15335; 2015-2230 on 7265, 9550, 9910 and 11715 kHz. Delhi has been heard on the out of band frequency of 9950 kHz 2145-2245 in a broadcast to China.

LITHUANIA: Radio Vilnius is using 11790 in English 2200-2230. The broadcast, on a Tuesday, includes a Letter-box program, following the news and a sports feature. The transmission is also carried on 6100, 7400, 13645 and 15445 kHz. The station has recently started a DX Club for listeners which involves the reporting of the reception of the transmissions twice each month.

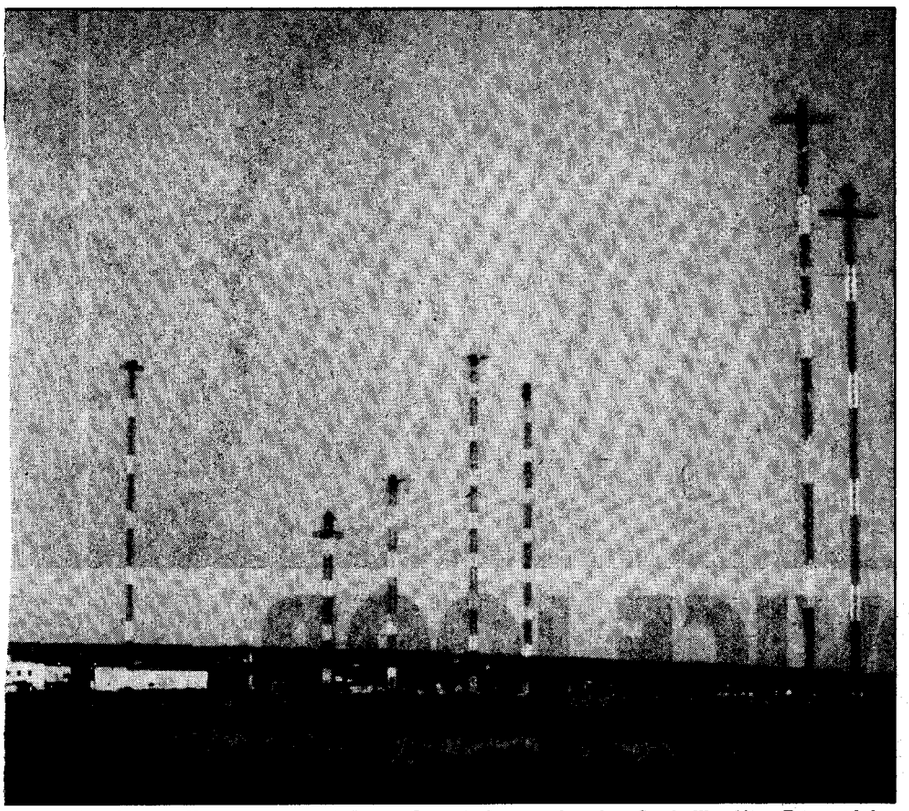
PAKISTAN: Broadcasts from 0230-0245 in slow speed news in English are now received on 17660 and 21490 kHz. Both signals provide excellent reception and Radio Pakistan has a further slow speed service 1900-1915 on 11570 and 15545 kHz.

ROUMANIA: Bucharest, in its English service to the Pacific, is now using 21665 kHz 0645-0715UTC. Better reception has been observed on 15335, while other frequencies used are 11940, 17720 and 1780 kHz.

THAILAND: Bangkok is heard in English with news at 1200UTC on 9655 kHz followed by commentary and a feature program with close-down at 1230UTC. Reception in New Zealand is always difficult on this frequency, but Australian listeners seem to have better success.

YUGOSLAVIA: Belgrade is using 21555 kHz on Sunday from 0600UTC when there is a relay of the internal services. An additional frequency, 9620 kHz, carries the broadcast, which has also been observed on Saturdays. They include relays of Radio Sarajevo and Radio Titograd broadcasting in Serbo-Croation. ETI

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand. He would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time.



The transmitting complex of Radio Canada International at Sackville, New Brunswick, which houses five 250 kW and three 100 kW transmitters.

ELECTRONICS
E T I - 7 8 1

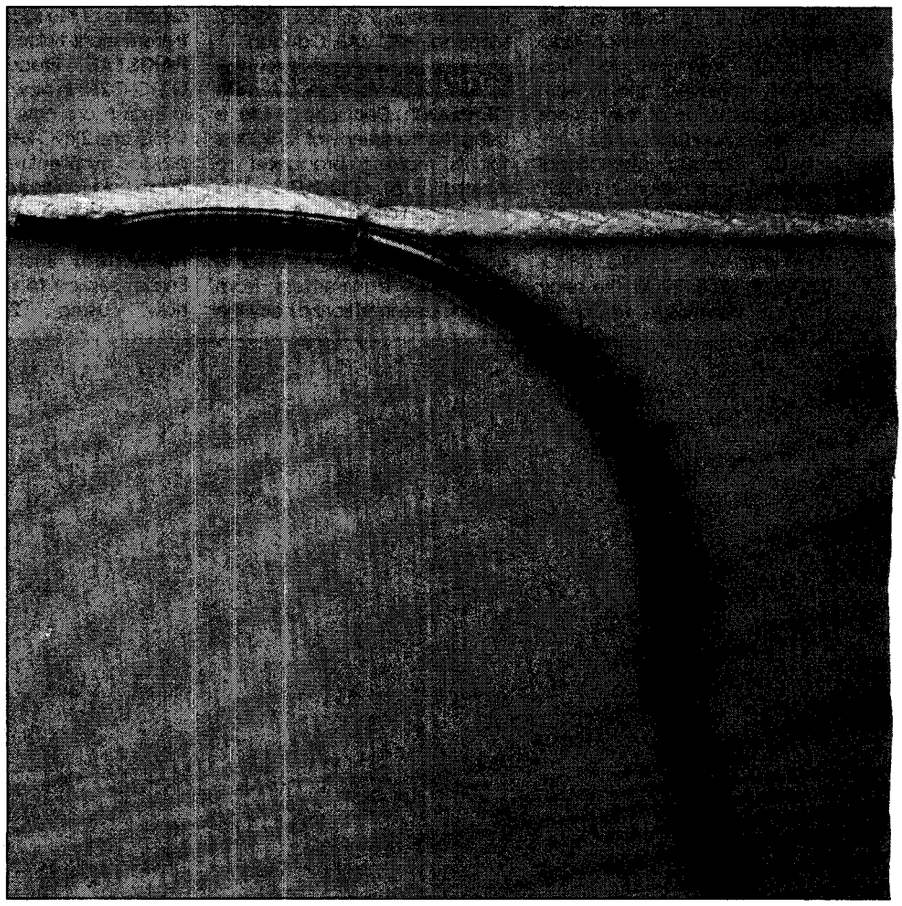
The most popular HF amateur band for local and regional use is 80 metres (3500-3700 kHz). It is a popular band, unhampered by the problems that beset the 40 metre band above and the 160 metre band below. Novice licensees are not permitted on either of these bands and the 80 metre band remains the lowest frequency band common to both novices and full calls. The biggest problem about using 80 metres, though, is the sheer size of any reasonable antenna; you need a lot of real estate to erect anything halfway decent, let alone a dipole. Here is a solution – even for inner-city residents!

If you've had the least experience in building antennas or experimenting with them, the realisation dawns sooner or later that loops wrap up an electrically large antenna into a physically small space. Where space to fit an antenna is at a premium, a loop should be considered first.

You can also reduce the physical size of an antenna by loading it with capacitance or inductance. But this often presents practical difficulties. In addition, the loading devices often tend to restrict the operating bandwidth of the antenna and reduce an already low efficiency.

An antenna known as the Taylor Loop is one which arguably offers the best compromise in terms of small size, reasonable efficiency and bandwidth that I have come across for an antenna designed to operate at the bottom end of the HF bands.

Constructed of coaxial cable and using 300 Ohm TV ribbon as a loading capacitor, it was originally described by James Taylor W2OZH in the early 1970s. The design



This compact antenna is ideal for the radio amateur holding a novice licence; it's cheaper, easier to erect and takes less room than any version of an 80 metre dipole. Full-call amateurs will also find it attractive. By Roger Harrison VK2ZTB.

THE NOVICE LOOP ANTENNA

achieves reported efficiencies of 8 – 10% where capacitively or inductively loaded verticals and dipoles are fighting to achieve efficiencies in the range 1 – 5%, so it's doing some two to ten times better.

Taylor's Loop provides a close match to 50 Ohms – great for today's rigs with solid state finals that demand this for maximum efficiency and output – and typically maintains a low standing wave ratio (VSWR) over bandwidths of 100 kHz at these frequencies, which is quite remarkable.

Taylor's little loop

Mr Taylor's little loop is shown in Figure 1, dimensioned here for the 80 metre band, centred on 3575 kHz, the middle of the novice segment. It is a rectangular loop, as you can see, mounted in the vertical plane, with a loading capacitor made up of a length of 300 Ohm TV ribbon and with the feedpoint placed in the centre of one of the long sides – the lower side for convenience, although it could equally well be placed in the upper side, putting the loading section on the bottom.

The antenna requires only around one-fifth the length of a dipole and only a few metres height (and you always need some height for an antenna). Hence, you can make it comparatively inconspicuous, to save any likely complaints from the Esme Watson next door.

The secret of getting reasonable efficiency out of an antenna is to use a low resistance conductor – that means low RF resistance. At RF, currents flow more on the surface or skin of a conductor. A conductor with a large surface area – that is, a large diameter conductor – will have a lower skin resistance compared to one with small surface area – a thin or small diameter conductor. That's one reason why tubing is used for 20 metre band beams and VHF beams, etc. But tubing's a little unwieldy with an antenna the

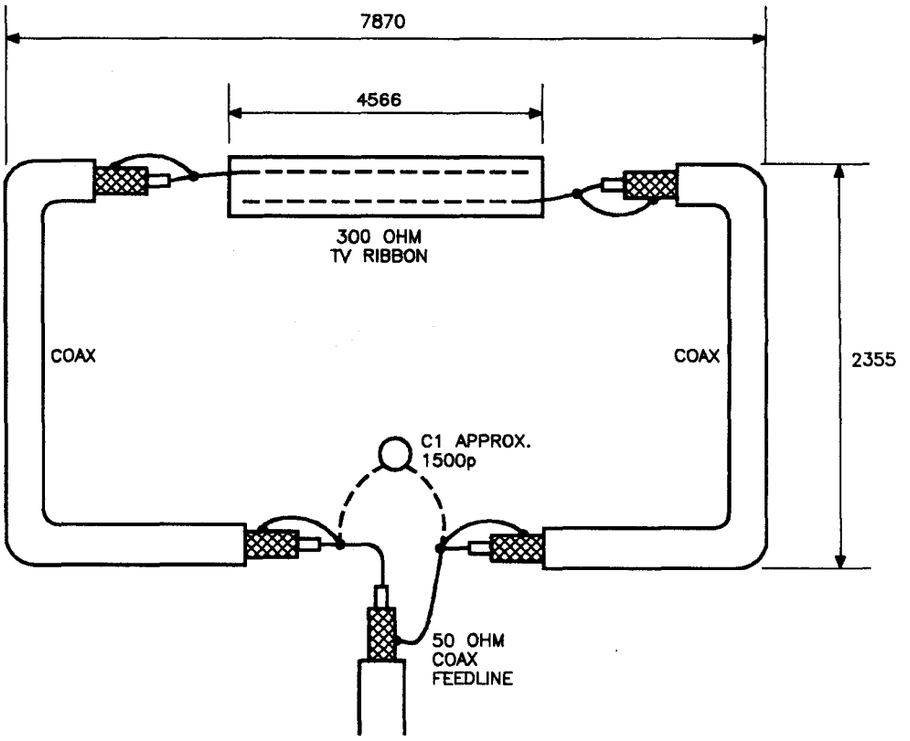


Figure 1. The Novice Loop doesn't take up much room! It is a capacitively loaded loop. The radiator is made from common, low-cost coaxial cable, the loading capacitor made from a length of 300 Ohm TV ribbon. Note that, essentially, only the outer conductor of the coax in the loop is used, the inner conductor may be ignored or shorted to the braid.

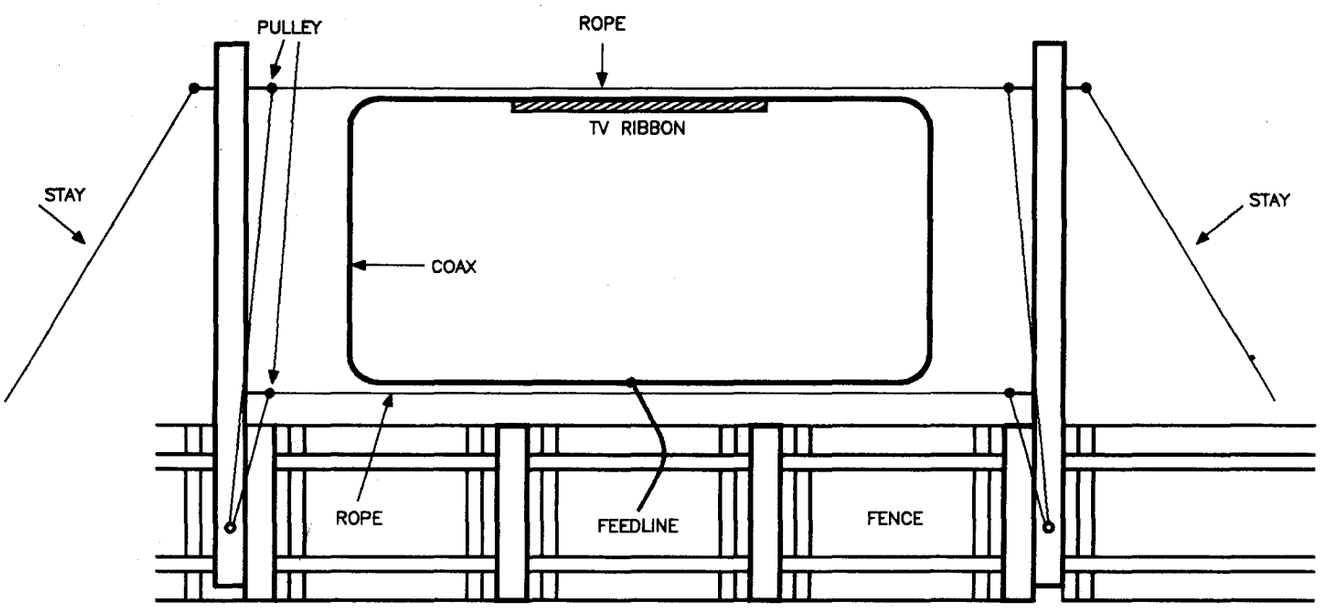


Figure 2. Here's one way of putting up the Novice Loop. It's just two supports each about three or four metres high, bolted to a fence and spaced about eight metres apart. The antenna is supported top and bottom with ropes (see Figure 4.)

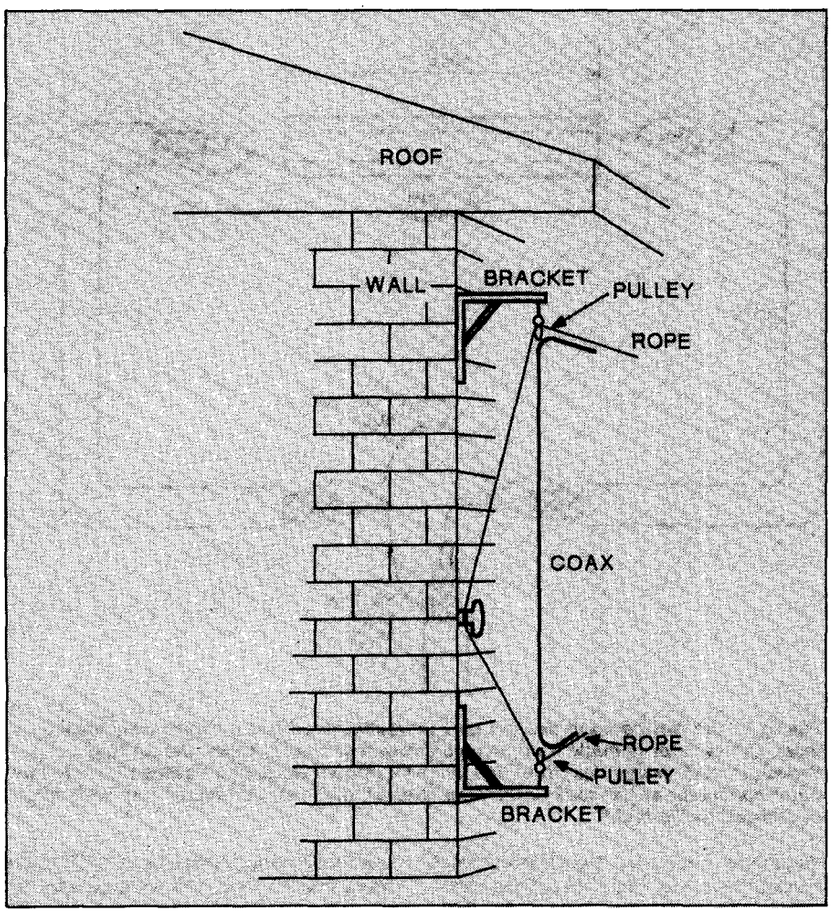


Figure 3. How the Novice Loop may be mounted on the wall of a building — but it must not be metal-clad or reinforced. The brackets are spaced about 2300 mm above each other, two sets about eight metres apart. Ropes support the antenna in a similar fashion to that shown in Figure 2, attached as shown in Figure 4.

size we're contemplating here – for some it may not be, but for most, it is. It's also comparatively expensive.

Loading devices affect efficiency, too. Coils need to have low RF resistance – and here you run into the same problem. Capacitors need to be able to withstand high voltages (as they tend to be used at a high voltage point on an antenna) and the ravages of the weather. You can make capacitive contraptions, but that can call for some pretty weird and wonderful mechanics. James Taylor clearly appreciated the keep-it-simple-Sam (KISS) philosophy, and when it comes to antenna construction, simplicity is often an ingredient of success.

Appreciating all these points, James Taylor made a couple of innovations. Firstly, he used common coaxial cable for the radiator. Just the outer shield, although the centre conductor is connected to the outer shield for convenience. This provides a low resistance conductor of relatively large diameter and comparatively low weight (compared to tubing) and comparatively low cost.

To physically reduce the loop dimensions it is capacitively loaded. Taylor's second innovation was to use 300 Ohm TV flat ribbon cable as a distributed capacitance that is also part of the radiator. Cunningly simple, cheap and quite effective.

The capacitive loading reflects an inductive impedance at the feedpoint. However, this is readily compensated for with low voltage capacitor connected across the feedpoint.

The antenna can be mounted at low heights, with the lower side only a metre or so from the ground, and still achieve acceptable performance. It can be mounted on the side of a building (wood or brick – no metallic cladding!) or strung between suitable supports. So it is versatile.

While Figure 1 shows 50 Ohm coax connected directly to the feedpoint, a 1:1 balun transformer may be used if you wish.

Construction

For the radiator, you will need around 17 metres of coax. You can use virtually any coax you can lay your hands on; it does not matter if it is 50 Ohm, 70 Ohm or whatever. Use a 9 mm diameter coax, such as RG8 or RG213, if you can, as the larger diameter achieves a greater operating bandwidth and best efficiency. If you do not need, or can live with less bandwidth, then the smaller diameter RG58 or RG59 (TV coax) is quite adequate. The feedline from the antenna to your rig needs to be 50 Ohm coax, though. At these frequencies, RG58 is quite adequate.

For the loading section, you'll need some five metres of 300 Ohm flat TV ribbon, the common type, not the low-loss type with slots punched out of the plastic between the conductors.

This antenna cannot be hung on its own, as the joints at the feedline and TV ribbon would not support the weight. It is best to secure it between two parallel rope supports. One method of mounting the Novice Loop in the clear is illustrated in Figure 2. Two wooden pole supports are bolted to fence posts, placed a distance apart so as to fit the antenna between them (i.e. at least eight metres apart). The supports can be of 50 x

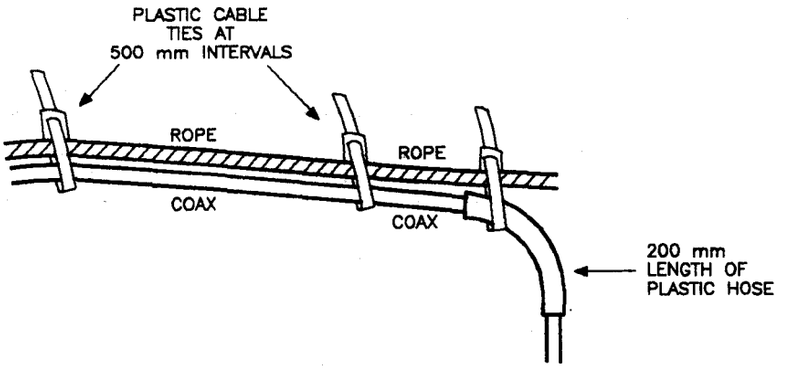


Figure 4. Here's how to attach the coax on the rope. Tie the TV ribbon in place the same way.

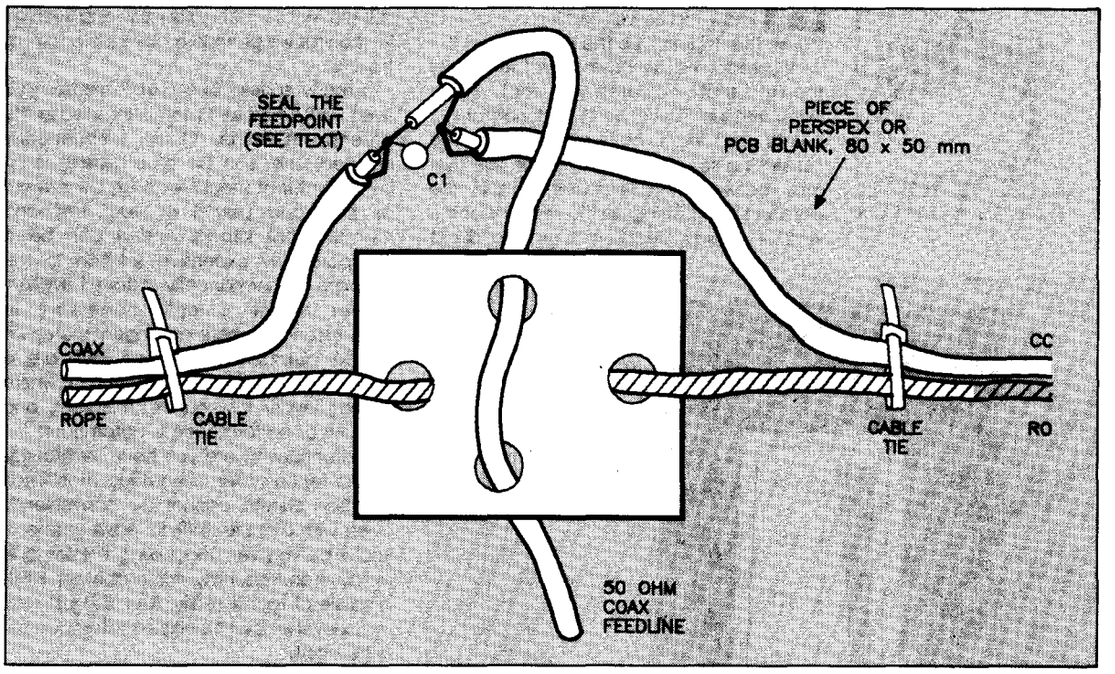


Figure 5. Here's a simple way to support the feedpoint joint and coaxial cable feedline.

50 mm or 50 x 100 mm dressed or undressed timber. You should get a timber suited to outdoor use, such as oregon or western red cedar, stained or treated to obviate the effects of weathering. The use of stays to counteract the tension of the antenna and its support is recommended. Coach bolts are best for securing the pole supports to the fence posts.

Figure 3 shows how the antenna may be supported on the side wall of a house or other building – provided it's wood or brick, not metal-clad or reinforced construction.

Only a light, small diameter rope is required to support the antenna. Nylon rope is no good for this job as it exhibits considerable stretch and will require frequent tensioning. Plastic clothesline is better, but not the variety that consists of wire rope covered with a plastic sleeve. A rope that does not hold moisture is best.

Lay the support ropes out on the ground to assemble the antenna. The coax and the TV ribbon may be secured to the support rope by several means. Plastic cable zip ties are ideal. Heavy duty insulation tape is good, though deteriorates in time and will need replacement. At the corners, a length of heavy-walled plastic tubing having an internal diameter just larger than the outside diameter of the coax should be slipped over the coax to spread the load a little. Figure 4 illustrates how it is done.

At the feedpoint, the coax feedline should be well supported. A simple and effective way to do this is illustrated in Figure 5. A rectangular piece of perspex or fibreglass printed circuit substrate (no copper!) has four holes drilled centrally in each side. It is threaded on the lower support rope and the feedline threaded up through the other holes, then looped over to connect to the antenna's feedpoint. You could mount a coax socket on this, make the feedpoint connections to it and put a plug on the end of your coax feedline.

The matching capacitor, C1, is connected in parallel with the feedpoint. It need not only be a low voltage (100 V) type, but can be a ceramic (not a high K bypass type) or film dielectric type. A value of 1500 pF is indicated, but this may need to be adjusted by paralleling smaller values across a 1200 or 1000 pF capacitor to bring the SWR down at the centre frequency. This can be done by trial and error once the antenna's mounted.

In Figure 2, the support ropes are passed through pulleys at the pole supports so that the ropes may be properly tensioned and adjusted from time to time. The pulleys are secured to eye bolts screwed into the poles, allowing the pulleys some free play. The eye bolts should be spaced about 2300 mm, one above the other on each pole, just less than the vertical side of the antenna. This is so that only the tension of the coax's own weight is on the vertical runs of the antenna coax. Tie the ends of the support ropes down to anchor points low down on the poles. A similar scheme can be made up for the arrangement shown in Figure 3.

The feedpoint needs to be effectively sealed to prevent the ingress of moisture into the coax feedline. But before you do that, a VSWR check is in order. Use low power and quickly check the VSWR on a clear frequency around 3575 kHz, making sure not to interfere with anyone.

With the SWR at a satisfactory figure, apply a sealant, such as Selley's silicone sealant, or similar, to the feedpoint and carefully wrap the joint in tape. Self amalgamating tape (a 3M product) is ideal. It is a rubber tape that glues itself together under its own tension once it is wrapped on itself. Make sure you do not short the joint. Treat the coax/TV ribbon joints similarly.

Now you're ready to roll on 80 metres! Remember to check and adjust the tension of the support ropes periodically.

For other frequencies

THIS antenna is useful over the range from around 3 MHz to maybe 8 MHz or so, and is readily scaled for use on frequencies other than 3.5 MHz shown here. To do this, find the ratio of the new frequency to the old frequency:

New frequency (kHz) divided by old frequency (kHz) = ratio.

Then divide the three dimensions shown in Figure 1 by the ratio obtained, rounding off to the nearest 5 mm. It's that simple!

You will need to vary the value of the capacitor C1, reducing its value as you go higher in frequency.

ELECTRONICS
E T I - 7 4 8

Amateur or CBer, whenever you use a transmitter, it's always a comfort to know the power coming out of your transmitter is going 'up the stick'. Hence the widespread use of some sort of RF power monitor that indicates just that. Some transmitters include an RF output monitor, but plenty don't. In any case, it's better to have something sampling the RF in the line that runs between the transmitter and the antenna and putting up the result on some kind of display, because it gives a direct visual indication that the transmitter, feedline and antenna are all behaving as they should. In the event something goes wrong, such an RF monitor will provide a quick indication of trouble.

In many shacks and mobile setups, I've seen SWR/RF power meters inserted in the antenna feedline. Often, permanently installed. This is a bit of a waste of an instrument that should really be considered as part and parcel of your test and measurement kitbag. And it can be a comparatively expensive solution to the problem. A permanently installed SWR/RF power meter is only necessary in circumstances where a stringent watch on the RF output and feedline SWR are a necessity. – like playing 'moonbounce', where getting every last ounce, milligram, and decibel of performance is paramount.

In situations where you have several rigs and antenna systems, individual monitoring of each system cannot be conveniently done with a single SWR/RF power meter – you'd be forever uncoupling it from one feedline and coupling it into another. Bit of a hassle all round, really. And, as I just said, the convenience of multiple meters can get quite costly.

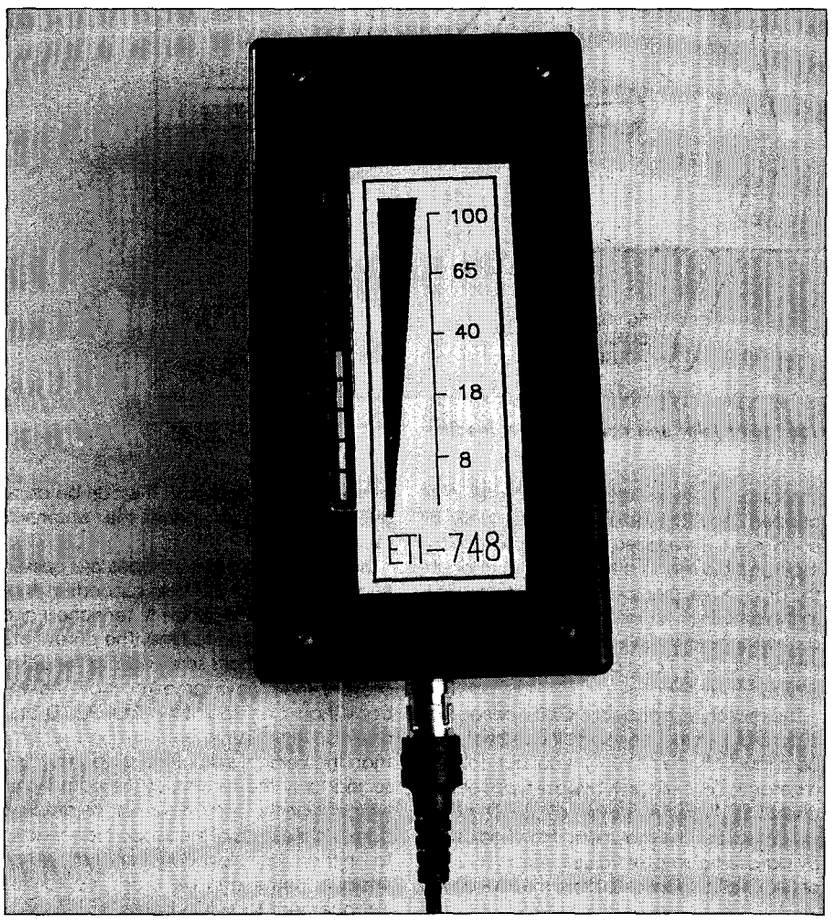
For making actual measurements, stick to using a good quality SWR/RF power meter. For RF monitoring purposes, you need something much less flash. Hence this project.

It comprises an 'RF Head', which is inserted in the coax line between the transmitter and the antenna. It samples a little of the RF voltage on the feedline and rectifies it. The dc so developed is passed to an indicator unit for display. This employs an LM3914 LED bargraph driver to drive an array of 10 LEDs. The column of LEDs lights up according to the dc voltage applied to the input of the LM3914. A LED bargraph provides a striking, highly visible display which you can keep an eye on without watching it directly.

Yes, I could have used a moving coil meter instead of the LED bargraph, but meters are comparatively expensive and certainly not as robust as this all-electronic indicator.

On dynamic transmission modes, such as single sideband and CW (Morse), the LED display accurately follows the RF fluctuations.

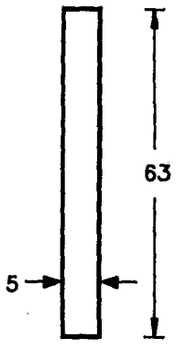
The project is easy to construct, can be used on all bands from 1.8 MHz to 50 MHz and is versatile enough so that you can have multiple RF Heads, each connected into a different transmitter/antenna system, and



View of the completed RF Monitor's indicator unit. The camera has just caught five LEDS lit. The lead at the bottom comes from the RF Head.

This simple, low-cost project provides a highly visible LED bargraph to monitor transmitter output in any amateur radio or CB station's shack. By Roger Harrison.

RF MONITOR WITH LED BARGRAPH



BARGRAPH
PANEL CUTOUT

Cutout for 10-LED bargraph.

have a single indicator unit, or as many as you want. The RF Head, or Heads, may be mounted in any convenient place where you can make a break in the feedline. Mounting an RF Head close to the antenna is a good idea, for it provides the best check on the transmitter/feedline/antenna system. However, such an arrangement is not essential; you can place your RF Head(s) wherever is convenient. The indicator is connected to the RF Head(s) via a length of low-cost shielded cable.

Considerations

Before proceeding with a description of how to build it, there are a few things to consider with regard to the RF Head. The RF Head

The RF Head. I used BNC connectors in this unit, which is housed in a diecast box.

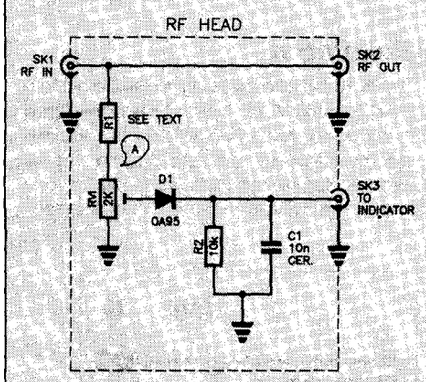
TABLE 1. Selecting a value for R1.

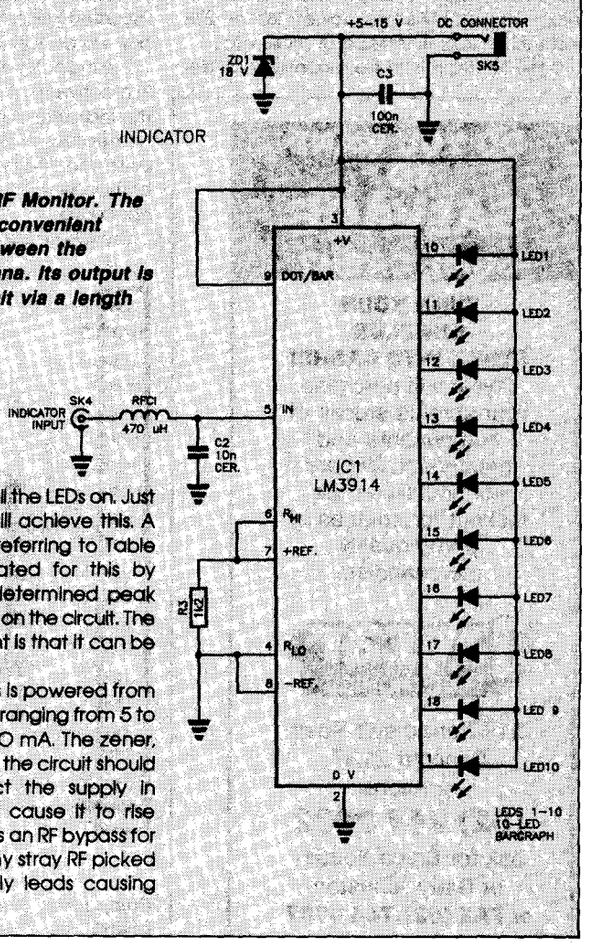
Peak RF Power	Value of R1
400	20k*
200	15k*
100	10k
30	4k7
5	910R

All resistors 1% or 2%* 1 W; all others 1/2 W.

picks off some of the voltage on the transmission line with a resistive voltage divider comprising R1 and RV1. The value of R1 is chosen so as to obtain 10 V peak at point A. This establishes the top LED as indicating the peak RF power and RV1 is adjusted accordingly. This, of course, presupposes that the load is resistive. You should have a flat feedline – that is, with low SWR – or very nearly so.

Table 1 lists values for R1 for five convenient peak RF power values. I have specified 1% or 2% tolerance resistors (E48 series values). Quite a few stockists carry E48 series resistors such as Rod Irving Electronics in Melbourne and Sydney, Stewart Electronic Components (Melbourne), Geoff Wood Electronics





Circuitry of the ETI-748 RF Monitor. The RF Head is inserted at a convenient point in the coax line between the transmitter and the antenna. Its output is linked to the indicator unit via a length of shielded cable.

HOW IT WORKS

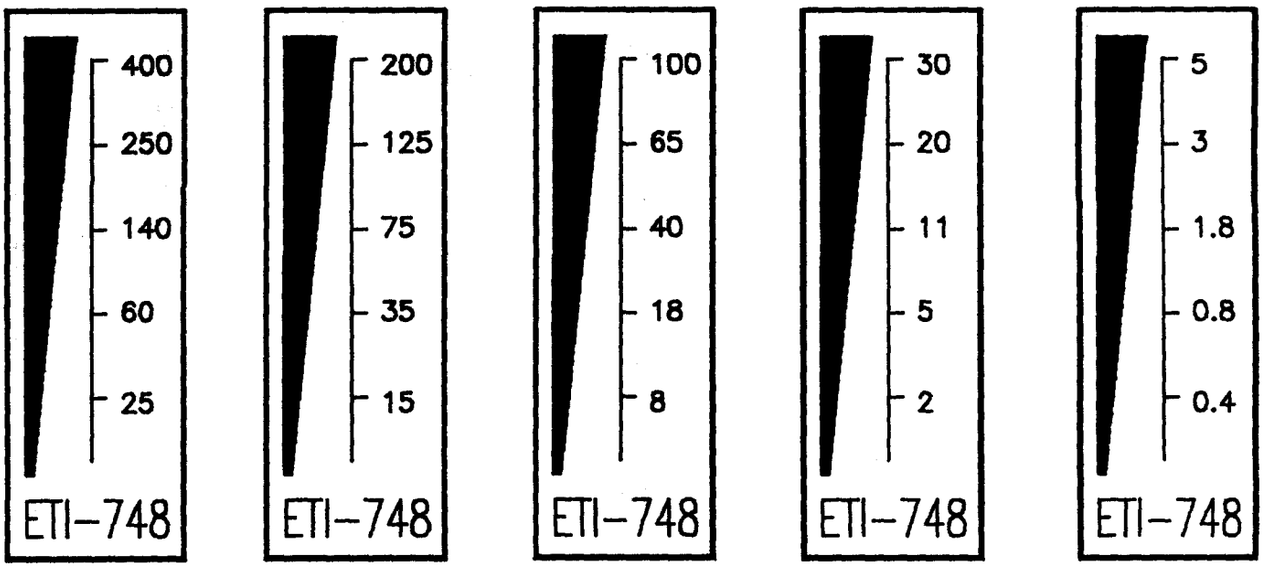
The RF Head is inserted in a break in the antenna feedline. R1-RV1 provides a voltage divider to pick off a small portion of the RF voltage on the line. This is rectified by D1, the peak rectified voltage charging C1. The voltage developed across C1 is coupled to the indicator via a screened cable between SK3 and SK4. Resistor R2 provides a dc return for D1.

The output of the RF rectifier is passed straight to the input of IC1, the LM3914 10-LED bargraph driver IC. RFC1 and C2 filter any stray RF that might appear at the input.

The LM3914 is connected so that it drives LEDs 1-10 in the bar mode, the number of LEDs that light up is lineally proportional to the input voltage coming from the RF head.

The value of R1 determines the applied power level that will drive all the LEDs on. Just 1.2 V at the input of IC1 will achieve this. A value for R1 is chosen by referring to Table 1. The RF head is calibrated for this by adjusting RV1 with a predetermined peak voltage applied to point 'A' on the circuit. The beauty of this arrangement is that it can be calibrated with dc!

The indicator electronics is powered from any convenient dc source ranging from 5 to 15 V, delivering at least 250 mA. The zener, ZD1 provides protection for the circuit should you accidentally connect the supply in reverse, or should a fault cause it to rise above 18 V. Capacitor C3 is an RF bypass for the dc leads to prevent any stray RF picked up from the power supply leads causing havoc with the indicator.



Full-size artwork for front panel labels.

(Sydney) and Radiospares Components (all state capitals). If you don't require a calibrated indicator as such, then just use the next nearest E12-series value (18k or 22k instead of 20k; 1k instead of 910R, etc).

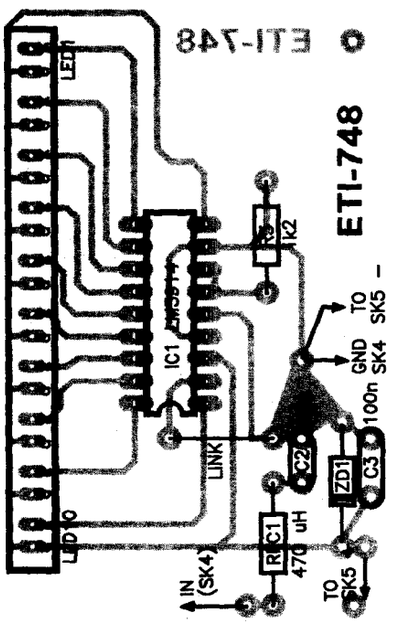
If the RF Head is to be mounted outside, then you should construct it in a sealable metal enclosure, such as a small diecast box. You need to keep moisture out. If it's to be mounted inside, then any small, cheap metal box will do the job.

The indicator electronics can be mounted in a convenient plastic jiffy box. If you want, the indicator could be incorporated into a homebrew transmitter, or perhaps an antenna tuner, with the RF Head components mounted near the output connector.

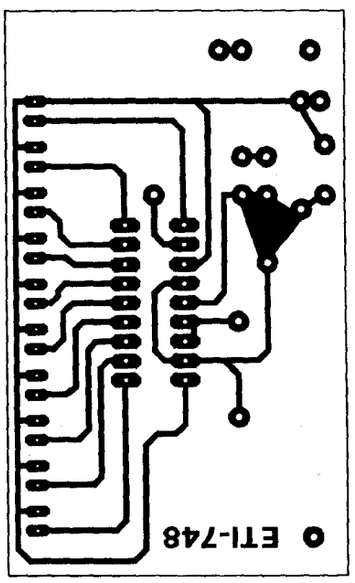
The 10-LED bargraph used came from Rod Irving Electronics, cat. no. Z10180. It's 10 rectangular red LEDs held side by side in a strip of moulded plastic, with the front face painted black. Other retailers stock a similar unit.

Building it

The RF Head components are soldered to a 5-lug tagstrip. A pc board was considered extravagant, here! Two SO239 coax sockets are mounted on opposite sides of the RF Head enclosure, or beside each other on one side, or the bottom – whatever's convenient.



Component overlay for the indicator pc board.



Printed circuit artwork, shown full size.

A short, heavy, tinned copper wire lead runs between their centre connectors. If the RF Head is to be used in a 50 MHz installation, it would be wise to place the sockets side by side to minimise the lead length between their centre pins.

You don't have to use SO239s, of course. Install whatever sockets are standard in your setup. I just specified SO239s as they suit the most commonly-used PL259 coax plug.

Position the 5-lug tagstrip in a convenient place adjacent to the sockets, so as to keep R1's lead lengths as short as practicable. The RCA socket (SK3) should be mounted down the other end of the box, as far away from the RF connectors as possible. Note that capacitor C1 is mounted directly across the pins of SK3, providing RF bypassing for the dc lead running to the indicator unit. The accompanying wiring diagram shows the general construction of the RF Head. Make sure you get the diode the right way round, otherwise you'll send negative dc to the indicator, which won't register anything!

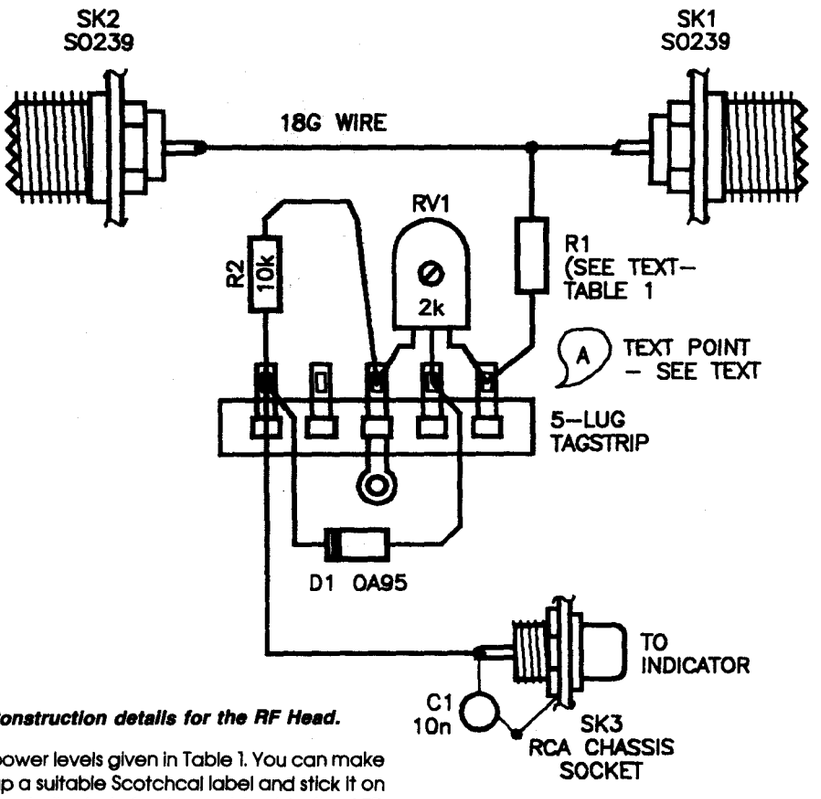
The indicator electronics is mounted on a small, 70 x 40 mm pc board. The accompanying overlay shows the component placement. It's a good idea, before assembling any components to it, to make a thorough visual check, ensuring that all the holes are drilled and of the correct diameter. Also, check around the IC pads and tracks to see that there are no whiskers of copper causing short circuits where they shouldn't. Check for any hairline breaks in tracks, too – but they're rare. Fix any problems. You should do this visual check, regardless of whether you made the board yourself, or have a ready-made one.

Once the board checks out OK, consider how the indicator is to be housed. You'll need to work out how to mount the board so that the LED bargraph protrudes through the front panel. The bargraph may mount directly on the board, so that the pc board and bargraph face the front panel, or the bargraph may be laid over, bending the 10 LEDs' leads at right angles. I've left housing details to you as individual requirements and preference will vary considerably. One tip – always centre-punch or otherwise mark hole centres before drilling. This stops the drill wandering and spoiling your work. Dimensions of the required cutout for the LED bargraph are detailed in a drawing here.

The components may be assembled to the board in any convenient order. The only thing to watch out for is the orientation of the IC and the zener diode.

The only external wiring required is to the power supply input dc connector and to the input RCA socket, SK4. This is pretty straightforward.

If you want a label or escutcheon for the indicator's front panel, I've included five artwork drawings that match up with the power levels given in Table 1. You can make up a suitable Scotchcal label and stick it on the indicator's front panel beside the LED bargraph. Remember that Scotchcal is easier to handle if you soak it in water first and wet the panel just before you apply it. This softens the glue and you can then gently slide the Scotchcal label into position. Smooth out any bubbles by sponging them towards the edges.



Construction details for the RF Head.

Checkout

Do a visual check of all your work – picking up any mistakes at this stage saves grief later! Check the polarity of your dc power supply connectors. When you're satisfied it's all hunky-dory, connect the power supply to your indicator unit, but don't hook up the RF Head. With the supply turned on, connect either a 1.2 V dc source, or a 1.5 V cell, to the indicator's input – negative to ground. The LED bargraph should light up. If not, power down and check for faults.

With the indicator confirmed as operating correctly, you can set about testing and calibrating the RF Head. Run a shielded cable between the RF Head and the indicator, linking SK3 and SK4. You'll need a variable dc supply. Set its output accurately to 10.0 V and apply it between point 'A' and ground. Power-up the indicator and then adjust RV1 so that the top LED just lights. There will be a small latitude in the adjustment.

That's it! Now install it and enjoy new-found peace of mind whenever you're on the air.

PARTS LIST ETI-748

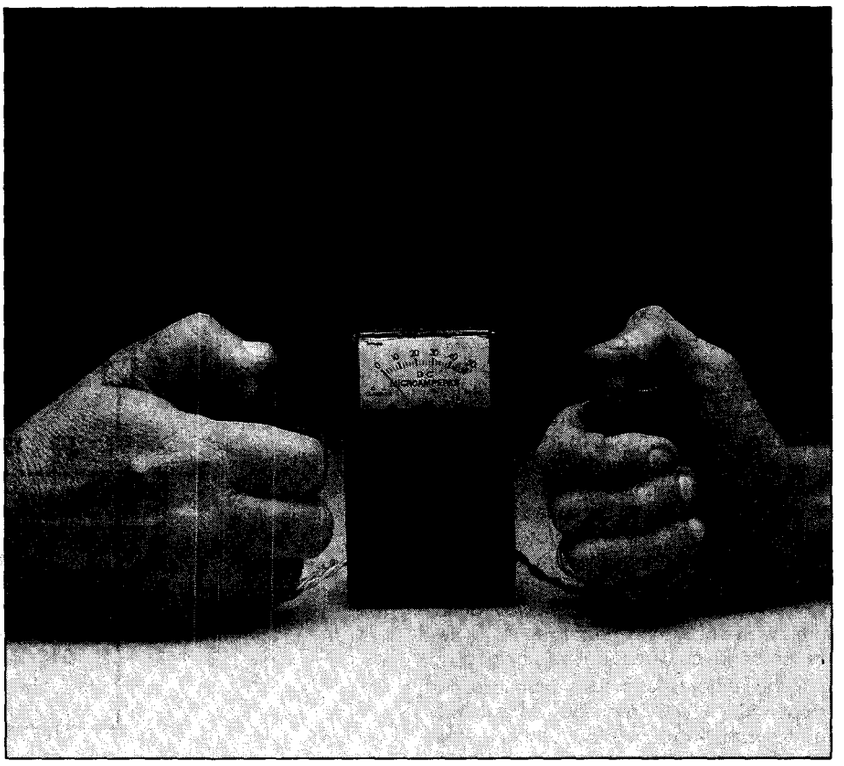
SEMICONDUCTORS
D1 ..... OA95
IC1 ..... LM3914
LED1-10 ..... 10-LED bargraph
ZD1 ..... 18 V/1 W zener

RESISTORS all 1/4 W, 5% unless noted
R1 ..... see Table 1
R2 ..... 10k
R3 ..... 1k2

CAPACITORS
C1, C2 ..... 10n ceramic
C3 ..... 100n ceramic

MISCELLANEOUS
RFC1 ..... 470 uH RF choke
SK1, SK2 ..... SO239 coax sockets
SK3, SK4 ..... RCA chassis-mount sockets
SK5 ..... dc connector
ETI-748 pc board; length of 22 gauge tinned copper wire; 5-lug tagstrip; small diecast box or other sealable metal box; tiny box for indicator unit; dc plug to suit SK5; two RCA plugs; and required length of shielded cable; 8 BA bolt and nut; Scotchcal escutcheon; hookup wire, solder, etc.
Approximate cost: $28 – $36.

ELECTRONICS
ETI-1546



On the heyday of the wild west, the gunslinger with the fastest reaction was the last one left standing in a gun fight. In these more civilised times, we just shoot-em-up on the old video/computer game. But just how fast *are* you? This fun little low-cost, low mortality project lets you actually measure the milliseconds of a person's reaction, displaying the result on a meter. Using this project, you can not only determine who's fastest among family, friends and acquaintances, but use it to indicate the relative reaction times of different individuals or of the same individual at different times.

This is an ideal project for newcomers to the hobby of electronics as there's nothing critical about its construction or operation. It's great at parties, or for a bit of amusement between friends. But seriously, you could survey people's reaction times under differing conditions for a school project, perhaps.

There are two pushbuttons: one marked START, the other marked STOP. One person presses the start button, which lights a LED; when the person being tested sees the LED light, he or she presses the stop button as soon as they can.

The project measures a person's reaction time by measuring the voltage on a capacitor which is allowed to charge in the interval between when the start and stop buttons are pressed. The longer the delay between start and stop, the higher the voltage on the capacitor. This voltage is indicated on a 50 microamp moving coil meter and the components have been selected so that a full scale deflection of 50 uA corresponds to a reaction time of 500 milliseconds and lower scale values correspond to proportionately shorter reaction times (e.g. 40 on the scale means 400 milliseconds, 20 means 200 milliseconds and so on).

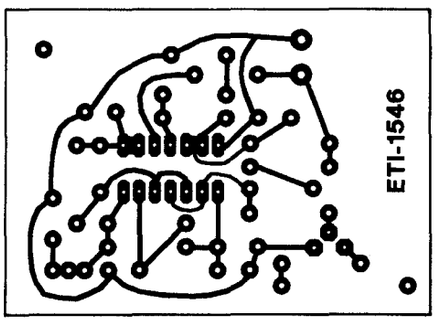
You might think that a digital display would indicate the voltage more accurately, and you'd be right, but the increased accuracy of reading would not justify the extra complexity. You can easily read the meter scale to the nearest ten milliseconds and even under exactly similar conditions any person's reaction time varies by at least that amount from test to test.

In fact, one of the most interesting things about testing your reactions is the amount of variation there is. This variation has two components, the random variation that occurs between successive tests under the same conditions, and the statistically significant variations that occur between tests conducted under different conditions. Those of you who are interested in psychology might like to investigate the effects on a person's alertness and thus

Speedy Gonzales!

REACTION TIMER PROJECT

Among all those serious projects, why can't we have some fun ones for a change? No problem — try this one! By Roger Harrison.



Full-size artwork for the printed circuit board.

reaction time with such things as mood, stress, time of day, degree of inebriation, biorhythm and phase of the moon.

Nearly all the interesting experiments you can do with a reaction timer involve relative and not absolute measurements, which is fortunate because the absolute precision of this timer is affected by several factors, including component tolerances, temperature and the slight non-linearity of the capacitor charging curve. A truly accurate timer would be very expensive and complicated to make.

The circuit

Two pushbuttons are used – one to start, which causes the LED to turn on, and one to stop, which the erstwhile contestant presses immediately on seeing the LED light.

The circuit monitors the voltage across a capacitor – C3 here – which is allowed to charge during the interval between when the start and stop buttons are pressed. The voltage on the capacitor will rise to a value proportional to the time elapsed. This voltage is displayed on the panel meter, and gives a direct measure of the contestant's reaction time. The meter holds its reading for a few seconds, then the project automatically resets, ready for the next try.

Now, a capacitor, when charged via a resistor, doesn't charge up in a linear way (that is, in a straight line). In fact, the voltage versus time graph, if you plot it out, is exponential. The voltage across the capacitor rises fairly quickly at first, then slows down as it begins to reach the supply voltage, slowing down increasingly, the closer it approaches it. However, for the first half, the voltage rises fairly lineally, certainly within a few percent, which is within the accuracy of the panel meter.

At the heart of the circuit is a 4011 which contains four NAND gates (hence, it's referred to as a 'quad NAND gate package'). IC1A and IC1B form what is known as a latch. Push a latch closed, and it stays in that position. Push it open, and it stays open. Well, a latch circuit works in a similar way.

This one has two outputs – pins 10 and 11. Set one output high (supply voltage) and the other output will be low (zero volts) - and the circuit will remain in that condition forever, unless you change something. Change the latch and the outputs will change, the one that was originally high will go low and vice-versa.

Here, when power is applied, capacitor C1 will be initially discharged, appearing as a short circuit between the pin 9 input of IC1B and ground. This ensures the output of IC1A (pin 11) is always low (O V) whenever the battery supply is turned on. The pin 13 input of IC1A is pulled high by R1, which is connected to the 9 V supply. C1 will charge quickly via R2 and the pin 8 input is held high.

When the START button (PB1) is pressed, the pin 13 input is grounded, changing the state of the latch. The pin 11 output immediately goes high. This drives the pin 9 input high and thus the pin 10 output goes low.

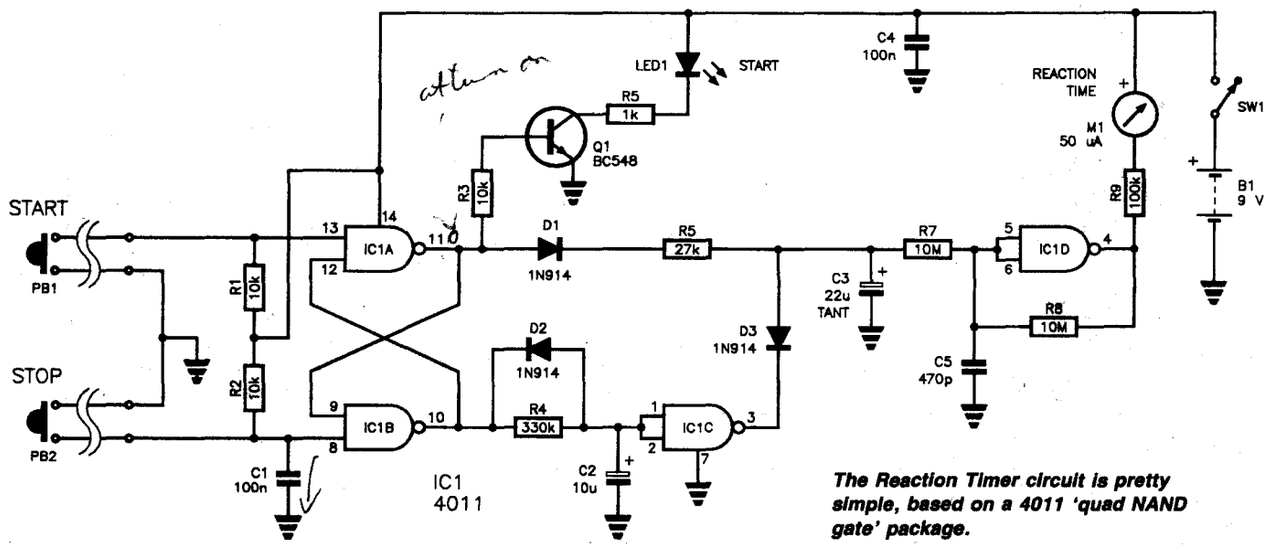
Immediately that the pin 11 output goes high, Q1 receives base current via R3, and it turns on. Its collector current flows via LED1 and R5, and the LED lights. At the same time, diode D1 conducts, and C3 will commence to charge via R5.

Now the meter circuit comes into play. IC1D is biased to operate as a linear amplifier, or buffer, by means of R8, which is connected between its joined inputs (pins 5 and 6) and the output (pin 4). With this arrangement, a very small current flowing into the input will cause a very much larger current to flow in its output, but its value will be directly proportional to the input current.

Now, R7 connects between the top of C3 and the input of this buffer amplifier, IC1D. But R7 is a very high value, 10 megohms, so only the minutest current will flow. The current flowing in IC1D's output flows through the meter M1, this current being directly proportional to the voltage on C3. As C3 charges so the meter reading rises. The circuit has been arranged so that the capacitor charges to 5 V in half a second (500 milliseconds). At 5 V the meter reads full-scale and thus, a 50 microamp panel meter gives a direct reading in milliseconds by multiplying the scale reading by ten.

When the contestant sees the LED light they press the STOP button (PB2). This pulls the pin 8 input of the latch circuit (IC1A and B) low resetting the latch. The pin 11 output immediately goes low so there will be no more base current to Q1 and it will cease conducting. Thus the LED will turn off. No more charging current will flow via D1 and R6 into C3 and the voltage across it will cease rising. Thus the meter reading will cease to rise stopping at that point indicating the contestant's reaction time.

When the latch changes state upon PB2 being pressed the pin 10 output of the latch goes high. Now C2 will begin charging via R4. After about three seconds the voltage across C2 will rise above the threshold of IC1C's joined inputs, and its output, which was initially high (because the previous low on pin 10 kept pins 1-2 low), will go low (O V).



The Reaction Timer circuit is pretty simple, based on a 4011 'quad NAND gate' package.

Capacitor C3 will then rapidly discharge via D3 and the meter reading will fall to zero, ready for the next try.

Capacitor C5 ensures the joined inputs of IC1D are low whenever the circuit is switched on, otherwise they might go high at power on (it's unpredictable), driving the output low and pulling maximum current through the meter, slamming the needle to full-scale, which isn't good for it.

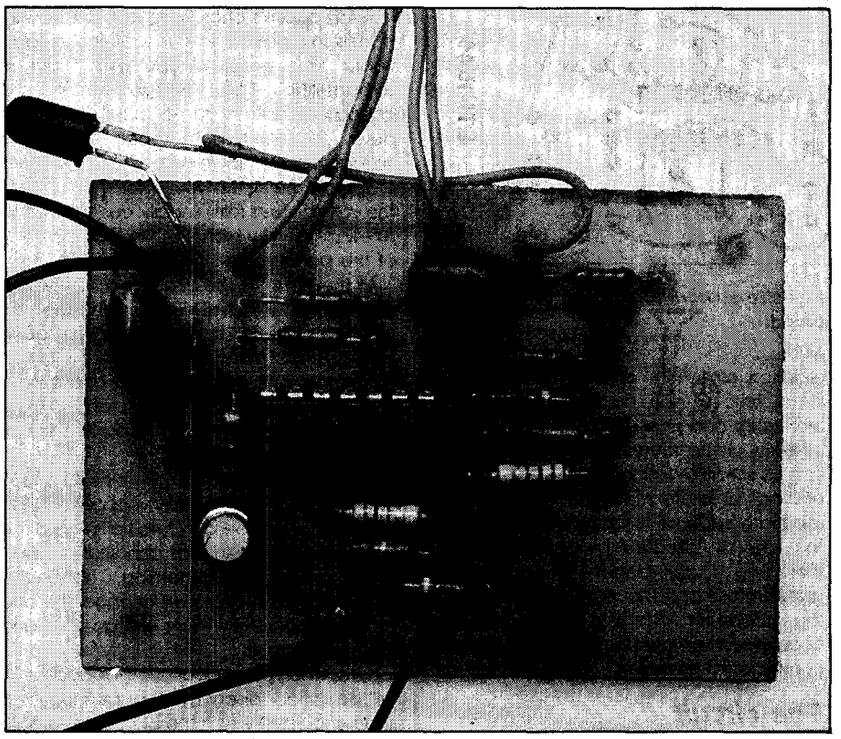
When the START button is next pushed and the latch changes state, pin 10 will go low and C2 will discharge via D2, setting the scene for automatic resetting when the contestant operates the STOP button.

The project is powered by a nine volt No. 216 transistor radio battery. No on/off switch is necessary because current drain on standby is so low that disconnecting the battery would make no significant difference to its useful life. While the circuit shows an on-off switch (SW1), it really is optional.

Construction

The printed circuit board makes assembly of this project easier, but you can make it on matrix board or something else if you prefer, because there is nothing critical about the layout.

If you're using the pc board, before assembling any components to it, give it a thorough visual check making sure that all the holes are drilled and of the correct diameter. Also, check around closely-spaced pads and tracks to see that there are no whiskers of copper causing short circuits where they shouldn't, and check for any hairline breaks in tracks – although such are rare. You should do this visual check, regardless of whether you made the board yourself, or are using a bought one.



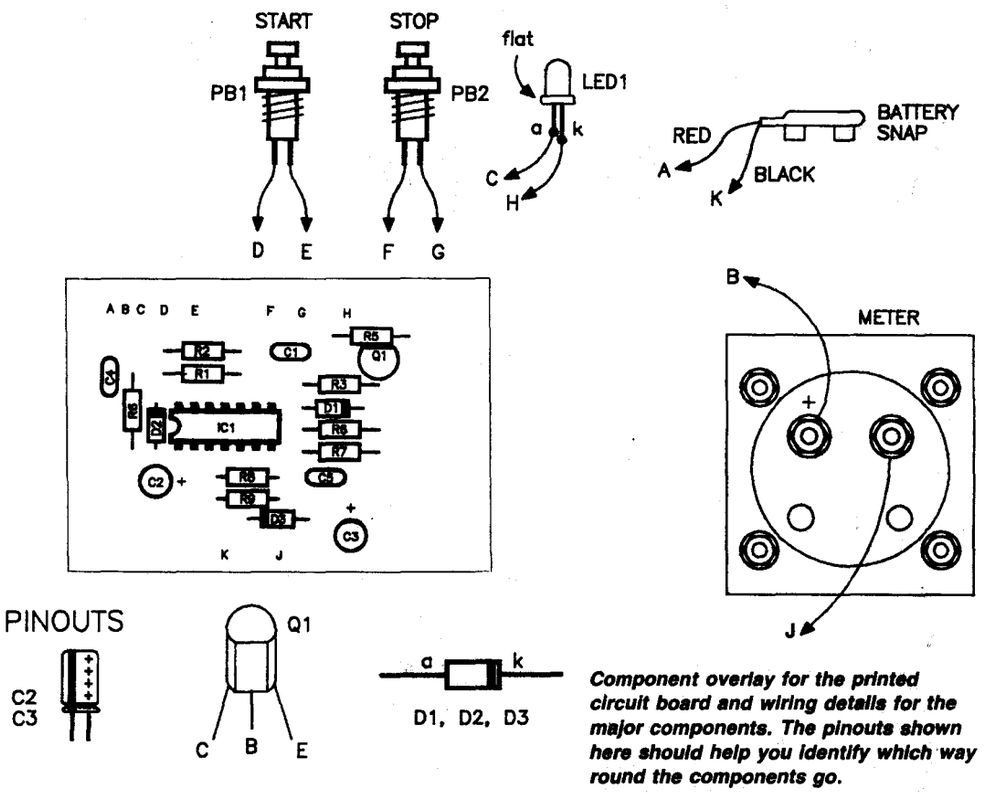
View of the completed printed circuit board. The LED was temporarily wired to the board here for testing.

The project can be housed, for convenience and a little protection, in a low-cost plastic jiffy case of a suitable size. This will depend on the meter you choose, about which, more later. The meter is mounted to the front panel, with the LED positioned where it is easily seen by the contestant. The pc board, or matrix board if you're building it on that, mounts in the bottom of the box. Twisted lengths of hookup wire lead out of the box to the START and STOP pushbutton. Cut notches in the side of the box to allow the leads to pass through, but so that screwing the front panel in place secures them. Tying knots in these leads on the inside of the box is a good idea, too.

It's best to tackle the mechanical work first and get it out of the way. Remember, centre punch or otherwise mark all hole centres before drilling. Use a fine file to clean up hole edges.

No front panel artwork has been drawn up for the project, because its operation is pretty straightforward and a Scotchcal escutcheon adds to the expense.

The components may be assembled to



Component overlay for the printed circuit board and wiring details for the major components. The pinouts shown here should help you identify which way round the components go.

the board in any order. The component overlay in the accompanying diagram shows the placement of components. Note the orientation of the diodes, the IC and the polarised capacitors. You'll probably find it easier to solder all the resistors, capacitors and diodes in place first, followed by the IC and transistor. When handling the IC, hold it by the ends, between thumb and forefinger and avoid touching the pins. Solder pins 7 and 14 first. It is a CMOS device, and while they're pretty rugged, a few precautions don't go astray. If you want to, use an IC socket instead of soldering it in place. When soldering, hold the soldering iron in place long enough so that the solder properly wets all parts of the joint, then remove it. Excessive heat can damage components.

Check the board once you've completed it. Make sure there are no little solder bridges between closely-spaced pads, particularly around the IC. Fix any suspected problems now. Once you're sure the board is OK, you can proceed to wire up the external components as the wiring diagram with the board overlay shows.

Check your work and you're ready for a tryout. Attach the battery. Press the START button. The LED will light and the meter will move rapidly up-scale. Quickly press the STOP button, the LED will go out and the meter will stop at some point on the scale. After three seconds or so, the meter reading will return to zero. If the project doesn't seem to work like this, disconnect the battery and recheck your work closely. Any errors should be easy to spot.

The project has been designed using components that are readily obtainable from the electronics retailers. However, I should draw your attention to a few points regarding the components.

The timing capacitor, C3, must be a tantalum type (as specified in the parts list) because this type has lower leakage than an electrolytic, hence holding its charge better. It's also more expensive (around 90 cents, compared to 25-30 cents for the electrolytic), but in electronics, as in most things, you get what you pay for.

Any make or shape of meter can be used. The smaller meters are less expensive but a little more difficult to read. You may even use a meter with a different full-scale value if you prefer, but if you do, you must alter the value of R9 so as to maintain constant the arithmetic product R × A, where R is the value of R9 and A is the meter current you want to represent 500 milliseconds. If A is not a number beginning with the figure 5, you may want to recalibrate the meter scale as well. This can be done carefully using a fine-pointed soft lead pencil, or a propelling pencil. eti

PARTS LIST ETI-1546

SEMICONDUCTORS
D1, D2, D3 ..... 1N914, 1N4148
IC1 ..... 4011, 4011B
LED1 ..... 5 mm red LED
Q1 ..... BC108, BC548, PN100

RESISTORS all 1/4 W, 5%
R1-R3 ..... 10k
R4 ..... 330k
R5 ..... 1k
R6 ..... 27k
R7, R8 ..... 10M
R9 ..... 100k

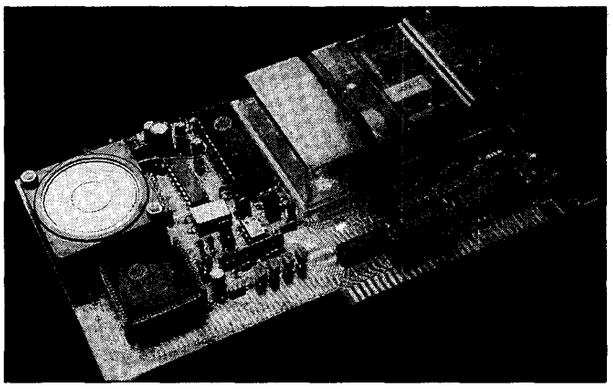
CAPACITORS
C1 ..... 100n greencap
C2 ..... 10u/16 V electro.
C3 ..... 22u/10 V tantalum
C4 ..... 100n greencap
C5 ..... 470p ceramic

MISCELLANEOUS
M1 ..... 50 uA panel meter; MU-45, MU-65 or TD-66
PB1, PB2 ..... momentary-action pushbutton
SW1 ..... miniature toggle switch (optional)
ETI-1546 pc board; plastic jiffy box – 150 × 90 × 50 mm; No. 216 9 V transistor radio battery and battery snap; hookup wire, solder etc.
Approximate cost: $34 – $39.

BUILD A 2400 BPS PC IN-MODEM

Here's an economical, easily-built high performance in-modem card for owners of PC-compatibles, featuring standard Hayes (AT) command set and 300 (V.21), 1200 (V.22) and 2400 (V.22bis) bits per second operation. It fits on a standard half-card and the kit costs just $289. Part 1 by Roger Harrison.

ELECTRONICS
ETI - 1625

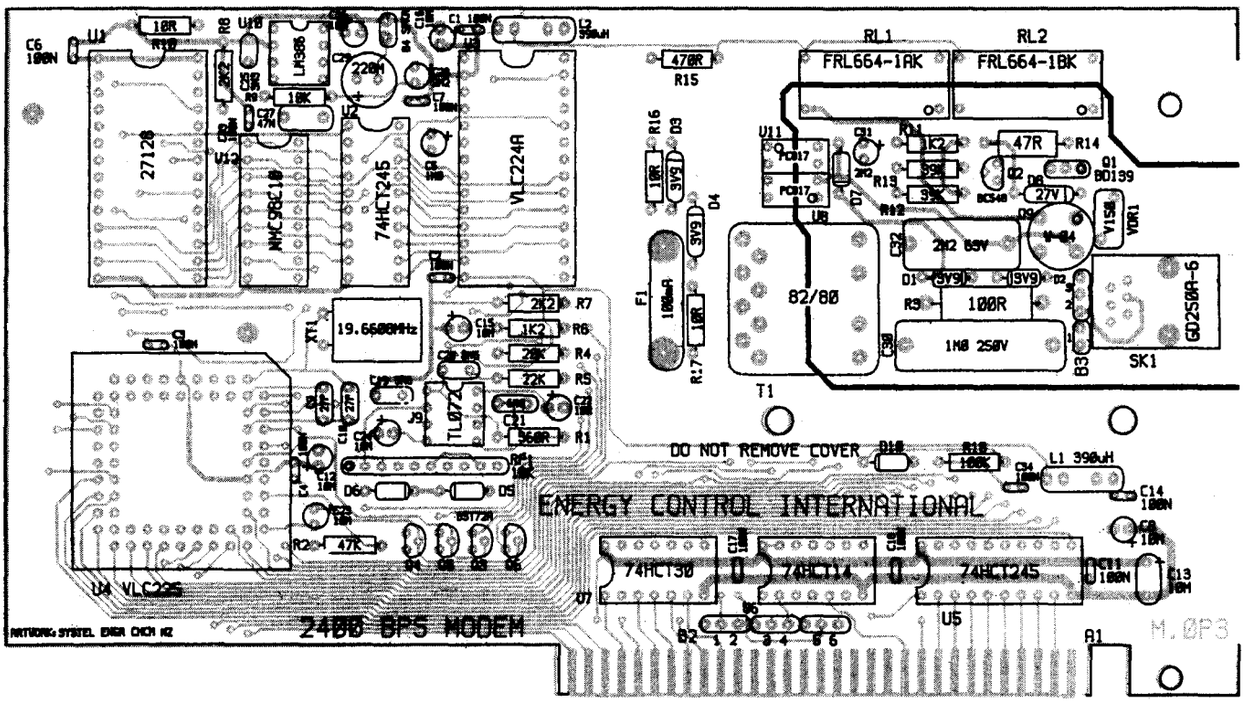


View of the completed modem. Note the clear plastic moulding covering the line interface area — it wraps around the board, covering both the component side and the track side. It is secured with two zip ties.

The virtues of computer modems have been extolled at length in the pages of this, and many other, magazines before. Suffice to say at the outset that, if you're a computer enthusiast, or a serious computer user – or even just a casual user – if you haven't discovered what you can do with a modem, and what having one can do for you, then it's high time you found out, because you're missing out! But, as I've just alluded, that's beyond the scope of this article.

Stand-alone modems abound, requiring a serial link between a free serial port on your computer and the modem input. You approach them in much the same manner as any other peripheral. But the proliferation of peripherals can prove a pain in many circumstances. Boxes of various sorts stacked around your computer with interlinking cables festooned all over the place – you know what I mean.

When IBM embarked on its fateful foray into the world of personal computers back in 1981, they did a sensible thing in giving the original PC an 'open architecture', putting connectors on the motherboard, thus



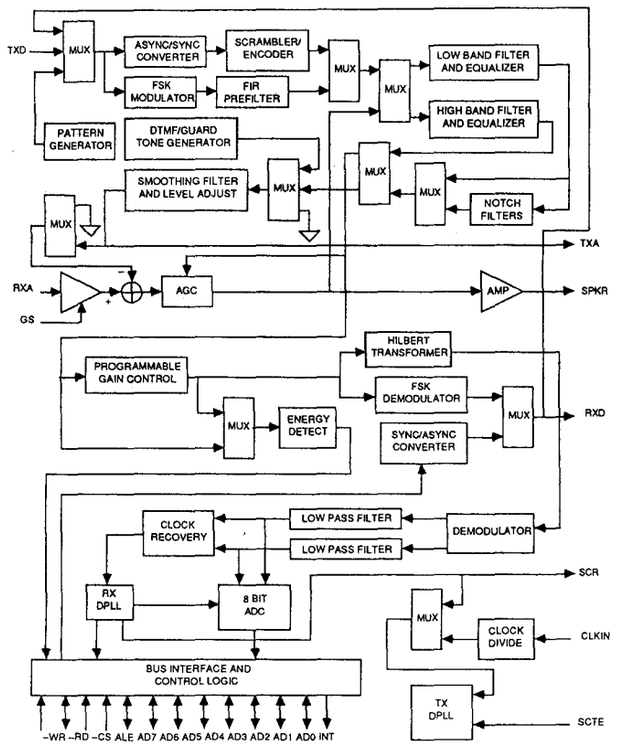


Figure 1. Block diagram of the VLC224A modem chip.

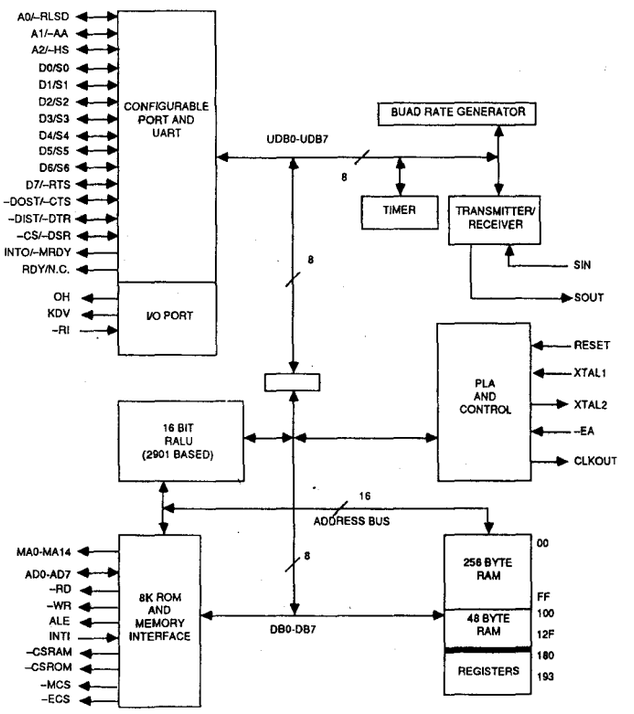


Figure 2. Block diagram of the VL7C225 advanced modem coprocessor.

allowing for add-in boards which could enhance the features and functions of the basic machine. Third-party add-in board makers were not slow to capitalise on it.

IBM's later PC models have followed the same course. And third-party board makers have trodden the path along with them. So the concept of putting a modem onto an IBM card was a natural; PC "in-modems", as they were dubbed, first appeared on the market a few years ago.

As modem technology has improved in the intervening years, it is now possible to fit all the electronics for a sophisticated, software controlled, multi-speed modem on an IBM half card, which is about 185 mm long by some 100 mm tall. This project describes such a modem.

PARTS LIST ETI-1625

SEMICONDUCTORS

D1 – D4 ..... 3V9/400 mW zener
D5-7 ..... 1N4148, 1N914
D8 ..... 27 V/1 W zener
D9 ..... WO4 bridge
D10 ..... 1N4148, 1N914
Q1 ..... BC548
Q2 ..... BD139
Q3-Q6 ..... BST72A
U1 27128
U2 ..... 74HCT245
U3 ..... VLC224A
U4 ..... VL7C225
U5 ..... 74HCT245
U6 ..... 74HCT14
U7 ..... 74HCT30
U8 ..... PC817
U9 ..... TL072
U10 ..... LM386
U11 ..... PC817

RESISTORS all 1/4 W, 5% unless noted

R1 ..... 560R
R2 ..... 47k
R3 ..... 100R, 1 W
R4 ..... 20k
R5 ..... 22k
R6 ..... 1k2
R7, R8 ..... 2k2
R9 ..... 10k
R10 ..... 10R
R11 ..... 1k2
R12, R13 ..... 39k
R14 ..... 47R, 1/2 W
R15 ..... 470R
R16, R17 ..... 10R
R18 ..... 100k
RP1 ..... 10k SIP
VDR1 ..... V150ZA1 varistor

CAPACITORS

C1 – C4 ..... 100n ceramic
C5 ..... 1u/35 V electro.
C6, C7 ..... 100n ceramic
C8 ..... 10u/10 V tant.
C9, C10 ..... 27p ceramic
C11 ..... 100n ceramic
C12, C13 ..... 100u/6 V tant.
C14 ..... 100n ceramic
C15 ..... 10u/10 V tant.
C16 ..... 10u/10 V tant.
C17, C18 ..... 100n ceramic
C19, C20 ..... 5n6 poly.
C21 ..... 6n8 poly.
C22 ..... 10u/10 V tant.
C23 ..... 10u/35 V electro.
C24 ..... 10u/10 V tant.
C25 ..... 3n3 poly.
C26 ..... 10u/10 V electro.
C27 ..... 47n poly.
C28 ..... 2u2/35 V electro.
C29 ..... 220u/16 V electro.
C30 ..... 1u/250 Vac poly.
C31 ..... 2u2/35 V electro.
C32 ..... 2u2/63 V poly.
C33, C34 ..... 100n ceramic

MISCELLANEOUS

F1 ..... 100 mA pigtail fuse
RL1 ..... Fujitsu FRL664-1AK pc-mount relay
RL2 ..... Fujitsu FRL664-1BK pc-mount relay
SK1 ..... RJ-11/6 pc-mount socket
T1 ..... 82/80 600 Ohm line isolation transformer
X1 ..... 19.6608 MHz HC36/U crystal

ETI-1625 pc board (M.OP3); 6-pin single-in-line header and jumpers (B2); TS-40 piezo speaker; two 12 mm plastic standoffs, with two 20 mm long 6 BA plastic bolts; PLCC socket for U4; IC sockets for U1, U3 and U12; cover guard for line interface area on-board, with two zip cable ties; IBM slot bracket.

Design details

The modem employs a recently-released chipset from VLSI Technology, the VLC224A and VLC225. The modem design was commissioned by VLSI's local distributor, Energy Control International, through their New Zealand office, prototypes being produced and submitted for type approval in New Zealand. Type approval for fully-assembled units of this modem was gained from New Zealand Telecom (CSA2008/89/016) prior to writing this article. Type approval from Telecom Australia was pending at press time.

The VLC224A is a complete modem IC on-a-chip compatible with CCITT V.22bis, V.22, V.21, Bell 212A and Bell 103 standards which provides full duplex communications at 2400, 1200 and 300 bits per second (bps). The CCITT standards are used in Australia and New Zealand, as well as Europe, while the Bell standards are used in the USA and a number of other overseas countries.

This device is designed to operate in conjunction with an external controller, such as the VLSI VL7C225 family of advanced modem coprocessors, or a general purpose microcontroller, such as the 8096. The controller performs all modem control and handshaking functions as well as adaptive equalisation.

Loopback testing is a feature of the VLC224A, which provides local analogue and digital, and remote digital loopback testing functions. It also features an audio output interface for audible monitoring of the phone line. Used with a VLC225 family controller, the VLC224A becomes a 'smart' modem controllable with the industry-standard Hayes AT command set. The interface between the 224A and its controller is a standard microcontroller interface that permits direct interfacing to an EEPROM which can permanently store configuration settings. A block diagram of the VLC224A modem chip is shown in Figure 1.

There are three devices in the VL7C225 modem coprocessor family – the 225, 235 and 245. The 245 is a serial device, while the 235 is a parallel device. Both have internal ROM programmmed with the Hayes AT command set. The 225 is a ROM-less version, allowing use of an external ROM for customised firmware. These controllers use a bit-slice processor to perform digital signal processing (DSP) and the control functions. The instruction set they use is a fast subset of the 8096 microcontroller instruction set. Figure 2 is a block diagram of the VLC225.

Data sheets for the VLC224A and VLC225 will be included with Part 2.

The modem circuitry is shown in Figures 3 and 4. The digital section is contained in Figure 3. The modem chip is U3, and the controller is U4. A 27128 EPROM contains the firmware – the command set software. Provision has been made for an EEPROM on-board for configuration firmware. This is U12, an NMC98C10, which was chosen for its fast access speed. Two buffers from U6, a 74HCT14, provide reset for the controller chip.

IBM COM port address configuration is provided by a set of jumpers at B2. U5 buffers the IBM data bus for the controller U4. Note

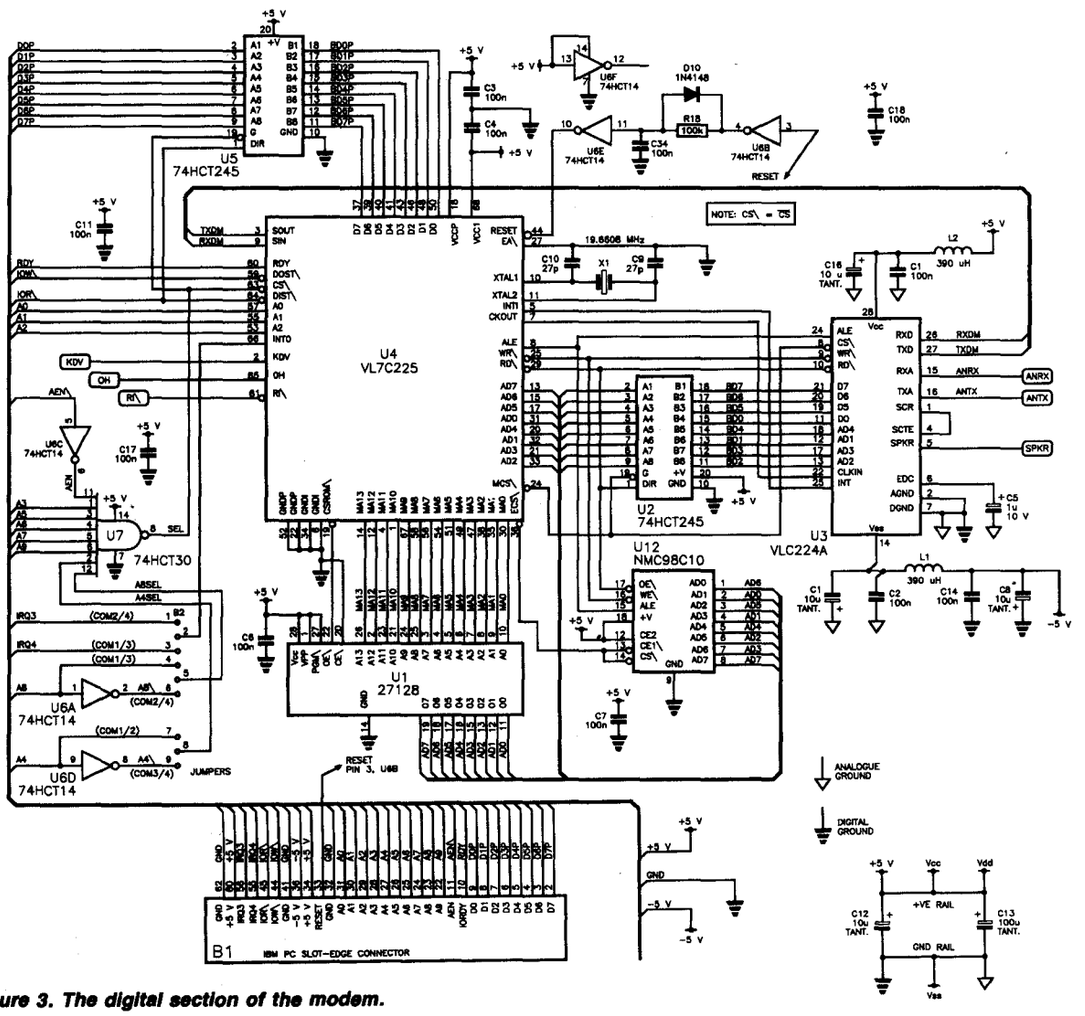


Figure 3. The digital section of the modem.

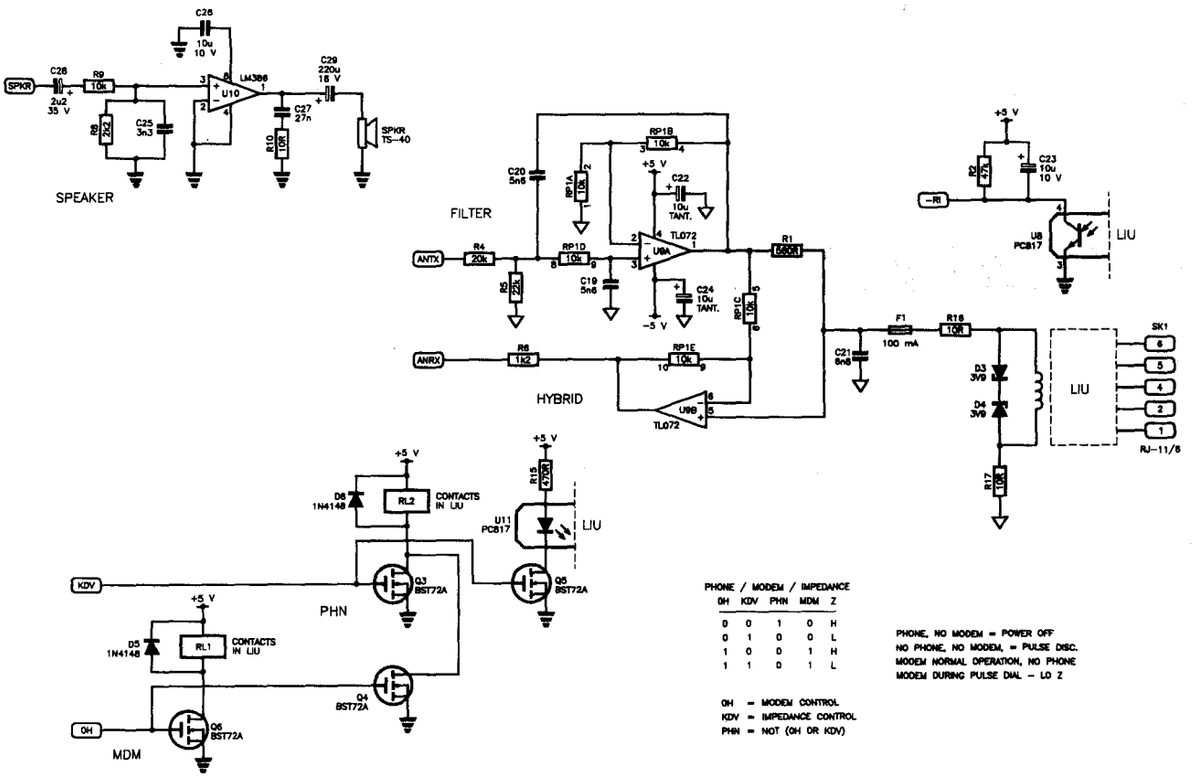


Figure 4. The analogue section of the modem. The line interface unit (LIU) circuitry is not shown as it is a proprietary circuit.

the supply rail bypassing and filter for the modem chip, U4.

The analogue section contains the transmit output filter, based around U9A, one op-amp from a TLO72, and the transmit/receive hybrid, U9B, the other op-amp from the TLO72.

Speaker output is provided by U10, and LM386 audio amp. It is driven directly from the SPKR output pin (5) of the modem chip, U4. A piezo speaker mounted on standoffs on the board provides the audible output.

The relay driver sections marked MDM and PHN control the line interface on-hook (OH) and dialling relays for the auto-answer and auto-dial functions. Optocouplers U8 and U11 interface ring indicator and auto-answer functions of the LIU.

Assembling it

The modem is assembled on a double-sided, through-hole plated pc board. Energy Control has retained copyright, so we have not reproduced the artwork – not that it would be possible to make one using typical homebrew pc board methods anyway. The board is solder-masked and the component side is silk-screen annotated. To assemble it, you'll need a fine-pointed, preferably temperature-controlled, soldering iron.

Familiarise yourself with the pc board before starting. The accompanying overlay diagram matches the annotation on the board. Solder all the small components in place first, followed by the IC sockets. Then follow with the larger components. As usual, watch the orientation of the semiconductors and the polarised capacitors. Check your work as it progresses.

With the board completed, you're ready for checking and setup, which comes in Part 2, next month.

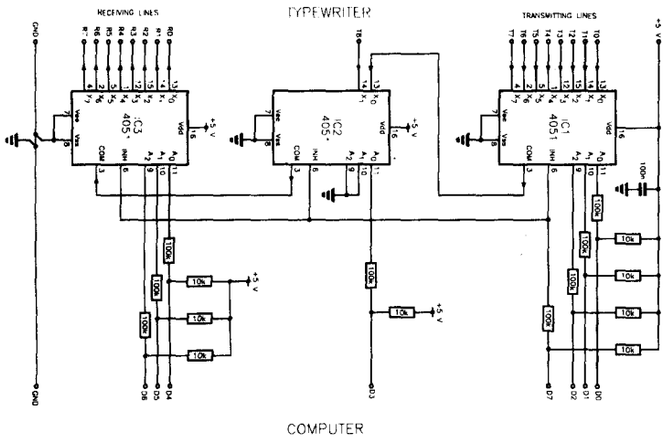
Kits, containing all the specialised components for this project, are available from Energy Control International, 26 Boron St, Sumner Park, Qld 4074 ☎ (07)376-2955, and FT Promotions, PO Box 547, Rozelle NSW 2039 ☎ (02)818-4838. Cost is $289; built-up units cost $399.

BIBLIOGRAPHY

Modern Modem Technology, by Roger Harrison, Jamye Harrison and Adam Searle. Part 1 – ETI, May 1989; Part 2 – ETI, June 1989.
The Turbo Modem, by Roger Harrison. ETI, May 1989.

INGENUITY

Circuits



Pseudo printer

GOT an electric typewriter but can't type? This circuit lets your computer do the typing for you. It allows the computer to perform any action that can be done by pressing keys, one at a time, on the typewriter. Little modification of the typewriter is required and its normal operation is not affected.

This idea came from a circuit published in FeedForward in January of this year entitled Pseudo Co-processing. The basis of this idea is that the keyboard switches on computers (and on electronic typewriters) are usually arranged as a matrix. Each switch shorts one transmitter line to one receiver line. By using analogue multiplexers it is possible to selectively connect any of the transmitter lines to any of the receiver lines and so simulate pressing any key.

The typewriter which was converted was a Panasonic KX-R200. It was lucky that all operations on this typewriter can be performed without having to press two keys at once. This was because the shift lock key was not mechanically interlocked. If this had not been the case an extra control line would have been required.

A bit of delicate disassembling of the typewriter showed that there were nine transmitting and eight receiving lines. The circuitry was TTL-based and there was no trouble in tapping the power rails.

There was a choice in bringing out of the typewriter all the matrix connections or placing the circuit inside and only bringing out the control lines. The latter is neater but the former was chosen as it made testing easier and reduced the number of times the typewriter had to be disassembled. Ribbon cable was used to connect the two keyboard connectors to a DB25 connector mounted on the case.

The circuit uses three 4051 CMOS analogue multiplexers. These feature an INHIBIT line which is controlled by a separate data line. Pullup resistors are used to allow interfacing to TTL-level inputs as well as for disabling the multiplexers when the computer was not connected and so allowing normal operation of the typewriter. The relationship between the data inputs and the key pressed is best determined empirically.

The drawbacks with this circuit are that you will have to write a program to convert ASCII files into typewriter code, that single-use carbon typewriter ribbons are very expensive, that printing is very slow (about 10 cps), and finally that all the timing must be handled by the software as there is no feedback.

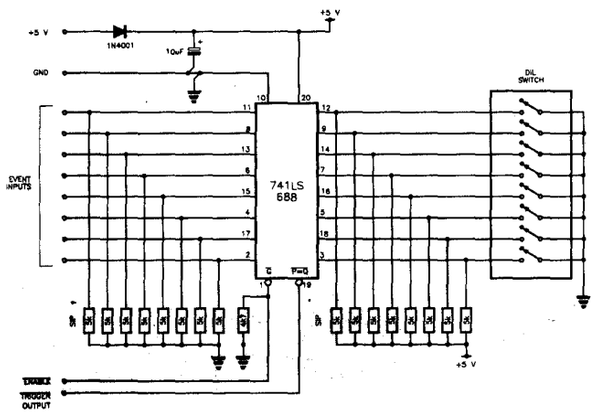
In writing the software, note that a key must be pressed for a certain minimum period (in the region of 50 ms), before the typewriter registers it. However, if it is kept down too long, the typewriter autorepeats. Note also that extra time must be allowed while in bold or underline modes.

The advantage of this circuit is that for the price of a few cheap ICs and a bit of effort, you get a simple printer with an output print quality second to none. Here's your chance to get something for practically nothing!

Wen Liang Soong,
Fullarton, S.A.

Idea of the month

Simple digital event trigger)



THIS is an extremely simple gadget which has proven most useful for fault-finding digital circuits.

By hooking its eight inputs to, say, the eight bits of a data bus, and its ENABLE to an active low WRITE, the device can trigger an oscilloscope whenever, for example, a CPU attempts to WRITE any number which matches the binary pattern on the DIP switches.

By connecting the TRIGGER output of one device to the ENABLE input of another, two or more units can be cascaded, so that they can be used to trigger a greater number of events, such as a 16- or 32-bit address bus.

The whole thing fits easily inside a 50 × 50 × 25 mm plastic box, and I used tiny test hooks on each of the leads so I could snap them to individual IC legs.

B. Woolfrey,
Lane Cove, NSW.

Programs

```
*** RESTORE FOR VZ-200/300 ***
1 DATA 237,91,33,121,205,44,27,210,217,3
0,11,237,67,255,120,201
2 FORQ=31389TO31404:READA:POKEQ,A:NEXT
3 POKE30862,157:POKE30863,122
```

Hint for VZ-200/300

EVER wanted to restore to a particular line number? This short routine will let you do it. In VZ basic, RESTORE simply sets the DATA LINE POINTER to the byte before the first program line. This routine makes the line number in the statement X=USR (line number) and calls a ROM routine to find the line in memory. It then moves back one byte, and stores this as the new DATA LINE POINTER.

An undefined statement error is given if no such line exists. This routine is stored in the cassette name buffer, but can be stored anywhere in memory.

Shane Rowe,
Spring Hill, Qld.

```
0 REM HEX/DEC TO DEC/HEX CONVERSION  WRITTEN BY DAVID MAUNDER.
1 REM  [C]COPYRIGHT 0[illegible]/04/89 .THIS PROGRAM JUST CONVERTS
2 REM  HEXADECIMAL TO DECIMAL AND VICE VERSA .IT IS WRITTEN
3 REM  FOR THE VZ-200 AND VZ-300 BUT CAN BE VERY EASILY ADAPTED
4 REM  TO OTHER MACHINES
5 REM------------------------
6 H$="0123456789ABCDEF":EF%=0:ER$="?ERROR":FF=65536
7 CLS:PRINT"[illegible]"
8 PRINT"WRITTEN BY D.MAUNDER"
9 PRINT
10 PRINT"WHICH:"
11 PRINT"      1 HEXADECIMAL TO DECIMAL"
12 PRINT"      2 DECIMAL TO HEXADECIMAL"
13 PRINT"      3 QUIT"
14 INPUT"?";A
15 IFA=1THEN19
16 IFA=2THEN28
17 IFA=3THENPOKE30845,199
18 GOTO7
19 CLS:
20 PRINT"      HEXADECIMAL TO DECIMAL"
21 PRINT"  RETN = CONTINUE      - = ABORT"
22 PRINT:INPUT"HEX#";H$:IFH$="-"THEN7
23 GOSUB40:IFEF%THENPRINTER$:GOTO22ELSEPRINT"DEC#=";D
24 0$=INKEY$:0$=INKEY$:IF0$=""THEN24
25 IF0$="-"THEN7
26 IF0$=CHR$(13)THEN22
27 GOTO24
28 CLS
29 PRINT"      DECIMAL TO HEXADECIMAL"
30 PRINT"  RETN = CONTINUE      - = ABORT"
31 PRINT:INPUT"DEC#";N
32 IFN<0ORN>65535THENPRINTER$:GOTO31
33 FORI=1TO4:GOSUB46:NEXT
34 PRINT"HEX#=";N$
35 N$=""
36 0$=INKEY$:0$=INKEY$:IF0$=""THEN36
37 IF0$="-"THEN7
38 IF0$=CHR$(13)THEN31
39 GOTO36
40 EF%=0:D=0:LN%=LEN(H$):IFLN%>4THEN45
41 FORI%=1TOLN%:B$=MID$(H$,I%,1)
42 IF(B$=>"0"ANDB$=<"9")OR(B$=>"A"ANDB$=<"F")THEN43ELSE45
43 J%=ASC(B$)-48:IFJ%>9THENJ%=J%-7
44 D=D*16+J%:NEXT:RETURN
45 EF%=1:RETURN
46 EF%=0
47 A=INT(N/16):Z=N-16*A:N$=MID$(H$,(Z+1),1)+N$:N=A:RETURN
```

Hex/dec and dec/hex conversion

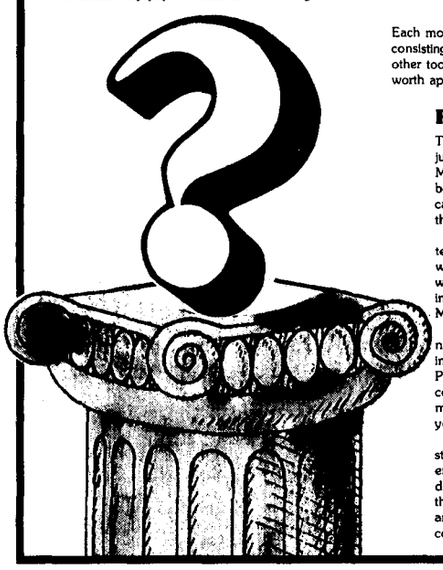
THIS short VZ listing does exactly what the name suggests and it can easily be adopted to other machines.

David Maunder,
Quirindi, NSW.

"IDEA OF THE MONTH" CONTEST

TO WIN THIS $150 KIT ENTER NOW!

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, proudly sponsors this contest with a prize given away every month for the best item submitted for publication in the "Ideas for Experimenters" column — one of the most consistently popular features in ETI magazine.



Each month we will be giving away a Scope Presentation Tool Kit, consisting of a Scope Soldering Iron, a Desoldering Tool and various other tools from Scope all neatly presented in a tough durable tool roll worth approximately $150.00

RULES

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each coupon. Photostats or clearly written copies will be accepted. You may send as many entries as you wish.

This contest is invalid in states where locals laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

COUPON

Cut and send to: **Scope-ETI 'Idea of the Month' Contest, ETI Magazine, PO Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea/program in ETI Magazine or other publications produced by it. I declare that the attached idea/program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."

* Breach of copyright is now a criminal offence.

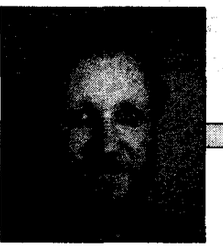
Title of idea/program .....

Signature ..... **Date** .....

Name .....

Address .....

..... **Postcode** .....



ROGER HARRISON

ANSWERS & ARGUMENTS

This column is intended as a forum for exchange between you, the readers, and the magazine. Via this column I'll answer queries on projects, general questions on electronics and related subjects that may puzzle or concern you, engage in a little argument on topics of interest, or discuss subjects you might like raised. It's up to you! Short letters will be appreciated, long ones may be edited; if asking questions, confine your letter to one or two topics please. Send your letters to: Locked Bag 888, Rozelle NSW 2039.

More on rotators

I like your article on antenna rotators (*Swing That Beam*, July ETI, page 37). However, could you point me towards any other material or background articles on the subject, and suppliers' addresses?

P.D.,
Brisbane, Qld

Two background sources were used to compile the article, in addition to literature from manufacturers: firstly, the "Antenna Handbook" published by the American Radio Relay League, and an article published in a local amateur radio magazine, "6UP", in 1985 (which I edited), titled "Antenna Rotator Systems" written by Steve Mahony VK5AIM. You can purchase a copy of the latest edition of the ARRL Antenna Handbook from:
Stewart Electronic Components
PO Box 281
OAKLEIGH Vic 3166
☎ (03)543-3733

The following companies supply antenna rotators:
Arista Electronics
PO Box 191
LIDCOMBE NSW 2141
☎ (02)648-3488
ATN Antennas
56 Campbell St
BIRCHIP Vic 3483
☎ (054)92-2224
Emtronics
PO Box K21 .
HAYMARKET NSW 2000
☎ (02)211-0988

For articles on the subject, I suggest you go to your state public library and look up journals such as "Amateur Radio" published by the Wireless Institute of Australia, or "QST" published by the ARRL, and "73 Magazine", "Ham Radio" magazine and "CQ" magazine – all US-published amateur radio magazines. Good luck!

Frequency lists

In 1983-84 your company published a magazine titled *Scanner's World*. I have the first copy. This issue contained a comprehensive list of frequencies for anyone interested in scanners. I would very much like to know if an updated list of frequencies is available. If not, could you put me in contact with someone who can provide such a list? I am particularly interested in Tasmanian frequencies.

W.S.,
Glenorchy, Tas.

Scanner's World was, in fact, a book – a one-off publication, or one shot, as they're known in the trade. Indeed, I edited Scanner's World. In the intervening years, there would have been quite a few changes to the frequency lists. Lists of frequencies and users covering the VHF and UHF bands for each state have been compiled by a company in South Australia. Known as "Frequency Registers", they can be obtained from:
Captain Communications
28 Parkes St
PARRAMATTA NSW 2150
☎ (02) 633-4333

If you're interested in the HF spectrum, below 30 MHz, and many scanners cover well down into this region, Australian Monitoring Services, a group of shortwave enthusiasts, publishes "The Australian Shortwave Guide". You can contact them via:
GPO Box 2143T
Melbourne Vic 3001

Clock problem

I have a digital wall clock that runs from mains power, but it loses time at a constant rate. It registers four minutes for every five minutes that have really passed.

My problem is that I want to speed the clock up quite considerably so that it shows one hour has passed for every ten minutes that have really passed. It is a *Micronta* brand, sold at Tandy Electronics stores, cat. no. 63-805.

It is to be placed in a model railway setup, that's why I want it to run fast!

How can I go about this electronically?

N.V.,
Clarence Gardens, S.A.

I believe your clock would be driven by a synchronous motor of some sort. That is, its speed of rotation is synchronised with the ac supply powering it. In this case, however, it seems the clock was destined for a country that uses 60 Hz ac mains (e.g: the USA), not 50 Hz as used in Australia. Thus, it will run at 5/6ths the speed intended, losing 10 minutes every hour! I wonder how many other customers have discovered this characteristic?

To drive the clock with a source of 360 Hz requires either a power

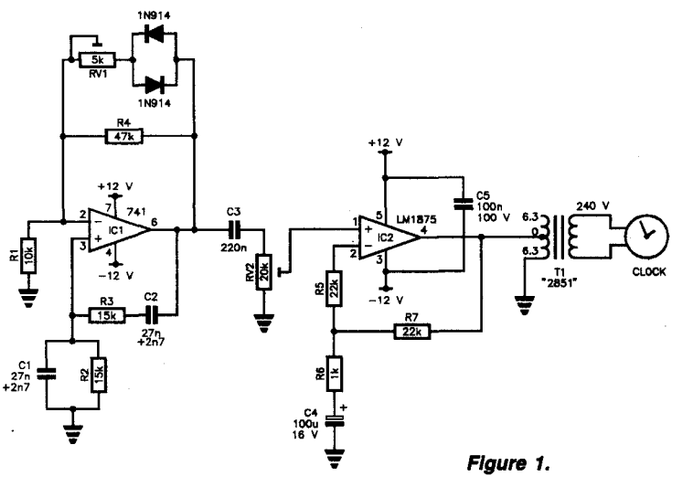


Figure 1.

oscillator or an oscillator/power amp arrangement, driving the clock through a transformer. The technique I have opted for here is the oscillator/power amplifier arrangement as per the circuit in Figure 1.

IC1 is a simple Wein Bridge oscillator, designed to operate at 360 Hz (or very close). Its output drives an LM1875 audio power amp, IC2. The output of IC2 then drives your clock via a reverse connected power transformer, T1 – a type 2851 transformer having a 6.3-0-6.3 V secondary and 240 V primary. Here it is operated way above its design frequency, but as it only has a small core and is lightly loaded, it should cope.

I could have configured IC2 as a power oscillator, but this circuit provides more control over the parameters for you. For a purpose-built circuit, a power oscillator and specially designed transformer would be the way to go. Figure 1 uses off-the-shelf components, however.

The oscillator's feedback is adjusted by RV1, and this controls the distortion – which is probably of not too much concern in this application. Set RV1 so the circuit oscillates reliably and the clock motor works OK – I'm punting on it working at this frequency, not knowing what sort of synchronous motor it is, although a colleague of mine I consulted was of the opinion it would work.

The voltage at the new secondary of T1 can be adjusted by RV2, the level control. If you get enough volts at T1 (not necessarily 240 Vac) to turn the clock motor reliably, you're in business.

To help you a little more, a pc board – even a kit – is available for the LM1875 amplifier. Contact our correspondent Graham Dicker, at:
PC Computers
36 Regent St
KENSINGTON S.A. 5068
☎ (08)332-6513
Ask for the LM1875 amplifier kit.

A subject to dwell on

I'm a keen "do-it-yourself" enthusiast in everything, from astronomy to Zen! That includes, cooking, electronics and motor car maintenance. I once read a book on "Zen and the Art of Motorcycle Maintenance". Great stuff!

I want to make myself a *dwell meter* to service my couple of cars (lovingly restored). Can you dredge up a simple circuit – I've seen a few elaborate ones – that shows dwell on a panel meter?

R.L.,
Meadowbank, NSW.

How many Zen Buddhists does it take to change a tyre? Answer – two. One to change it, and one not to change it!

Right, one simple dwell meter – coming up! See Figure 2, here. For those not familiar with the term dwell, or dwell angle, this relates to the rotation of the distributor cam shaft and is a measure of the period for which the points remain closed during one revolution of the cam.

The gap between the points, when open, determines how long the points remain closed – or dwell – during rotation of the distributor cam. The narrower the gap, the longer they remain closed during rotation of the shaft, or in other words, they remain closed for a greater angle of one complete rotation – the dwell angle.

For the benefit of other readers, the points gap is adjusted by means of a small set screw and must be set accurately for correct timing of the engine and to give the ignition coil primary sufficient time to energise ready for each spark (which happens when the points open and the current through the coil is interrupted).

The manufacturer's specification for points gap sets the dwell angle fairly accurately when the points are new, but when they become worn, the dwell angle will be incorrect. A measurement of dwell angle is the only really accurate way to set the points.

The Figure 2 circuit shows the simplest way to measure dwell angle with a moving-coil panel meter. The battery voltage is regulated by a 6 V zener diode to provide a steady voltage reference for the metering circuit.

When the points close, current flows through the meter and the series resistors RV1-R2-R3 to the chassis (earth). The potentiometer RV1 is adjusted for full-scale reading on the meter with the points permanently closed (engine OFF, turn motor over by hand). As the meter reads average current, it will accurately display the ratio of the time the points are closed to the time they are open, which is a direct measure of the dwell angle.

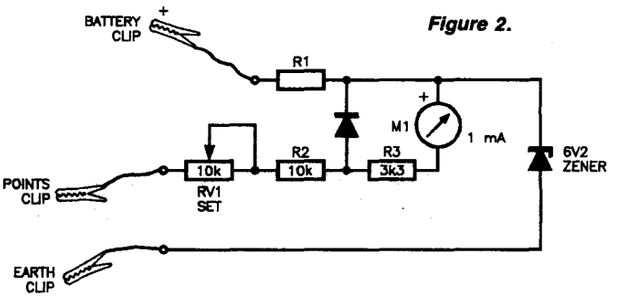


Figure 2.

Diode D1 provides protection for the meter from the substantial negative voltage pulse that appears across the points just as they open, caused by the inductance of the ignition coil primary. Current from this pulse will flow via D1-R2-RV1. Diode D1 will conduct, most of the current flowing through it rather than through R3 and the meter.

The meter calibration is different for each type of engine. A 4-cylinder engine has a maximum of 90° of cam rotation for which the points can be closed (because there are four lobes on the cam and 360° divided by four is 90°). For a 6-cylinder engine, with six lobes on the cam, it is 60°, and for an 8-cylinder engine it is 45° (which is why you can halve the 0-90° scale when measuring dwell on an 8-cylinder engine).

The manufacturer's specification for dwell angle will usually be between half and two-thirds of the maximum time the points can be closed.

Divide your meter scale into six equal segments. If full-scale is 90°, half-scale is 45° and each mark is at 15 degree intervals. That's for a 4-cylinder motor. For a 6-cylinder motor, full-scale is 60°, half-scale is 30° and each mark is at 10 degree intervals. For an 8-cylinder motor, simply halve the 4-cylinder scale values – full-scale is 45°, each mark is at 7.5 degree intervals.

Keeping abreast

Magazines such as ETI help people in the industry keep abreast of recent developments and, as such, you should be congratulated.

Australians need to be better than the rest when it comes to electronics and electrical engineering to survive in the marketplace. We may not be able to do it big, but we *can* do it better!

P.S.,
Brisbane, Qld.

Hear, hear!

WA suppliers

I think ETI's a great magazine, but how about including some more alternatives for West Australian residents when you list kit & project parts suppliers? Possibly see if you could get someone over here to supply single pc boards shown in kits.

J.S.,
Mt Lawley, W.A.

Well, you've not got a lot of choice over there! Basically, it comes down to Altronics, Dick Smith Electronics and Radiospares Components. If there's anyone else – please put your hand up! I've tramped the suburbs of Perth on occasions myself, looking for suppliers, and asked around the traps – but, as I said, there's not a lot of choice.

As for single pc boards, your nearest outlet is All Electronic Components in Melbourne. The largest manufacturer of project pc boards in Australia is Jemal, located in Victoria Park, Perth. But as a manufacturer, they're not set up for one-off sales. So it's back to mail/phone/fax for ordering your requirements.

ELECTRONICS

ETI PROJECT BUYERS' GUIDE

Readers who've been with us a while will remember this column from earlier years. For those who have only recently become readers, we're resurrecting *Shoparound* to let you know which firms are stocking kits for current projects published in the magazine, those firms stocking printed circuit boards, and companies that carry components used in projects we've published.

Electronics retailers and other suppliers are circulated with information on projects to be published in ETI some three months in advance of publication. This is then checked as close as possible to the date this column has to be prepared, but there is still a time lag of around six weeks before the magazine appears and this may affect the availability of a particular component and thus the availability of a kit. This is something entirely beyond our control, and often beyond the suppliers' control. The information supplied in this column is as accurate as we can ascertain at the time of writing.

ETI-1546 Reaction Timer

This novel, simple-to-build project was designed so that all commonly available parts were used. So, you favourite electronics retailer should be able to supply you with all your requirements. For printed circuit boards, see the item at the end of this column.

You might like to do a bit of selecting when it comes to the START and STOP pushbuttons. A wide variety are available on the different retailers' shelves and you might try before you buy to get pushbuttons to suit you. Make sure they are the momentary action variety, though.

ETI-1625 PC In-modem

Short form kits for this project, containing all the critical components – modem chipset ICs, the special line interface components, pc board etc, are obtainable from Energy Control International at 26 Boron St, Sumner Park Qld 4074, ☎ (07)376-2955. Cost is $289.

Fully-built units are also available, for $399, from Energy Control International, and also from FT Promotions, PO Box 547, Rozelle NSW 2039, ☎ (02)818-4838.

ETI-748 RF Power Monitor

An ideal beginners' project. And, in keeping with that, all the components are widely available from electronics retailers.

All the semiconductors are commonly stocked items. Some retailers do not carry RF chokes, however, so your may need to hunt around a little to find a supplier. We note Dick Smith Electronics list a 470 uH RF choke, catalogue number L-1811. The 10-LED bargraph used came from Rod Irving Electronics, who list it as catalogue number Z10180.

For the printed circuit board and perhaps a Scotchcal label, see the next item.

PCBs and panels

Printed circuit boards for ETI projects are generally obtainable from three suppliers:
All Electronic Components,
118-122 Lonsdale St,
MELBOURNE Vic 3000,
☎ (03)662-1381.
Acetronics,
112 Robertson Rd,
BASS HILL NSW 2197,
☎ (02)645-1241.
RCS Radio,
651 Forest Rd,
BEXLEY NSW 2207,
☎ (02)587-3491.

However, these firms are not able to supply boards for projects where the pc board copyright is retained by the author or kit supplier.

Don't forget that Scotchcals of front panels and meter scales, etc can also be supplied, where available, by the above firms.

BOOK REVIEW

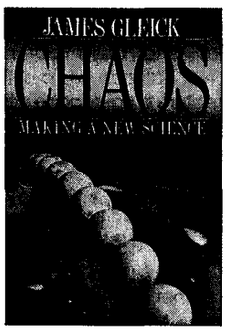
CHAOS — MAKING A NEW SCIENCE

In 1960, in a small office of the Massachusetts Institute of Technology, Edward Lorenz was modelling global weather changes using a computer made up of a mass of wires and vacuum tubes. Reams of printout contained numbers (a day's weather took a minute to compute) and primitive graphs.

During the early 1970s, Australian-born Robert May applied his background as a theoretical physicist to the modelling of biological populations at Princeton University. At about the same time, physicists Harry Swinney and Jerry Gollub were studying the transition from laminar to turbulent fluid flow using the precise techniques they had learned from the study of phase transitions.

In these and in other experiments, involving everything from pendulums to cotton prices to the pattern of electrical current on the surface of the human heart as it beats, subtle and yet surprisingly complex patterns have been discovered in the data that have, in effect, created an entirely new science – chaos.

James Gleick's book *Chaos – Making a New Science*, is the most definitive book yet on the subject. Gleick traces the history of the above-mentioned and other scientific research projects rather like a historian would chart adventures. Physicists study fluid dynamics or demographics, a mathematician studies computer communications and commodity prices – even Jupiter's Red Spot gets a mention.



This style works very well because the research documented is very much a process of discovery. Many of the researchers are highly individualistic, and the unique backgrounds of many that have enabled them to make these discoveries paint a stark contrast to the almost clone-like conformity the business world sometimes expects of its members. This makes the book very readable for the scientifically inclined, but it is not achieved by sacrificing discussion of the scientific concepts involved.

What ties all of these diverse research programs together is "chaos": For example, in many experiments the predictable did not occur.

Lorenz had expected that small changes to the inputs to a model of the earth's weather would make insignificant changes to the outputs. The alterations were, however, dramatic. In what was later to be termed "the butterfly effect", he proposed that even if atmospheric measurements were made at every square foot of the earth's surface and every foot going up to the limit of the atmosphere, even such a minor fluctuation as the turbulence caused by the wing of a butterfly between the measurement points would totally change the weather from what it would otherwise have been, in a few months' time.

A number of laboratory experiments had long been known to give non-deterministic results. Conventional thinking held that with a more precise knowledge of the initial conditions, the behaviour of the systems could be exactly determined. Many of these researchers have, however, convincingly illustrated that the behaviour of many such systems is inherently indeterminable.

What I find most fascinating is that while they are examples of order giving way to chaos, chaos also gives way to order.

Robert May discovered in his modelling of biological populations that when the growth rate factor was high enough, the resulting seasonal population numbers were chaotic. But the factor above which this population was chaotic could be precisely determined.

The graphing of some types of non-deterministic behaviour would reveal patterns that would never repeat themselves, yet remain within observable boundaries. The forms produced when such phenomena were graphed were given the name *strange attractors*.

For those with a natural curiosity about scientific matters, the book contains a number of interesting mathematical questions and anecdotes. For example, how long is a coastline?

A trivial question? Not really. Suppose one follows the coastline, counting the number of intervals that are separated by a straight-line distance of one kilometre. The result would be a measurement of the coastline in kilometres. However, if the process was repeated using an interval of one metre, a very different length would be measured. Continuing to reduce the unit of measurement would continue to increase the length of coastline until one approached infinity.

Gleick also covers items like Cantor dust, the Sierpinski carpet and the Menger sponge. Most of these were discovered at the beginning of the century, but without an obvious application appeared to be destined to the museum of interesting but useless ideas.

Chaos presents a number of discoveries that have small but perceptible ramifications for the study of just about every field of science. But it doesn't stop there.

The existence of physical phenomena that produce outcomes which cannot be determined, combined with the discovery of laws to which behaviour, otherwise described as chaotic, obeys, raises an interesting philosophical point. Whether the life and behaviour of every member of the human race has been preordained or is under the control of each individual's freewill has always been a central question in the study of philosophy.

The book makes no reference to this issue, but the evidence almost forces the reader to give it some thought.

Finally, turning our attention to our own field, electronics, a few points will raise themselves in the minds of the readers. The first is the growing acceptability of the computer as an essential tool of research in every field of science. Almost without exception, the experiments described in the book were done with the aid of the computer. ETI

Reviewed by Stephen Coates.

Published by the Penguin Group, 1988. Price $14.99.

SEMICONDUCTOR WATCH

Roger Harrison reports on what's happening in the world of semiconductors.

Dragonkat chips ▶

THE new advanced single-chip 8-bit microprocessor from Motorola Semiconductors HK Ltd, called 'Dragonkat', has won the 1st Hong Kong Governor's Award for Industry – Machinery/ Equipment Design 1989.

Said to have the power to drive an entire microcomputer system on a single chip, the 'Dragonkat' contains 93,000 devices packed in a 128-pin QFP package.

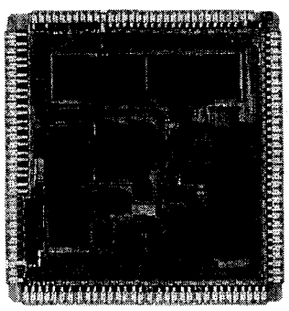
According to the manufacturers, its high level of integration will lead to the development of new products not technically possible before. It is also the first time such a sophisticated device has been developed in Hong Kong by Hong Kong people.

Dragonkat is expected to be used in miniaturised end products like hand-held personal organisers, advanced pagers, portable telecom equipment and multi-language translators, among others.

The chip's ROM can be programmed by the user for greater design flexibility. Also, the built-in phase lock loop (PLL) circuit can change the internal bus speed by software, reducing power consumption and prolonging battery life.

The device automatically alters its frequency to match the amount of power needed by the function being performed.

There is a Self Test mode, which allows the manufacturer of an end product to test the system quickly and efficiently, and an



inbuilt keyboard interrupt that frees the CPU from keyboard scanning to execute a more useful program.

Communication with externals through the MCU is facilitated through a built-in asynchronous serial communication interface.

Dragonkat also has 16-bit multiplexed address lines and 8-bit non-multiplexed data bus for full 64K byte memory access. Memory switching methodology enables the device to address over 1 megabyte of memory space.

Further information can be obtained from your local Motorola Semiconductor Sales office or an authorised Motorola distributor.

READER INFO No. 266

Improved LED display driver

AN improvement on the industry standard part, the Maxim ICM7218/ICM7228 includes on chip two types of seven segment decoders, multiplex scan circuitry, segment and digit drivers. An 8K x 8 static memory is also included.

Both the ICM7218A and the ICM7228B accept data in a serial format and drive common anode or cathode displays. They also feature a no decode where each individual segment can be independently controlled.

The ICM7218C and the ICM7218D accept data in a parallel format and also drive common anode or cathode displays.

For further information contact Maxim's Australian distributor, Veltek Pty Ltd. Speak to Geoff Nell the Customer Service Manager on ☎ (03) 808-7511.

READER INFO No. 267

Single chip fax modem IC

THE YM7109 LSI from Yamaha is a CMOS one-chip modem for half duplex synchronous data transfer at 9600 bps, 4800 bps, 2400 bps and 300 bps.

Designed for use in a public telephone system, the device is said to be ideal for modem applications for a Group 3 (G3) fax machine. It incorporates a built-in programmable dual tone originating function and programmable tone detection function.

A built-in interface register which can connect to the data bus of a microprocessor is also featured on the YM7109. Through this register the operating mode and various parameters can be set by the microprocessor.

It can also read status flags and transfer the data to be transmitted or received. The transfer, transmission and receiving of data and modem operation is also possible through a serial interface.

Available in a 40-pin DIL, 68-pin PLCC and 44-pin QFP, the YM7109 features CMOS 5 V operation and lower power consumption.

More information is available from Energy Control International, 26 Boron Street, Sumner Park Qld 4074. ☎ (07) 3376-2955.

READER INFO No. 268

New SRAMs

NEW 12- and 15-nsec devices from VLSI Technology are targeted at the fast cache workloads required by the newer high-frequency RISC and CISC microprocessors; 15-nsec speeds are achieved with +/– 10% power supplies.

Twelve and 15-nsec versions of the VT20C19 2K x 8 and VT20C79 4K x 4 are available. Each features fast chip-select and output enable control. The VT20C69 4K x 4 offering a fast chip-select feature is also available.

Speed improvements on these devices were gained through VLSI's new 1-micron MOS process. They are all available in either 300 mil DIP packages or 300 mil SOJ packages, with full JEDEC standard pinouts.

Further enquiries are directed to VLSI's Australian agent, Energy Control International, 26 Boron Street, Sumner Park Qld 4074. ☎ (07) 376-2955.

READER INFO No. 269

RISC machine chip

THE VL86C020 is a CMOS technology, general purpose

32-bit microprocessor and 4K-byte cache combined on a single chip. Developed by the Logic Division of VLSI Technology and Acorn Computers Ltd, it is said to mark a significant clock speed enhancement for the RISC family.

Known as the ARM3 (Acorn RISC Machine), the device is fully software compatible with the second-generation VL86CO1O ARM2, and can also be used with the existing VL86CO1O family support.

The family comprises the VL86CO1O Acorn RISC Microprocessor (ARM), VL86C11O Memory Controller (MEMC), VL86310 Video Controller (VIDC), and VL86C41O I/O Controller (IOC).

All four form a full 32-bit high performance system, and are available in one 84-pin (processor) and three 68-pin packages (JEDEC Type-B pr PLCC).

The latest addition to the line up, the VL86CO2O, can be obtained in a 16O-pin quad plastic flatpack.

For more details contact Energy Control International, 26 Boron Street, Sumner Park Qld 4074. ☎ (07) 376-3286.

READER INFO No. 270

AM stereo decoder

THE MC13O24 device from Motorola is a low cost single-chip C-QUAM AM stereo receiver IC. It operates over the range of 1.8 to 8.O volts and can be powered by two AA batteries at around 3 volts with only 5 mA of current required.

A smart signal quality detector is also incorporated. It examines the lock condition, the C-QUAM 25 Hz pilot tone level, interference caused phase modulation, and alterations in the station tuning circuit.

Conditions preventing good stereo are identified, and the receiver drops back to mono without any transition pop effect.

The IC has distortion of less than 1 per cent, stereo channel separation of 25 dB, 'blend on' stereo turn-on, and fast, high-accuracy VCLO tuning lock-up.

Further information is available from your local Motorola Semiconductor Sales Office or authorised Motorola distributor.

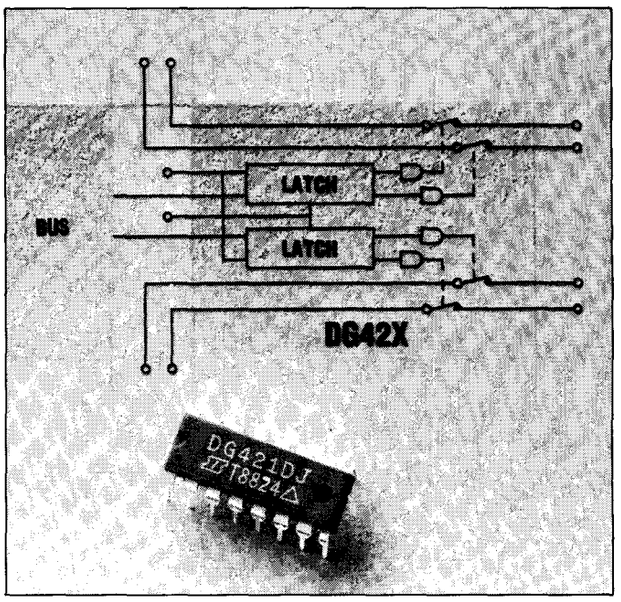
READER INFO No. 271

100 million transistors per chip?

ANDREW Grove, president and CEO of Intel, has told a meeting of the Institute of the Electrical and Electronic Engineers (IREE) in the USA that in future there would be around 5O to 1OO million transistors on a chip in microprocessors.

"There are no physical limits on the shrinking of the feature-size dimensions of a chip," he said.

READER INFO No. 272



High-performance gates ▲

THREE high-performance silicon gates from Siliconix, the DG421, DG423 and DG425 simplify bus interfaces by removing the need for external latches. This saves both board space and component cost.

Featuring three new dual analogue switches with on-board data latches, the DG4OO family enhance a number of microprocessor-controlled applications, such as computer networks and processing systems.

They support extremely accurate data transmissions in such operations. With a maximum switching speed of 175 ns and maximum power dissipation of 35 uW, the devices are said to be ideal for sample-and-hold circuits in telephone networks.

The fast switching speeds also suit D/A converter de-glitching in data acquisition systems.

The three devices are currently available in plastic 16-pin DIPs. Ceramic DIPs and surface-mount versions will be available later in the year.

For further information contact Anitech, 1-5 Carter Street, Lidcombe NSW 2141. ☎ (O2) 648-4O88.

READER INFO No. 273

INVENTOR FLIES INTO BREECH, ZIPS GAP IN MARKET

That's exactly what the headline read in an obscure industrial newsletter that passed across the Dregs hack's desk recently. It referred to a patent application filed by Tokyo inventor, Danny Steinberg, concerning a device known as "Zip Sure". It's for men only (Scots, Indians, Fijians and other non-trouser wearers excluded) and is an electronic device that tells the trouser-wearer when he's left his fly undone.

Apparently, it involves modifying the fly zipper, adding two small contacts at the top which come together when the zip is closed. A timer is triggered when the zipper contacts are opened. After a delay of some 60 seconds, the timer triggers a silent warning device. A second pair of contacts attached to the trousers' top clip disable the alarm device when the trousers are removed temporarily, or taken off and put away.

For the silent alarm, Mr Steinberg apparently suggests this could be a small vibrator that presses against the anatomy. The report fails to say which *part* of the anatomy.....

I sent a copy to a colleague of mine, the peripatetic Professor Donald F. Richards of the Sackville Academy of Lateral Thinking, Ebenezer, NSW (S.A.L.T. of the Hawkesbury). An adventurer, sailor, erstwhile inventor, philosopher and occasional broadcaster, Don is founding professor and sole beneficiary of the Academy. Don is best described as "an ideas consultant". Something like the world-renowned Edward de Bono, only in a more modest way, you understand.

You don't believe me? Sacre bleu! This man is a real person; I jest not! He has led the research vessel previously known as the Dick Smith Explorer on several journeys to the tropics and Antarctica. Indeed, last year he captained the vessel that carried the celebrated and successful Bicentennial expedition to climb Antarctica's Mt Minto. He has appeared on the Robin Williams Science Show on the ABC.

Mention of the Science Show brings us back to Danny Steinberg's "Zip Sure" invention. This invention was originally devised by the aforementioned Don Richards ... as a joke and broadcast on the Science Show on the 18th of June 1983, to be exact.

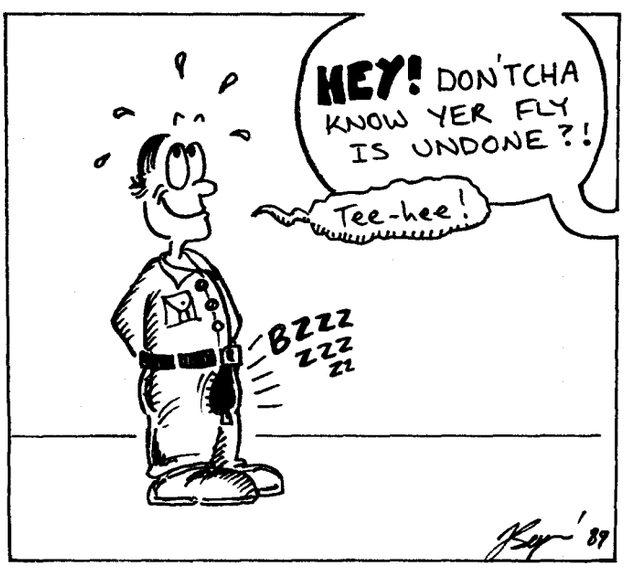
Let me quote: "I refer to the development of a device that will alert the wearer to the fact that the zipper on the front of his trousers is not closed. With the development of men's dress and the use of the zipper in place of multitudinous buttons, the final action, or closure, is often overlooked.

"My research indicates that 47% of males suffer from Closure Aberration (or C.A. as it is known in research circles) at some time during their life."

He went on to suggest, "... what we are looking for is a small device that will give a restricted audible or visual warning if the closure is not made within a certain period of the top clip being done up."

Mr Steinberg's patent application, so far as I can determine, fails to acknowledge this single breakthrough contribution by the megasynaptic Professor Donald F. Richards made over five years ago on the Robin Williams Science Show on the ABC.

And you thought I just made up all these Dregs things, didn't you?



Time, gentlemen

Spot the deliberate mistake. In October's Dregs, under the above heading, we ran the following copy: *Did you know that, on the 6th of July, at 1.23 pm and 45 seconds, the date/time was 1:23:45 6/7?*

Can't see it? What year is this? 1989, right! Now, on the 6th of July, at 1.23 pm and 45 seconds, the date/time was – 1:23:45 6/7/89!

Murphy and the corollaries

No, it's not the name of a new heavy metal band, or some obscure Irish folk quartet featuring Uelleain pipes, bohdran and tin whistle (if tin whistles are made out of tin, what do they make fog horns out of?). No. This is about Murphy's Law and all its manifestations – and womanifestations to be non-sexist about this – in electronics.

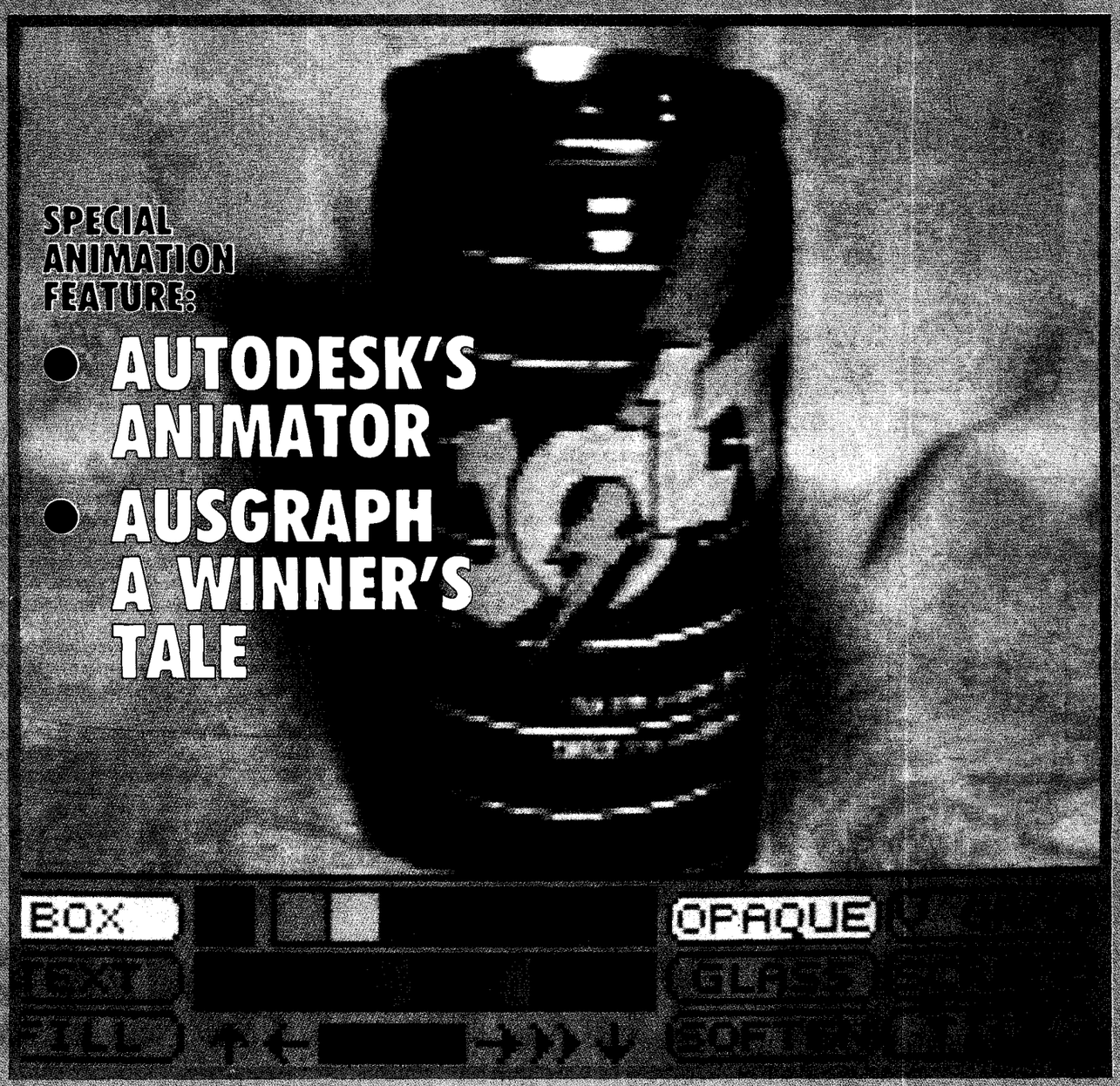
Your basic Murphy's Law, as everyone knows, says: "If anything can go wrong, it will". After it has gone wrong, you commiserate by confirming – "it could have happened to anybody!"

So, Murphy's Law of soldering irons says that, in the event the soldering iron is knocked off the bench, it will fall hot end first onto the nearest piece of exposed flesh. This is a certainty, even though the manufacturer has weighted the handle to prevent it falling hot end first. I have the scars to prove it. Could've happened to anybody.

From time to time, each month, we'll bring you more corollaries to Murphy's Law, as it applies to electronics. eti

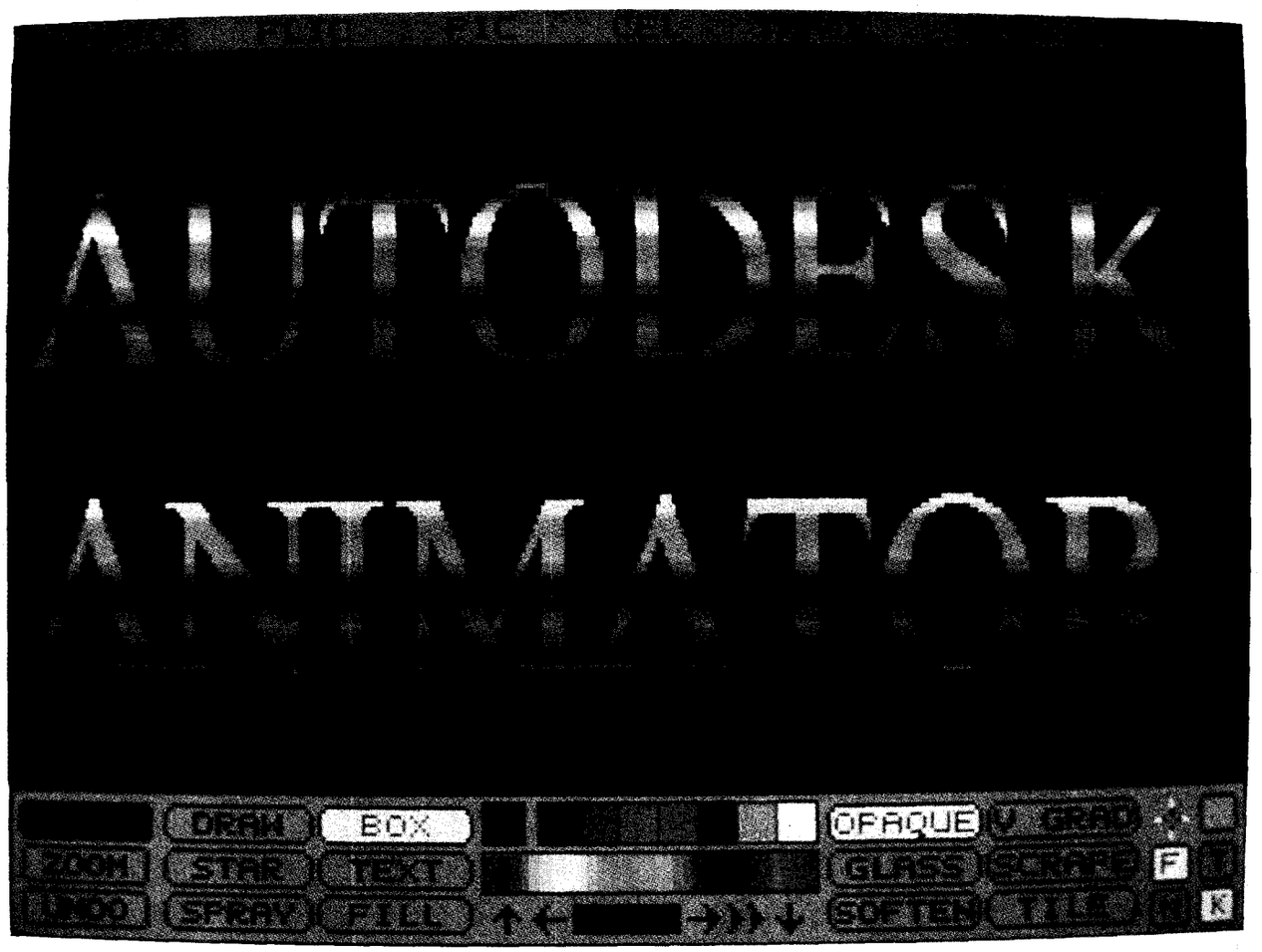
Workstation

ETI'S NEW COMPUTING SECTION



SPECIAL ANIMATION FEATURE:

- **AUTODESK'S ANIMATOR**
- **AUSGRAPH A WINNER'S TALE**



COMPUTING

MAKING MOVIES WITH YOUR MOUSE

Autodesk Australia has released an exciting graphics creation to add life to your PC.

The first product of its kind, says the company, Autodesk Animator is an animation desktop video program for Compaq, IBM and compatible personal computers. Hardware requirements are 80286 or higher, VGA graphics 640K memory, mouse or digitising tablet and 10MB hard disk. No math co-processor is required.

Autodesk Animator will provide PC users with an effective tool for creating sophisticated, animated presentations ideal for business engineering and scientific simulation, storyboards, home and professional video products, educational tapes, product training and point-of-sale demonstrations.

A single screen integrates paint, image processing and animation into one simple interface. A wide range of image and motion creation tools can be accessed by using pull-down menus, pop-up dialogue areas, slider bars, buttons and scrolling windows.

There are five types of animation in the program:

- Cell Animation – for existing motion and characterisations using special functions for drawing, frame-to-frame registration and in betweening functions.
- Optical Animation – for swooping and spinning images with sophisticated combinations of spline path motion and full

3D transformations.

• Polymorphic Tweening – for transforming one complex shape into any other, controlling timing, motion and perspective for dramatic effect.

• Titling – using a power object-oriented text editor, multi-directional scrolling and type-ons with a large number of customer type fonts.

• Colour Cycling – from diagrams to colour effects with user-definable colour ranges and timing. By freezing any frame of an animation it becomes a canvas where Autodesk Animator's paint and image processing tools can create a huge number of visual effects.

Animator provides 22 different drawing tools including polygonal lines, spline curves, boxes, circles, ellipses and stars. Basic forms can be enhanced with airbrushing, fills, streaks and gels.

Any of 26 ink types can be used to simulate transparency, shading, embossing and colour gradations. These, combined with any drawing tool, provide the user with 572 different combinations to explore.

Animator has an assortment of automated image processing tools. Photographic quality images can be scanned in or digitally imported. Among the wide range of input formats supported by the program, both static and animated, are: Graphics Interchange Format (GIF), PC Paintbrush (PCX), Target (TGA or PIX), Macpaint, Atari and Amiga. Autodesk Animator accepts other Autodesk product files including AutoCAD and Autoshade.

Users can also search and replace colours. Painting is done with any of 256 colours from a 262,144-colour palette using either HLS or RGB colour definition tools to get exactly the colour needed.

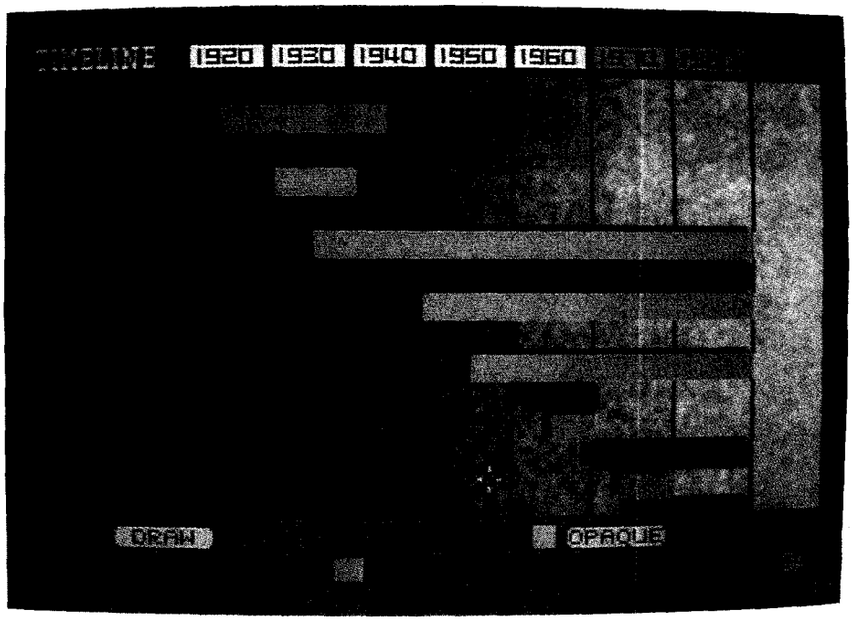
For realistic and professional quality animations, true-colour transparent shadows can be created and animated over any range of frames. Digital compositioning functions will add layers of animated graphic and photographic elements, and image processing inks can automatically create wipes and lap-dissolves.

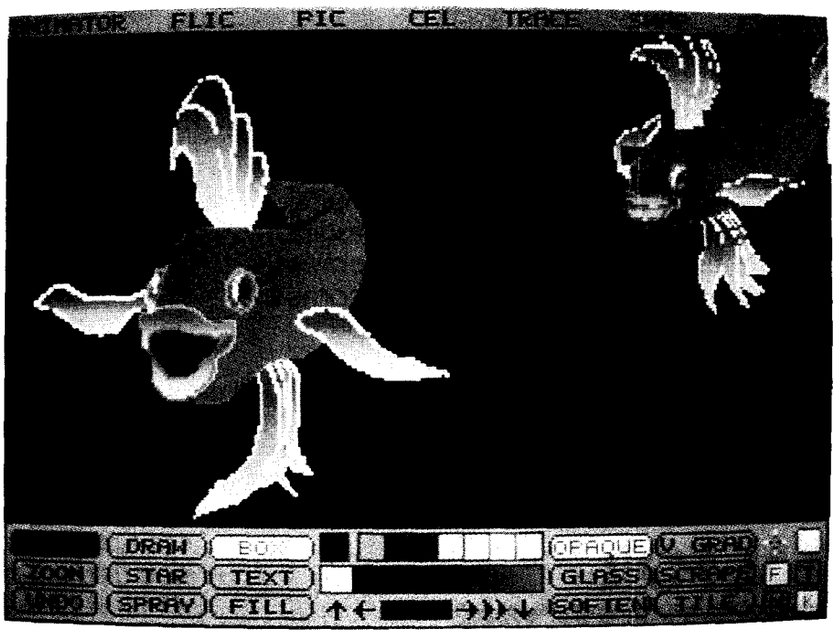
Users can create, edit and play back a full-length presentation, in real time, off a hard disk, and, with the appropriate VGA to PAL graphics card, the whole production can be recorded to videotape in one pass. The presentation can also be distributed to other computer users with Animator's public domain player facility.

One of the program's developers, Gary Yost, sees one of Autodesk Animator's most important applications as being its ability to quickly transform PC animations into a professional communications medium.

"For the first time on a PC, a user can animate, edit and produce on the hard disk a completely finished presentation – from a few seconds to over an hour in length – which can also output to VHS," said Yost.

Autodesk Animator will sell in Australia for $395. eti





A new product from Autodesk Australia will, for the first time, allow PC users to animate, edit and produce a presentation on hard disk, then output it to VHS.

The 1ST VGA Paint Program!

256,000 COLOURS TO

Splash!™

ONTO YOUR COMPUTER SCREEN

Splash is the first VGA paintbrush program! It's the most exciting computer paint brush program to hit the scene in years. Your mouse becomes a paint brush, your computer screen becomes a canvas and you can become the artist you've always wanted to be.

Splash gives you a palette of over 256,000 colours, 60 pattern and brush sizes, colour fills, stamps and spray cans. What's more, you'll master Splash in no time flat.

IDEAL FOR PRESENTATIONS

Prepare slides for your presentations, drawings for newsletters, cartoons or just have fun. Splash gives you all the tools you need for truly professional quality presentations and design work.

EASY TO USE!

Splash has been designed so that you become the master quickly and easily. Dialogue windows and drop down menus make selection a breeze and there's useful design hints in the documentation so if you can see it in your mind ...you can put it on the screen.

SPECIAL FEATURES

- 256,000 colours available
- 60 different pattern and brush sizes
- 13 text fonts plus import facility
- Magnify for pixel by pixel editing
- Stretch or compress images to any size
- Supports most printers
- VGA or MCGA graphics
- Compatible with Pagemaker, Ventura Publisher and most other Desktop Publishing programs

Available from: Dick Smith Electronics, John Martins, Harris Scarfe, Myer, Harvey Norman, Grace Brothers
FOR YOUR NEAREST RETAILER IN YOUR STATE CONTACT
NSW: Pactronics Pty. Ltd., 33-35 Alleyne Street, Chatswood. (02) 407 0261
VICTORIA: Pactronics Pty. Ltd., 51-55 Johnston Street, Fitzroy. (03) 417 1022
QUEENSLAND: Pactronics Pty. Ltd., 12 Station Street, Newslead. (07) 854 1982
SOUTH AUSTRALIA: Baringa Pty. Ltd., (08) 271 1066 Ect. 6132
WESTERN AUSTRALIA: Pactronics WA, 757 Canning H'way, Ardrose. (09) 332 3807
MAIL ORDER: The Amatrad User, 1/245 Springvale Road, Glen Waverley 3150/ (03) 233 9661
NEW ZEALAND: Micro Dealer, 60 Tarakau Drive, Palupanga, Auckland (09) 279 9000

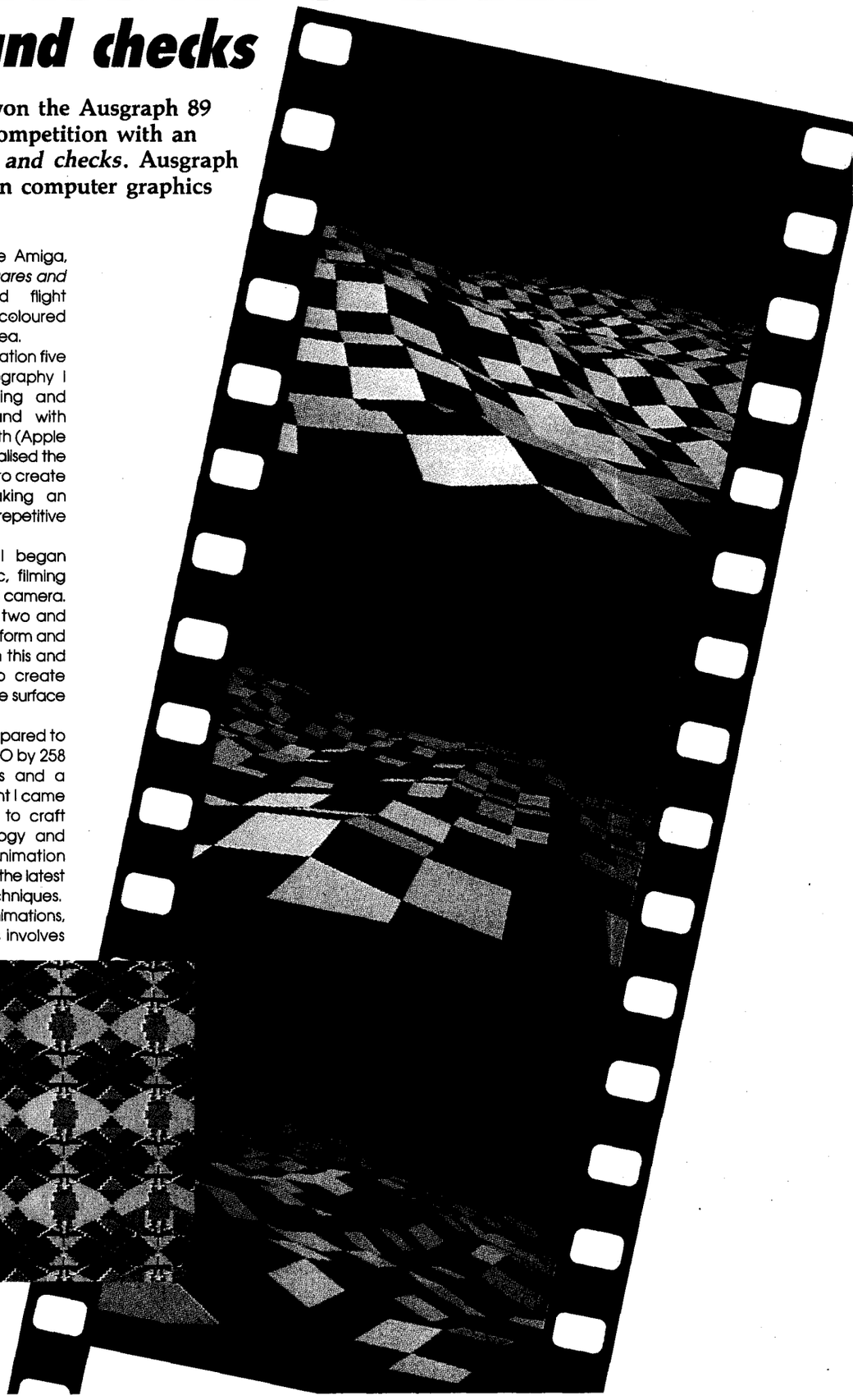
Pactronics

READER INFO No. 60

A WINNER'S TALE

squares and checks

Recently, John Tonkin won the Ausgraph 89 Computer Animation Competition with an animation titled *squares and checks*. Ausgraph is an annual Australasian computer graphics conference.



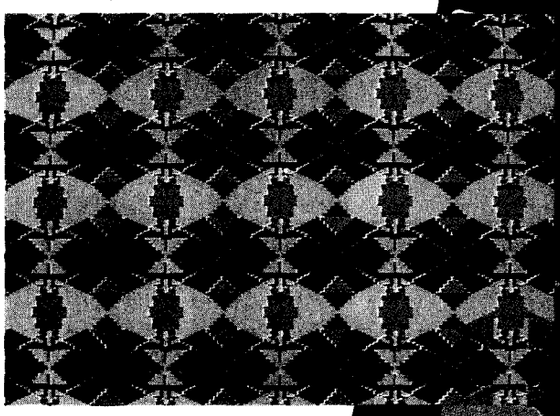
Produced on a Commodore Amiga, using my own software, *squares and checks* is an animated flight through a landscape of falling coloured squares and an undulating tiled sea.

I began creating computer animation five years ago. While studying photography I became interested in filmmaking and animation. Having played around with various microcomputers in my youth (Apple IIe, Tandy TRS-80, Sinclair ZX 80) I realised the enormous potential of computers to create animation. The process of making an animation is often methodical and repetitive – things that computers do well.

Using a BBC microcomputer I began programming animations in Basic, filming them off the screen using a Super 8 camera. This work consisted of a series of two and three dimensional studies in colour, form and motion. A common theme of both this and my current work is the desire to create engaging images that play upon the surface of the eye.

The BBC was primitive when compared to modern microcomputers. It had 320 by 258 graphic resolution with 8 colours and a memory of 32k. Using this equipment I came to appreciate that it is possible to craft animations using simple technology and techniques. Much computer animation suffers from the gratuitous pursuit of the latest technology and sophisticated techniques.

Firstly, I made two dimensional animations, consisting of moving patterns. This involves



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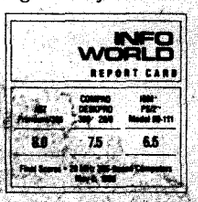

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PC Digest May 1988

*Source: PC Week, (U.S.) November 14, 1988.

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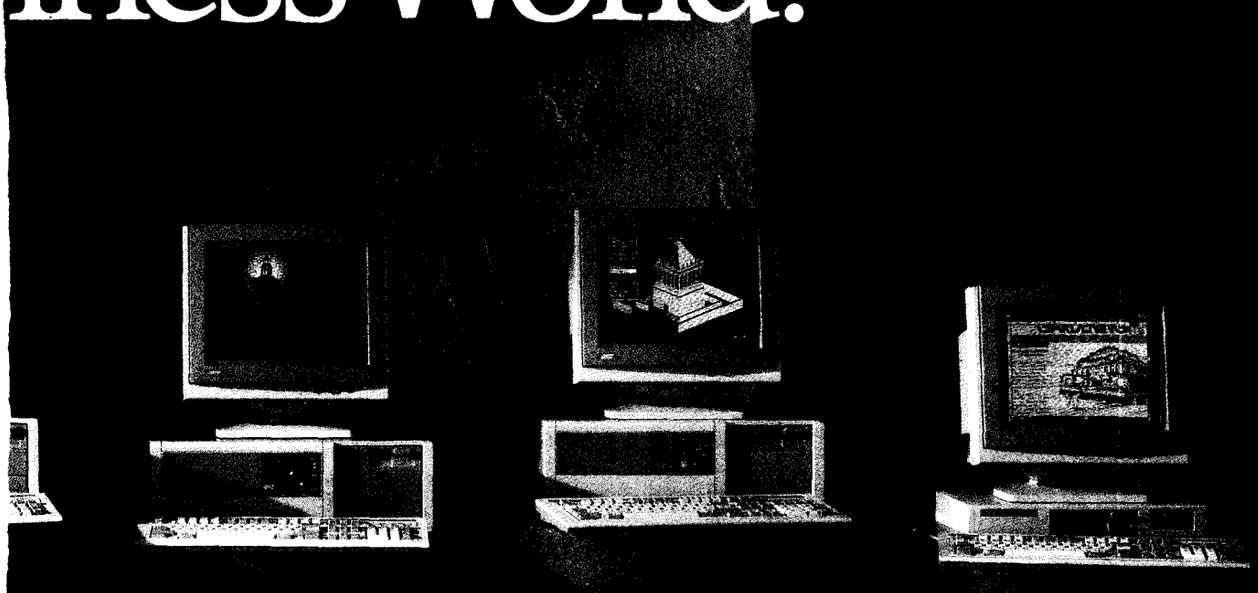

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READER INFO No. 30

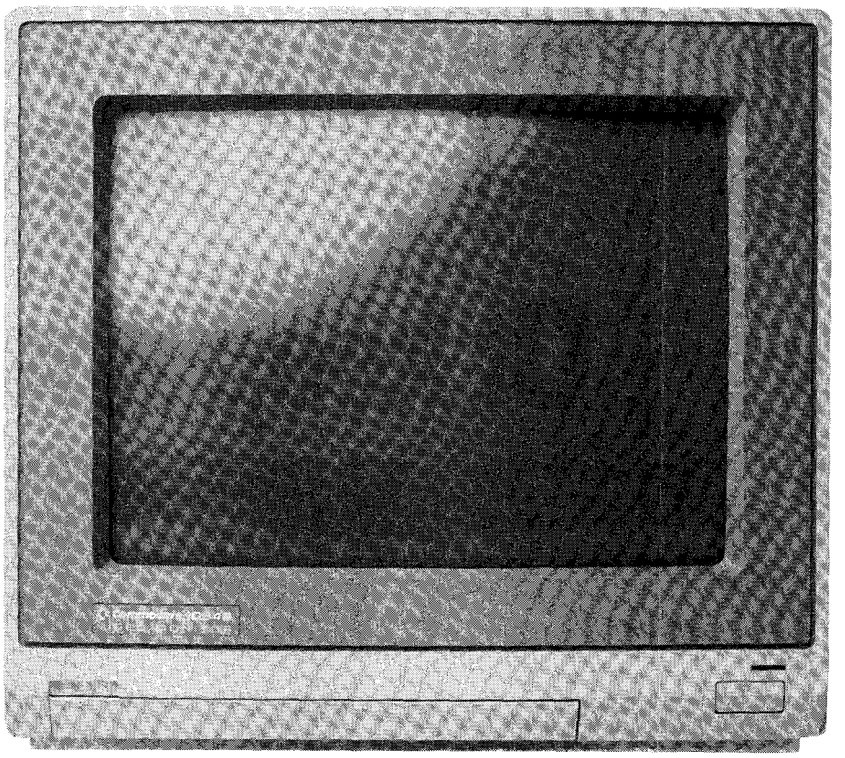
drawing shapes (defined by the coordinates of their corners) directly onto the screen, filming a frame and then repeating this process.

Then I started making three dimensional animations. By visualising what happens in the human eye I was able to work out how to create a perspective view. This involves modelling objects in a three dimensional (x,y,z) space and then projecting them on to a two dimensional surface, the screen. The view from any point in this 3D space can be created. In an animation both the objects and view point can be moved in 3D space.

I made an animation of a wire frame (like a stick figure) representation of a man in a room with a chair, table and television. I then explored abstract forms – tumbling shapes and a rippling black and white checkerboard (a precursor to *squares and checks*). These programs pushed the BBC to its limits. I would remove all spaces between the words in the program to save memory. The most complicated of these animations would take the computer 1 minute to generate each frame. As film is projected at 24 frames per second the time to record such an animation can be considerable. The computer was able to trigger the Super 8 camera to record each frame of the animation as it was formed.

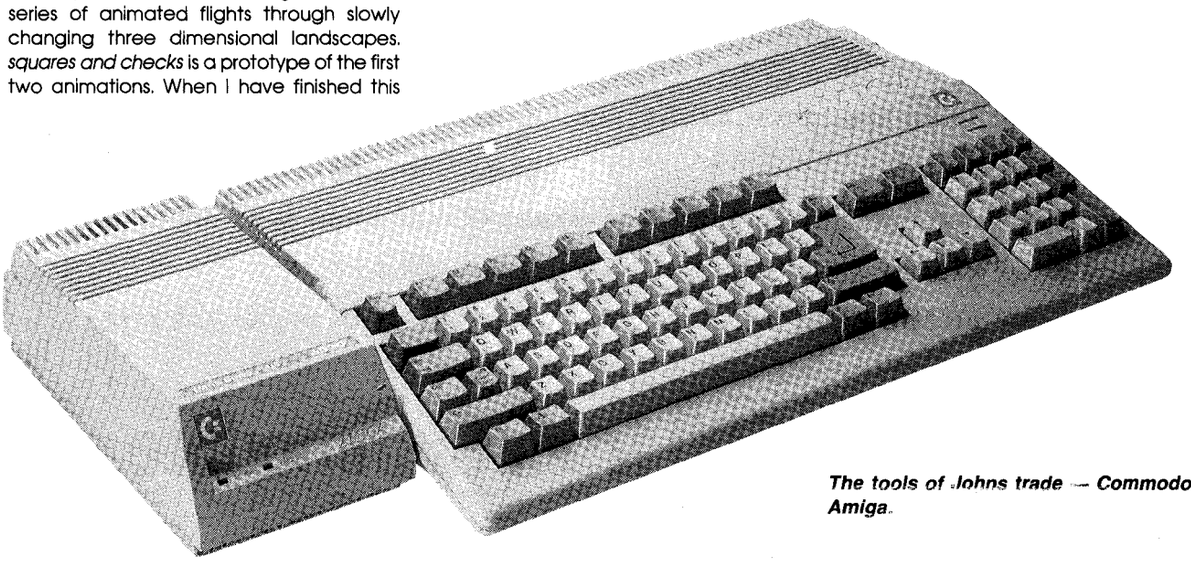
In 1987, I was funded by the Australia Council's Artists and New Technology Program to be artist in residence in the Department of Computer Science, University of Adelaide. I bought an Amiga 500, monitor etc. which I initially anticipated using as an adjunt to the residency, but ended up using exclusively. This was because the Amiga is more powerful than the VZX 750 minicomputer at the University and I had unlimited access to it.

During this period, I developed the techniques that I am now using to create a series of animated flights through slowly changing three dimensional landscapes. *squares and checks* is a prototype of the first two animations. When I have finished this series (in about two years) I plan to exhibit them using several video projectors running continuously and arranged like an exhibition of paintings.



I am writing graphics software for the Amiga in the language C. Because much of the same software is needed for each of the animations, I have been writing in the form of a library that can be accessed by each program.

Although programming my own software is laborious and often tedious, it gives much more flexibility and control over the final product than using bought software. There are several good 3D animation packages available for the Amiga (eg. Sculpt 4D and Turbo Silver). However, they can only be used in specific ways. They involve creating a 3D model using computer aided design tools and then viewing the rendered model.



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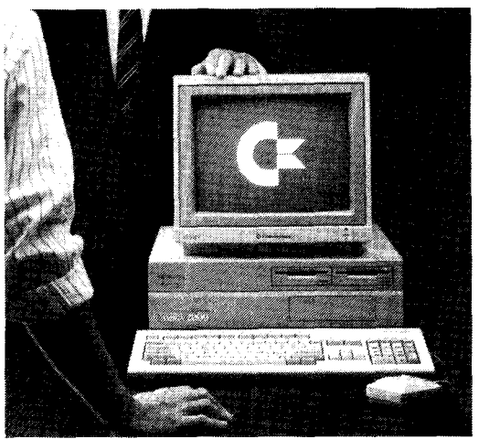

The premier feature is undoubtedly multitasking. This lets you run virtually unlimited programs simultaneously.

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Accordingly, the software collection for Amiga is as diverse as it is numerous.

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A winner's tale

Rendering techniques determine how the model looks and can include the mapping of textures, for example marble, onto the model's surfaces.

I use very simple rendering techniques – most surfaces are one colour. I am much more interested in the creation of the 3D model. I use procedural modelling techniques to create self-generation landscape. This means that I define generic objects and rules which are used by the program to generate the landscape around the viewpoint as the animation is filmed. For example, for the falling squares animation I define what a square is, how it falls and what happens when it hits the ground. Although I can choreograph the ratio of different square colours and the overall number of squares, I do not know where any particular square will fall. Because the landscape is self-generating there will always be falling squares whereever the flight path goes. The landscape is seemingly infinite.

It takes several hours of these animations to generate each frame. To create flight path through a landscape I have written a mouse driven program, much like a flight simulator, which allows me to fly through the landscape in real time. For this program to be interactive a very simple version of the landscape must be used – so that the screen updates every second rather than every few minutes. This flight path is then used to create the final animation – a process which can take days or even weeks.

To film each frame of an animation the computer signals a motor that shutters a 16mm Bolex camera. Because this is a clockwork camera I must wind it up every 600 frames – somewhat incongruous for a computerised system. 16mm film produces animations of much better visual quality than Super 8.

In high resolution mode (640 by 480) the Amiga is capable of 16 simultaneous colours. By recording each frame using a colour separation technique I am able to use 4096 colours. This gives me more subtle control over colouring.

Once the animation is filmed it can be both copied as a 16mm film print or transferred onto video tape. Music is an integral component of the final product. Musician friends create original music for each completed animation.

To date, most computer animation has been produced on big, expensive computers. This means that the field has been dominated by the advertising industry which can afford the hardware. As this technology rapidly gets cheaper, it is becoming more accessible to individuals to create their own work. This will significantly change the sort of animations being produced.

For example, the Commodore Amiga offers exceptional price/performance, and

IRIS Animation
TAKE a point-of-view journey inside an operating auto engine. Create an animated robot housewife of the year 3000 glistening in the glow of Jupiter. Assemble a car's suspension system piece by piece as the car rolls along a computer generated highway. All these sequences and images, and the one above, have been created on the IRIS super-workstation using advanced 3D modeling, animation, and rendering software available today. Enquiries to Silicon Graphics Computer Systems' Graham Frost on ☎ (02) 959 3349.

is a well designed and capable system. Software to create both two and three dimensional animation is readily available. Commodore has recently announced products that will expand an Amiga 2000 into a powerful graphics workstation. A 25MHz 68030 accelerator card will make the Amiga run at least 8 times faster while a graphics card will increase screen resolution to 1024 by 768, with 256 simultaneous colours.

Software technology is also continucily advancing. Object orientated programming is a relatively new method for designing and implementing software that is quite different to traditional structural programming. It aims to increase programmer productivity by using reusable software components, or classes, that can easily be extended to form subclasses. A class contains both data and the methods to manipulate that data. Graphics software is in a continual state of evolution. Object orientated programming should enable this evolution to be executed in a more natural way. I am currently learning C++, a language that adds object oriented features to C.

The RenderMan interface, developed by Pixer (creators of the animations *Luxo Junior*, *Red's Dream* and *Tin Toy*), is designed to be a standard interface between a program and rendering software capable of producing photorealistic images. It enables rendering to be defined and performed in a consistent manner. These sorts of software packages are currently only available for graphic workstations. Hopefully they will soon be available for machines like the Amiga as they will drastically reduce the amount of programming required to produce an animation.

In the long term, programming will become much easier with artificial intelligence techniques being used to interpret the programmer's intentions and translate them into functional software. The distinction between programmer and user will become blurred.

As video technology becomes digital, it is converging with computer technology. Computers will be able to display and manipulate huge numbers of images in real time as video. With the introduction of erasable optical disks it will be possible to record computer animation direct to optical disk.

It is important to remember that any technology is a tool, a means to an end rather than an end in itself. What is significant in any art form is how tools are employed for creative expression. Because the computer is a complex and sophisticated tool it takes time to learn to use it with sensitivity.

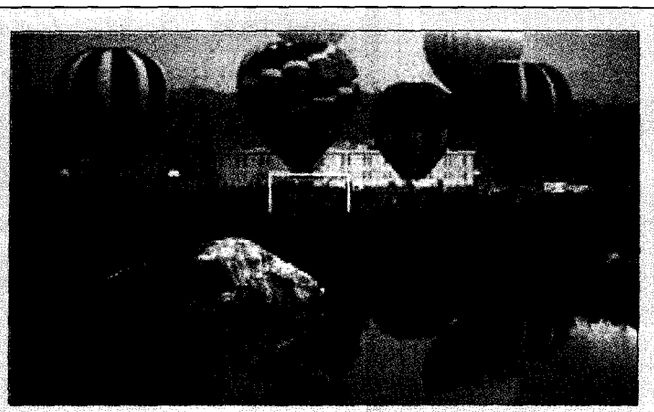
I want to use the computer to create animations with a dream-like intensity that evoke a feeling of infinity.

I am currently working with a group of musicians and animators to produce films combining computer and other forms of animation, set to original music. We plan to release this material as music video.

Over the past five years, whilst working on both computer animation and other film projects, I have supported myself by working as a barman, waiter, cook, dishwasher and childcare worker. After winning the Ausgraph competition I was approached by the South Australian Department of Fisheries to work as a computer graphics consultant on a population modelling program. I am now working part time on this project. This means that I can support myself yet still continue to work on my own animations.

This project is an example of scientific visualisation, a rapidly expanding field that uses computer animation techniques to visualise scientific processes. Scientific visualisation can be used to create new research tools to both view and simulate different phenomena. For example, scientists are using these techniques to investigate how molecules interact and what happens if two galaxies collide. Computer animation can also be used for education through the visualisation of unseen phenomena. For example, what goes on inside living cells.

Computer animation is a valuable tool for both the arts and sciences. I will continue in this exciting field. eti



VGA Splash!
THIS paint program features a mix of 256 colours from a pallette of 256,000; over 60 patterns and brush sizes; an overlay/underlay capability and a range of different fonts.

With solid, pattern or gradient colour fills for effective image scanning and a stretch or squeeze facility, Splash! is claimed to be easy to use.

For more information contact Ewen Bishop at Pactronics on ☎ (02) 407 0261.

COMPUTING

Plotting and graphing software for scientists & engineers

TECH*GRAPH*PAD (T*G*P) is an engineering and scientific plotting and graphing software package form Binary Engineering.

It is an easy to use, menu-driven package that assists the technical professional in generating graphical representations of engineering and scientific data for use in technical reports, proposals and symposia presentations.

T*G*P directly accesses data stored in Lotus 1-2-3, Symphony, Quattro and VP Planner worksheets, .PRN files, ASCII files, Labtech Notebook and others.

With T*G*P, you can create multiple X-Y plots including Linear X-Y, Linear-Log, Log-Log and Polar plots. In addition, the curve fitting functions will allow one to fit up to a 5th order polynomial to any data set. It also provides power and log curve fitting options. Data smoothing via splines, Bezier polynomials or Savitzky-Golay Least Squares is available.

T*G*P File Editor allows one to create, edit or manipulate data, create new data files, merge data files, exchange X-Y pairs, scale data and change units.

T*G*P supports a number of printers and plotters. These include: HP Laserjet and Paintjet, dot matrix printers (HP Deskjet, Epson, IBM and 100% compatibles) and plotters (HP 7470, 7475, 7440, IBM 7371, 7372, DEC LVP16, Roland and others that support HPGL). Binary Engineering is at present developing drivers to support Postscript.

Please contact Interworld Electronics & Computer Industries (Aust) P/L, 53 Wellington Street, Windsor, VIC 3181.

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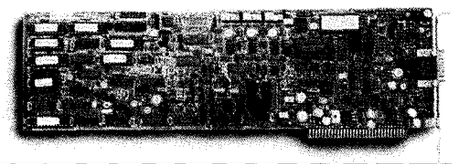

Video graphics encoding for IBM-type PCs ▲

MAKING true PAL broadcast output available to the IBM-PC graphics user, Magni has released the 4031 Genlockable Video Graphics Encoder.

Designed for operation with the Metheus 1128 Ultra Graphics Accelerator, the 4031 provides a video output which meets all the requirements of a PAL standard video signal. No interconnection with an external reference is required – the 4031 operates at broadcast line and field rates on a stand-alone basis.

A variety of special effects, including video-to-graphics and graphics-to-video fades, luminance keying, and colour zero keying are available using the 4010, an external control box. In combination with your graphics programs these features allow sophisticated video effects.

Magni is based in Beaverton, Oregon (USA) and maintains a worldwide network of distributors. For more information contact Quinto Communications on ☎ (03) 819 6675.

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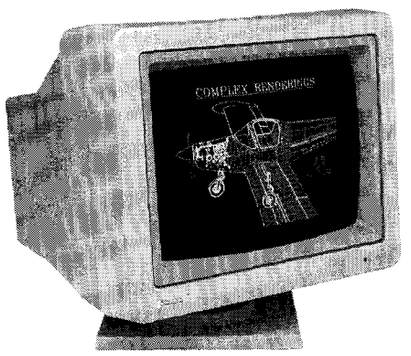

Ultra 16 colour monitor ▲

INTELLIGENT Systems Australia has released the Princeton Graphics Systems Ultra 16 Multisynchronous Colour Monitor, an addition to the range of professional quality monitors already offered by Princeton Graphics Systems.

The Ultra 16 is a 16" high resolution colour monitor which combines compatibility with state of the art monitor technology. It has a wide autosynchronous horizontal/vertical scan frequency range to ensure compatibility with all IBM PC, XT, AT, PS/2 systems and graphic standards (up to and including IBM's 8514/A high resolution adapter), as well as the Apple Macintosh II & SE. The Ultra-16 is designed with automatic picture sizing, both horizontal and vertical, a feature necessary for true PS/2 compatibility. The 16" diagonal screen size offers a wide viewing area and the monitor's high resolution displays clear images in bright, vivid colours. The Ultra 16" is ergonomically designed with a black matrix tube, non-glare etched screen with dark tinted glass, a built-in tilt and swivel base, and colour switch.

Australian distributor for Princeton Graphics Systems is Intelligent Systems Aust. Pty Ltd, Unit 2/92 Voltri St, Mentone VIC 3194. ☎ (03) 583 0666 or Sydney (02) 790 0855.

READER INFO No. 294

New version of Drawbridge

A NEW version of Drawbridge, the powerful graphics editor for programmers, has been released by MicroWay. Among the enhancements of the new version (3.2) is the updating of the code generation facilities of the MetaWINDOW graphics library which has code generation for fixed, relative, and virtual or inverted coordinate systems.

Also, the Borland graphics interface supports Turbo C V2 and Turbo Pascal V5.5, has code generation for fixed and relative coordinate systems and supports stroke fonts.

The Microsoft graphics library provides support for QuickC V2, and for bitmap and stroke fonts. It also has code generation for fixed and relative systems.

All three have up to eight user-selectable fonts per display.

More information is available from David Looke, MicroWay, 292 Chesterville Road, PO Box 219, Moorabbin Vic 3189, ☎ (03) 55-4544.

READER INFO No. 295

Praise be to Praxa

STARFIRE II, the flagship product of leading Australian software developer, Praxa Limited, has international qualities applicable to the Fortune 500 market, a leading US computing executive said in Melbourne this month.

Mr George Luntz is chief operating officer and vice president of Sales and Marketing of MCBA Inc., a Los Angeles-based company specialising in the development of business applications with over 30,000 worldwide user sites. He has been visiting Praxa to review recent product enhancements, evaluate Starfire II's offshore market potential, and explore the possibilities of expanding the relationship of the two companies for the mutual benefit of both.

The relationship between Praxa and MCBA goes back to 1980, when Praxa Sales and Marketing director, Martin Fuggle, was an Australian distributor of the MCBA Classic software.

Starfire II is an integrated financial, distribution and manufacturing software package.

In Australia, Starfire II has a national user base including a number of the country's top 50 companies. Among these are Comalco, Amatil, Amatek, the Herald and Weekly Times, Australia Post, Unilever and the Australian Stock Exchange.

READER INFO No. 296

Low cost MCA card

DIGITHURST Ltd of the UK has released a new version of its MicroEye IC full colour video capture card.

Compatible with the IBM PS/2 and other microcomputers which support Micro Channel Architecture (MCA), it has applications in desktop publishing, picture databases, product design, print analysis and advertising and many other uses.

Once pictures have been captured, they may be displayed at a user-selected size and position on the screen. A mouse-driven utility package performs this function, and saves the images in either pc GEM, TIFF or Byte mapped format.

This enables the images to be later merged with a range of database and presentation packages where they can be joined with text.

The MicroEye IC accepts full colour PAL pictures, converting them to a byte map of 640 × 480 pixels at 16 million colours. It uses a VGA graphics standard and also supports MCGA and EGA.

MCA provides faster data transfer than the PCAT bus version. The card also incorporates on-board intelligence to simplify image capture.

Two DMA channels transfer image data from the card to the PS/2's memory. They are configured using the Programmable Options Select (POS) system of the PS/2.

However, the PS/2 DMA controller is not limited by 64K boundaries, which simplifies the allocation of memory for storing images.

For more details contact the Dindima Group Pty Ltd, PO Box 106, Vermont, Vic 3133. ☎ (03) 873-4455.

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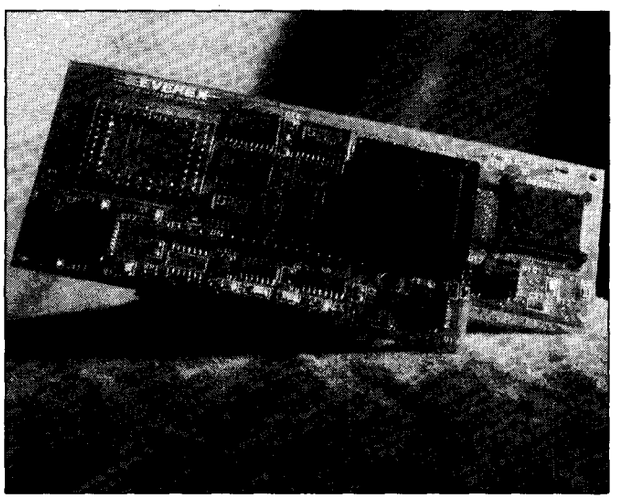

In step with In Step

THE In Step from Everex is a daughter-board which plugs directly into the system board of Step 286/12 and 286/16 systems.

As well as allowing you to incorporate the more advanced memory capabilities of a 386, it processes data at 32-bits per CPU cycle and runs both 286 and 386 software including UNIX 386 and Microsoft Windows 386.

Fully compatible with PC/AT industry standards for hardware, the In Step is based on the Intel 80386X microprocessor.

It enables an upgrade of the Step 286 system without sacrificing the zero wait-state performance or filling an expansion slot. In short, it provides superior processing for the price of an upgrade.

Based on the Intel 80386SX microprocessor, the Step 386is, also from Everex, has many of the features of the Step 286. This includes the ability to run both 286 and 386 software, zero wait-state operation and 32-bit processing per CPU cycle.

It is the fastest 386SX available. With the 80387SX math co-processor the 386is enhances productivity on CAM/CAD, graphics and other math intensive operations.

The device is fully expandable. It has six 16-bit expansion slots, two 8-bit expansion slots, and is available in a small footprint and standard AT-size chassis.

Information on either of these products is available from Australia Everex Pty Ltd, ☎ (02) 427-6111.

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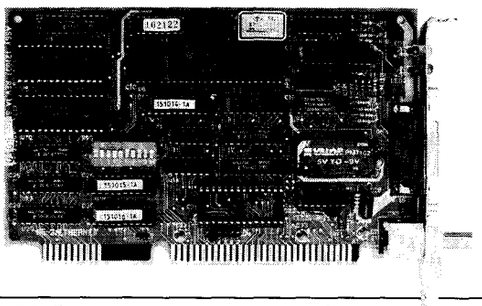

New Ethernet networking cards

ELECTRONIC Solutions has just released a new line of high performance Ethernet networking cards. The NE-1 and the NE-3 cards are 8-bit and are compatible with eight- or sixteen-bit slot.

They come with two diagnostic LED displays to monitor real-time cabling signals. They are 100% compatible with IEEE 802.3 and Ethernet standard, and come with IEEE registered NODE-ID (STATION-ID).

Both cards support a high performance transceiver to drive cable lengths more than 300 metres through Thin-Ethernet (BNC) port and standard Ethernet.

They each have optional remote reset capability. A remote reset ROM chip allows for a diskless workstation to boot from the file server.

The NE-1 card is Novell NE1000 hardware compatible, but with a larger buffer to reduce heavy network traffic. It supports 8K/16K/32K/40K64K multi-packet RAM buffers. It also supports NetWare, NetBIOS, APX etc.

The NE-3 card is a Western Digital EtherCard Plus WD8003EEBT hardware compatible and supports DECnet-DOS (PCSA), C-NFS, TCP/IP, NetWare 3+, OS/2 Lan Manager, UNIX/XENIX, NetBIOS and APX. It also supports 8K/64K multi-packet RAM buffer.

The NE-2 card is a full 16-bit Ethernet card with 16/64K RAM buffer. It has ROM support for diskless workstations, support for NetWare and all Gateway communications products plus 100% compatibility with IEEE registered NOSE-ID.

All three cards come pre-configured with the most commonly used default configuration, but may be reconfigured for different I/O address, Boot ROM Address, buffer size, interrupt and DMA and Ethernet version.

More information is available from Electronic Solutions, ☎ (02) 906-6666.

READER INFO No. 299

DEFINITELY NOT YOUR AVERAGE COMPUTER

APPLIX 1616 power, price and flexibility

MOVE UP TO THE 68000

If you take your computing seriously, Applix is for you!
The Applix 1616 microcomputer.
The 1616 gives you the power of the Motorola 68000 processor, supported by a hardware design that lends itself to all purposes — industrial control, educational applications or serious programming.
The 1616 is available fully assembled or in "kit" form; the 1616 can be tailored to your level of computing needs.
Just build the motherboard for programmable controllers, data acquisition systems, low cost computers (cassette based) or go all the way to a fully optioned powerful 68K development system.
The choice is yours!

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- Motorola 68000 or 68010 processor.
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- 64K ROM expandable.
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- Optional disk/co-processor card.
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- Graphics: 320H × 200V 16 colours, 640H × 200V any four of 16 colours.
- Standard RGBI interface or composite video.

THE OPERATING SYSTEM

1616/OS is a programmer's delight
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- Inbuilt screen editor.
- File & Directory management.
- I/O redirection.
- Over 100 documented internal system calls.
- Monitor functions.
- Installable drivers.
- Unprecedented Hardware accessibility.
- Windows and graphics and more . . .

The flexibility and power of 1616/OS make it a pleasure to use. Complicated tasks are simple.

"C" DEVELOPMENT SYSTEM

All Australian. The Hi-Tech "C" Compiler running under 1616/OS comes with macro assembler, linker and librarian. The special Applix Library utilises the power of the 1616 system calls. A cross-compiler running under MS-DOS and producing code for the 68000 is also available.

DISK/CO-PROCESSOR CARD

Truly a computer in its own right, the 1616 Disk Controller Card adds another dimension to the 1616 system.
SSDCC Technical Features:
- On board Z80H CPU (running at 8Mhz).
- 8K to 32K of ROM.
- 8K to 64K of static RAM.
- WD17722 disk controller chip.
- Supports both 3.5" ad 5.25" DS 80 track floppy drives.

Options:
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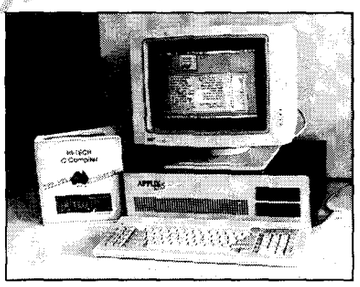
- Two additional serial ports (under Z80 control) using the Z8530 SCC.
- CP/M support



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Mini kits start at $239, basic kits from $599, keyboard $139, power supplies from $89, disk controller kit from $249. Fully built ready to run systems $1800.
All software has been specially integrated into 1616/OS to utilise the 1616s power.
68000 macro assembler free,
32 bit forth including source $89
SS Basic $69 Hi-Tech "C" $275
If you require further information, pricing and updates, user groups information.

CONTACT APPLIX TODAY

Applix Pty Ltd, 324 King Georges Road, Beverly Hills
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Telephone: (02) 758 2688

READER INFO No. 40

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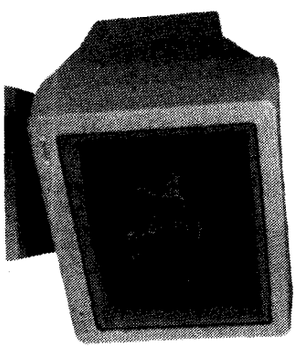

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Resolution:
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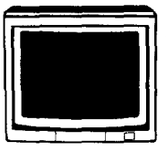

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Resolution:
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KEYBOARD WITH SOLAR CALCULATOR

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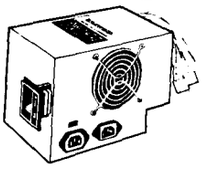

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X19120.....$27
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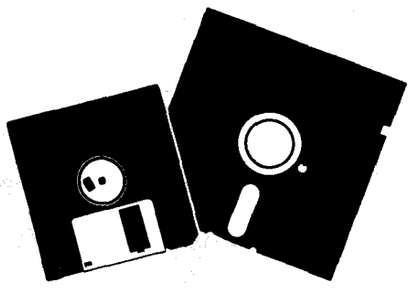

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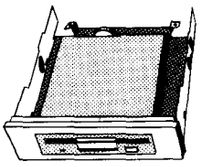
		7912UC	$1.00	LM338K	$7.50

DRIVES



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Y11090	20.00 MHz	$0.85

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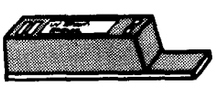

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- Dimensions 217 x 80 x 68mm

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- 3 slot expansion bus, includes extender card and cable

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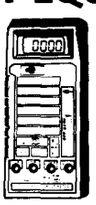

MULTIMETER (YF-2100)

- Large display 4 1/2 dgt 0.5" height LCD with maximum reading of 19999
- Automatic polarity."-" display for negative input
- High over-load protection for all ranges

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METEX 3800 MULTIMETER

Compact, rugged, battery operated, hand held 3 1/2 digit multimeter
- 1/2" high contrast LCD
- Automatic over-range
- Automatic polarity indication on DC ranges
- Diode tester
- Audible Continuity Test
- Transistor hFE Test

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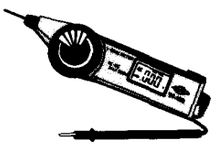

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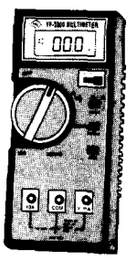
- Autoranging operation
- Data-hold for easy readout
- Full range protection
- 0-500 volts AC-DC
- 0-20 MΩ
- Dimension & weight =133 x 29 x 17mm and 60g approx

Q11270.....$63

MULTIMETER (YF-100)

- Autoranging for DCV, ACV, OHM & continuity measurement

Q11264.....$41



MULTIMETER (YF-3000)

- Large display 3 1/2 digit 0.5" height LCD for easy readout
- Auto/manual range select easy to operate
- Automatic low battery" - + " display for battery indication
- Warning sound for overload and conductance
- Data hold function for easy readout

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METEX 4500H MULTIMETER

10A, 4 1/2 digit multimeter with digital hold, transistor tester and audible continuity tester.
- Readout hold
- Transistor Tester
- 4 1/2 digit x 1/2"(H) LCD
- Audible continuity tester
- Quality set of probes
- Digital readout hold
- Built in tilting bail
- Instruction manual
- hFE test
- Diode Tester
- Vinyl case

Q91560.....$105

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Z88

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$988

It comes with a wide range of FREE software complete with a comprehensive User Manual

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512K RAM Pack	$688
32K EPROM Pack	$68
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PipeDream (PC version)	**$295**
Z88 BBC Link	$88
Serial Printer Cable	$38
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Carrying Case	$38

Alarm
BASIC
Calendar
Calculator
Clock
Diary
Printer Editor
Terminal
Import-Export
Pipe Dream

The Z88 has 32k RAM and 128k ROM built in, readily expandable up to 1.5 MbRAM. Its size is 2.5x21x30cm, about the size of an A-4 pad. Our LINK software allows file transfers between the Z88 and most desktop computers. So the Z88 can be a truly PORTABLE EXTENSION of your desktop computer.

For further details, contact:

Jansit Computers

5/5 Macquarie Street, Parramatta NSW 2150

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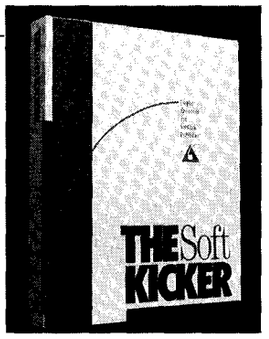
READER INFO No. 42

Soft Kicker Ventura publisher monitor



THIS software is said to turn an EGA or VGA monitor into a 'window' on a 24 inch, 1004 x 1008 pixel screen.

In full page view, the user gets a x2 window at the cursor position. A tap on the right mouse button and the screen instantly toggles between full page and magnified view.

Soft Kicker features:

- Instant access to any part of the page
- Instant switching between full page and enlarged view
- Automatic scrolling with no screen rewriting or need for scrolling bars
- Automatic scrolling as you type
- Magnified x2 "Mag View" window
- No need to use the 'reduced view' mode

Soft Kicker uses software to access the extra unused memory in an EGA or VGA card to store the entire page. No extra DOS, expanded or extended memory is used. A screen becomes a window on a complete high resolution page.

For further information write, call or fax: LOGO Distribution Service, PO Box 389 Drummoyne 2047. ☎ (02) 819 6811 Fax (02) 819 6930.

READER INFO No. 300

Corel Draw 1.1

COREL Draw 1.1 is a windows based illustration package, including 45 new typefaces, an actual typeface conversion program, additional clip art, window clipboard support, a computer graphics metafile import/export utility and a slide making interface.

The new typeface conversion program referred to as WFNBOSS, (pronounced as woof-in-boss), is a windows based program. WFNBOSS supports over 300 fonts. Corel Draw version 1.1 directly supports Adobe fonts.

Forty five new cOrel typefaces will be added to this upgraded version of Corel Draw. These will come from fourteen different type families, which can also be manipulated with all of Corel Draws' type features. One can print these to absolutely any windows supported device.

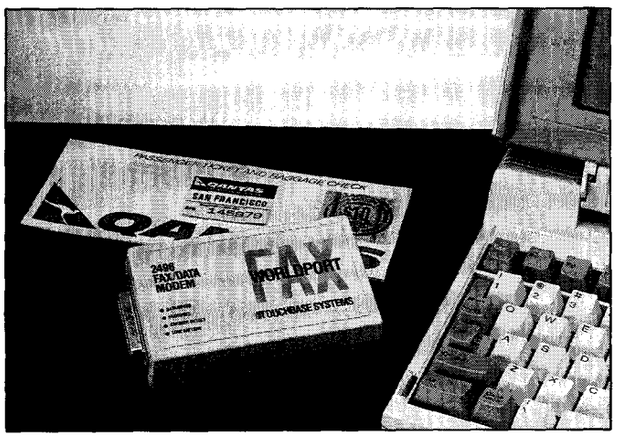
Corel Draw supports the windows clipboard. To cut and paste graphics between Corel Draw and other windows applications is yet another advantage of the upgrade.

CGM (Computer Graphics Metafile) which has import/export capabilities in Corel Draw 1.1, is another dimension. It is compatible with page-layout packages, desktop presentation, and word processing packages. CGM format is a feature that Corel Draw 1.1 benefits from, as it is a vector based format, which is resolution independant, device independant, and keeps colour information.

Corel Draw's slide making capabilities are claimed to make it a unique illustrations package.

For further information contact: Dimension Graphics Pty Ltd, Head Office: 13th Flr, 132 Arthur St, North Sydney NSW 2060. ☎(02) 929-5855 Fax (02) 929 8317.

READER INFO No. 150



Yuppies get new status symbol

THE high-tech world of miniaturised electronics has pr[illegible]ed a new 213 gram [illegible]vice that will supplement the up-market laptop PC and the portable phone as "must-have" yuppie status symbols.

The small, lightweight, portable appliance is a combined fax modem and data modem that lets fax machines and PCs communicate with each other.

Called the WorldPort 2496 Portable Fax/Data Modem, the economically-priced unit is manufactured by US company, Touchbase Systems Inc. It is being distributed in Australia by data communications specialist, Dataplex Pty Ltd, of Lilydale, Victoria.

Dataplex' managing director, Brian Taylor, says the WorldPort 2496 is ideal for business people on the move and those who work away from their offices.

"Because it is such a compact (12.22cm x 6.99cm x 2.5 cm) unit, it is extremely versatile. You can take it anywhere, use it with all portable, laptop and desktop PCs that run the MS.DOS operating system and need only a standard telephone jack for direct connection," Mr Taylor said.

"This means it can be used to send faxes from a PC in your home, hotel room or office to a fax machine anywhere in the world. It also lets your PC receive faxes from anywhere, talk to other PCs anywhere or it can be used to communicate with asynchronous modems anywhere."

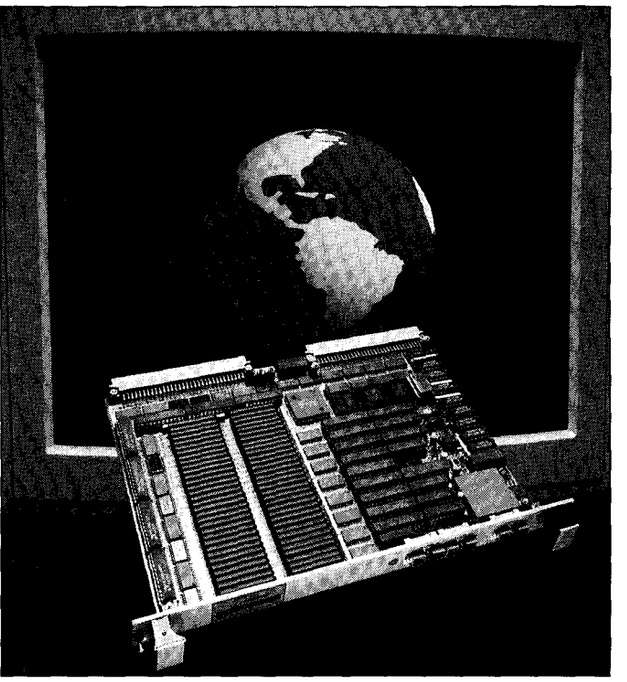
The WorldPort 2496 offers facsimile operation, at speeds up to 9600 bps, that conforms fully to CCITT Group III standards, while the full-featured data modem facility operates at up to 2400 bps.

The unit runs on its own self-contained battery as well as a calculator plug pack and is approved for connection to the Telecom network. The WorldPort 2496 also features proprietary software for unattended fax transmission and reception.

The unit retails for less than $1000.00.

For further information, please contact Douglas Noble, marketing manager, Dataplex Pty Ltd, 7-9 John Street, Lilydale, Vic 3140. ☎ (03) 735 3333.

READER INFO No. 151



Advanced high resolution display controller ▲

PRIMAGRAPHICS Ltd, of the UK, has announced Venture, a new high resolution display controller which uses the latest techniques to provide exceptional functionality in one double Eurocard module. The card will connect into any VME bus system to transfer 8, 16 or 32 bit data at up to 15 Mybtes/second.

The Venture frame store has a capacity of 2 Mbytes to give typically 1792 x 1170 x 8 bit pixels of which 1376 x 1072 are visible at 60Hz refresh. Hardware pan and scroll allow smooth movement, within the frame store, and the larger areas can be covered by writing new data to the edges of the image. Red, green and blue video signals are generated via colour look-up tables to give 256 colours from a palette of 16 million. The hardware cursor can also be shown in any colour and can be either crossed hairs or any 64 x 64 pixel shape.

Bit planes may be updated in any combination using the individual write enables, and a special writing mode allows 32 pixels of any depth to be set or reset to specific colours in a single cycle. This feature provides very fast line drawing, polygon fill, character generation and single bit image transfer.

Typical applications for the new Venture card include full colour page make-up, high quality image storage and retrieval, radar or sonar display, fabric design and medical imaging.

Primagraphics is able to provide complete systems incorporating one or more of these display controllers with a 68030 based processor running Unix with X windows. Systems can be configured to customers' specific requirements.

For further information, please contact The Dindima Group Pty Ltd, PO Box 106, Vermont, Vic 3133.

READER INFO No. 152

Protel Traxview

PROTEL Technology Pty Ltd has announced a new member of its CAD family – Protel Traxview.

Traxview is a Gerber™ format file editor and viewer with full viewing and advanced editing facilities, giving the professional designer complete control over his files. A panelisation program is included which allows the user to replace multiple Gerber™ format files on the same film. This not only minimises production time but also maximises cost savings on film.

Traxview's viewing and editing facilities include:

View mode – zooming and panning, viewing files in single or multi colours.

Editing – placing, deleting, moving and editing of flashes and strokes. All edit changes can be global.

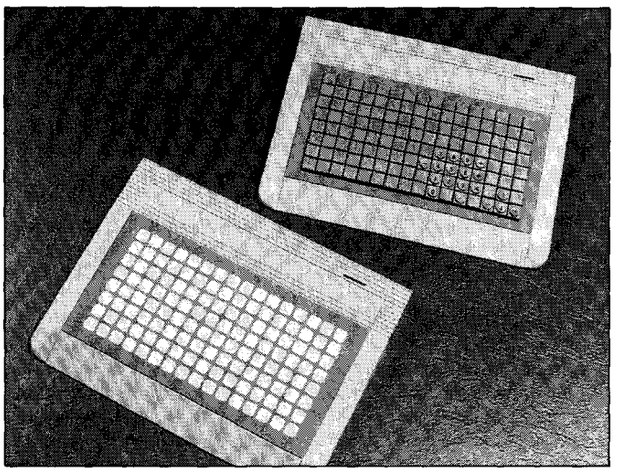
The panelisation program also includes placing, deleting and moving of Gerber™ format files. Specified files can be scanned and sizes automatically stored. A zooming facility is included.

Minimum software requirements – IBM PC-XT, AT or 368 compatible with 640K RAM.

Protel is offering this productivity tool at a special introductory price of $495.

For further information contact: Protel Technology Pty Ltd, GPO Box 536F, Hobart, Tasmania 7001. ☎ (002) 73 0100, Fax: (002) 73 1871.

READER INFO No. 153



Custom keyboard ▲

THE Model 260 series of user programmable custom keyboards from Unique Micro Design are designed for applications requiring non-standard keyboard layouts.

These include CAD, word processing, point of sale, desk top publishing and other specialised applications. Because the keys are programmable, software does not need to be changed to use the custom keyboard.

Single keys can be programmed to output multiple codes, saving keystrokes. Up to 128 keys can be arranged in an 8 × 16 matrix, each programmed with user-defined codes.

There are two styles of keyboard to choose from, membrane and keycaps. Membrane has a flexible plastic sheet covering the keys, making it suitable for environments such as bars and restaurants.

Keycaps has removable key caps which can be marked by the user or pre-printed with standard symbols.

The custom keyboard can be used as a stand-alone RS-232 device in terminal based systems, and can also be connected to a PC via the keyboard interface where it is used in conjunction with a standard keyboard.

For further information contact Unique Micro Design, Unit 2/23 Wadhurst Drive, Boronia Vic 3155. ☎ (03) 887-0734.

READER INFO No. 154

JIM TUCKER

DIG DAT JIVE

The latest language available on your home PC is called Jive. It is not unlike English but the fact is you don't even have to learn it. A public domain PC program does the work. By Jim Tucker.

Jive is spoken and understood only in certain parts of the United States. It is down-to-earth street language that's spoken mostly by blacks and seldom written.

I am always amazed by the variety and creativity of programs in the public domain and here's an example. I found it grubbing around on Adelaide's best bulletin board – The Oracle. You simply write something in English, save it, and tell your PC to translate it into Jive.

So let's try it. Here's what I just said.

The latest language available on yo' plantation PC be called Jive. Sheeeiit. It be not unlike English but de damn fact be ya' dozn't even gots t' learn it. A public domain PC honky code duz de work. What it is, Mama!

Jive be spoken and understood only in certain parts o' de United States. It's down-t'-earth street language dat's spoken mostly by blacks and seldom written.

Ah am always amazed by de variety and creativity o' programs in de public domain and here's an 'sample. Sheeeiit.

Ah found it grubbin' around on Adelaide's best bulletin board – De Oracle. Sheeeiit. Ya' simply scribble sump'n in English, save it, and tell yo' PC t' translate it into Jive. Sheeeiit.

So's let's try it. Here's whut Ah plum said, dig dis.

We now resume our normal English column. The Jive program (written in C) converted those opening paragraphs into Jive in just two seconds. The Jive text has been completely unedited (and unexpurgated) by me. What you see is what it produced. I can't speak Jive!

The rules for Jive are obviously trivial (mostly word substitution with a few expletives added) but don't laugh! One day there will be a home computer program that will convert English into French, Japanese, German, or whatever. Not on the PC we know, of course. By then 1000 gigabytes of memory running with an Intel 80-9999-86 chip will be commonplace. Or will it be the NEC V400000? It's not a matter of if it can be done, just when.

Time for change

ADELAIDE'S annual three-day computer jamboree is called Comtec. This year Assmann Company displayed a large rack of components including a talking clock. The talking clock (phone 1194) receives about 50 million calls a year.

Would you believe Australians pay Telecom more than $10m a year just to hear Gordon Gower tell them the time of day?

Grandad Tucker had a modest farm. He looked at where the Sun was in the sky, guessed the time of day and probably got it right within five minutes. He did have a pocket watch, and there was an ornate clock on the mantlepiece of the Tucker homestead, but nobody took much notice of that because it was always wrong.

Now your PC can not only tell you the time of day to the second, public domain software can display the position of the Sun, the planets and major stars for any time and date this century.

Anyhow, when I asked about the talking clock at Comtec, the man on the stand said it was all hush-hush and I would have to talk to Telecom. "Then, why are you showing this secret, yet magnificent, talking clock at this prestigious exhibition?" I enquired. "You'll have to ask Telecom," said the man from Assmann.

I did. It turns out the talking clock, which has been in service for 30 years, is about to be retired. It is a mechanical device with the 25 words and phrases recorded on optical disks and read by optical detectors, similar to the sound track on a movie.

The new machine, developed in Adelaide by Assmann, is fully digital. Curiously though, a totally digital system was developed in Adelaide 10 years ago and has been used there for the last decade.

Jim and the bin

I HAVE just bought a cut-sheet bin feeder for my printer – it cost the modest sum of $160; but I was blowed if I could make it work, and, being tired of reading ill-written manuals, I decided to save time and phone the suppliers. "What do I do?" I asked.

Now, I have a bit of clout, and sometimes pull rank (much published computer writer and that sort of thing). So if I have trouble getting info about a printer, pity the poor Mr Average buyer.

The people who sold it didn't have a clue how it worked, yet they had sold dozens of them. The Adelaide wholesaler told me to call Melbourne (STD calls are part of my business, so I didn't quibble). Melbourne played horrible music for a few minutes and told me to call Sydney.

The bloke in Sydney lied. "Turn switch 1-5 off and it works a treat," he said. But, as I discovered, that sets the paper out detector off.

I called him back, he talked to a superior and, I am ashamed to annouce, I am a fool. I spent $160 on a bin feeder and did not spend several hours reading both the bin feeder manual and the printer manual from front to back and the other way round.

Had I done so I would have read in the printer manual, not the tractor feed manual, that if you fit a bin sheet feeder to a Star NX-1000 make sure that DIP switch 1-4 is off and 1-5 is on. If you do that you might save about $30 in phone calls.

Next time I buy something like this I might ask for the suppliers to deliver it, install it and prove that it works. I wonder how much that would cost? If you have any horror stories please let me know. Write to Box 582, Blackwood, SA 5051.

Stacking stuff

STORING floppies is always a problem. Big filing boxes hold 50 or 60 diskettes but they cannot be stacked on top of each other. You have to lift off the top boxes to get at the disks in the bottom box.

It's like a computer stack in RAM – last in first out (commonly called LIFO).

Here's help: stackable drawers from Able Office Supplies ☎ (08) 46 0991. They slide out and can be stacked up to the ceiling. Each container holds about 200 diskettes and costs around $45.

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LOGO for Beginners	BP-193	**$11.00**
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- High quality Japanese drives

5.25" 360K $170.00
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- Reads & write 360K disk

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- Convert printed matter into text
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- Hand held, 105mm width half page
- 100, 200, 300 & 400 DPI resolution

* FREE desktop publishing software
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- Summagraphic MM1201 & MS Mouse compatible
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- Australian built & telecom approved
- Hayes compatible
- Auto dial, answer & disconnect
- V21, V22, V23 & V24
- 300/300, 1200/75, 1200/1200 and FAST 2400/2400
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Internal $349.00
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- Square flat screen
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COLOR CGA
- 14" 640 x 200 display
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ITEM	UNIT PRICE	SC	QTY	TOTAL
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360K X 100 (DB)	70.00	1		
1.2M X 10	15.00			
1.2M X 100 (DB)	145.00	1		
1.44M X 10	53.00			
1.44M X 40 (DB)	200.00	1		
DISK BOXES				
FOR 5.25" DISKS (100)	13.50	1		
FOR 3.5" DISKS (40)	11.50	1		
PRINTER STAND 10"	16.00	1		
PRINTER STAND 15"	16.00	1		
COMPUTER STAND	16.00	1		
COMPUTER CABLES				
POWER CABLE	7.50			
PRINTER	9.50			
MODEM	10.00			
VIDEO EXTENSION	11.00			
KEYBOARD EXTENSION	8.00			
SERIAL EXTENSION	14.00			
PRINTER RIBBONS				
STAR NX1000	8.00			
EPSON LX800	8.00			
EPSON LQ500	8.00			
SUBTOTAL (1)				

ITEM	UNIT PRICE	SC	QTY	TOTAL
FLOPPY DRIVES				
5.25" 360K	170.00	2		
5.25" 1.2M	220.00	2		
3.5" 1.44M	250.00	2		
SCANNER	480.00	1		
DIGITISER TABLET	590.00	3		
MOUSE	75.00	1		
JOYSTICK	35.00			
MODEMS INTERNAL	349.00	1		
MODEMS EXTERNAL	395.00	2		
MONITORS				
MONOCHROME	199.00	3		
CGA COLOR	460.00	4		
EGA COLOR	675.00	4		
MULTISYNC COLOR	900.00	4		
DISPLAY ADAPTERS				
DUAL CGA/MGA	120.00			
EGA	240.00			
VGA	390.00			
PRINTERS				
PANASONIC 1081	375.00	3		
SUPER 5 1201	360.00	3		
SUBTOTAL (2)				

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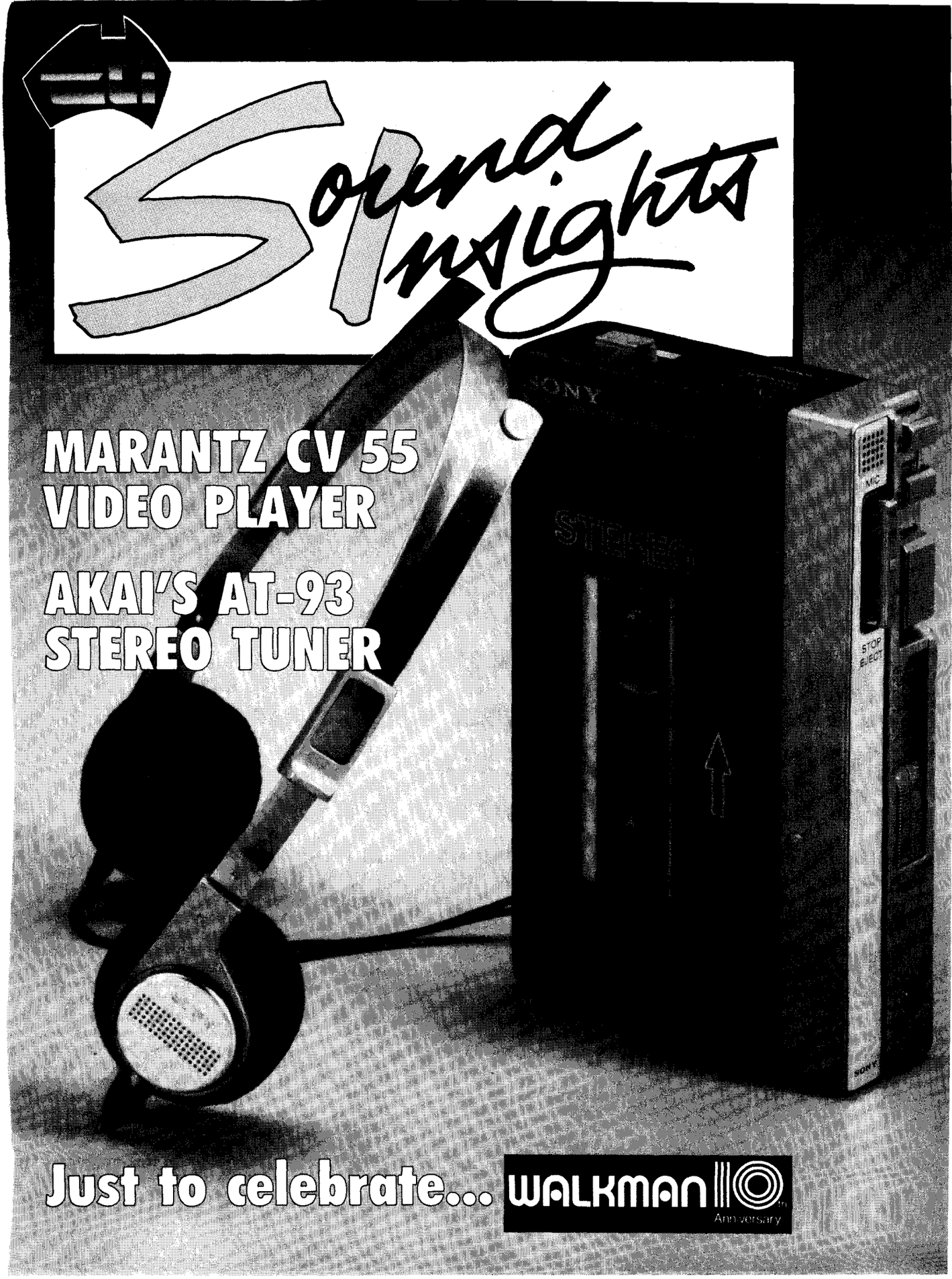
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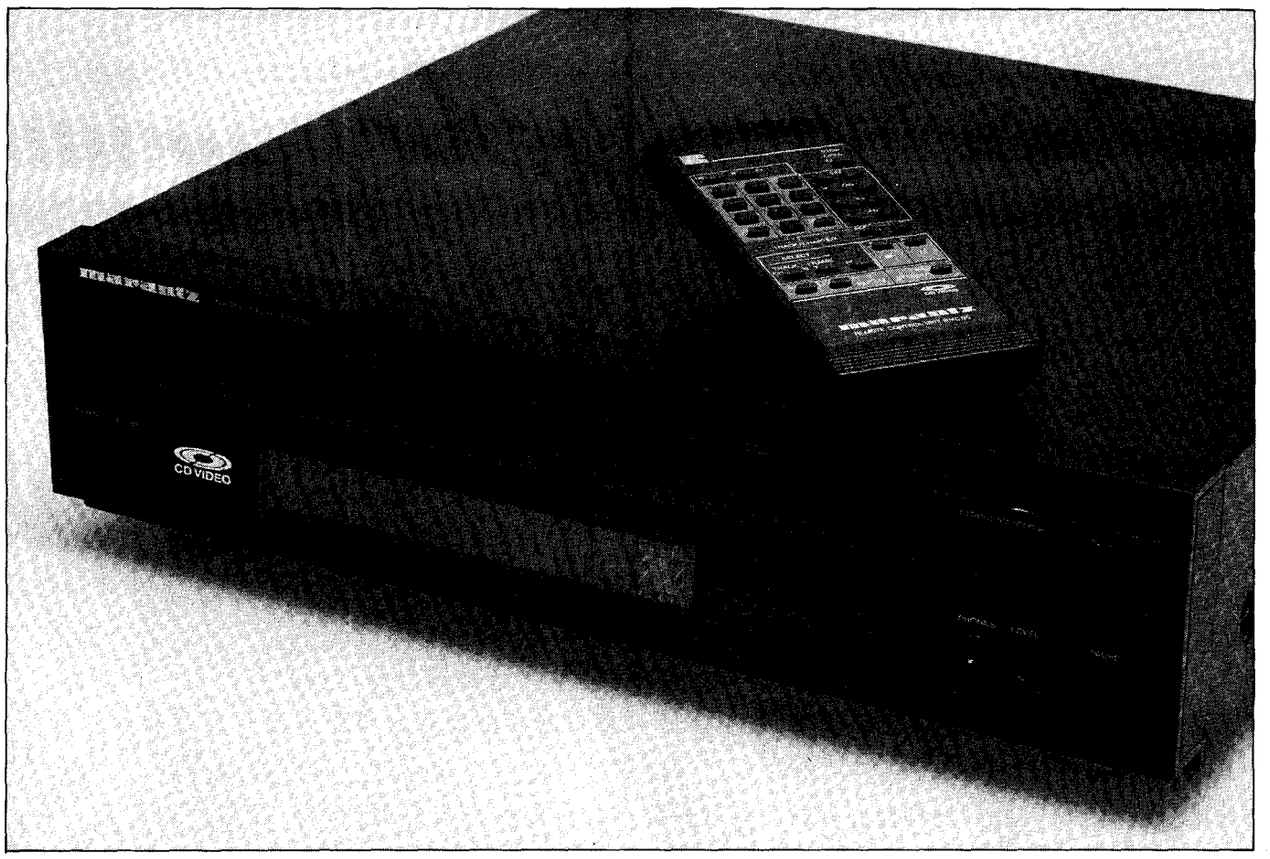
MARANTZ CV 55
VIDEO PLAYER
AKAI'S AT-93
STEREO TUNER
Just to celebrate...
WALKMAN 10
Anniversary



MARANTZ CV 55 VIDEO PLAYER

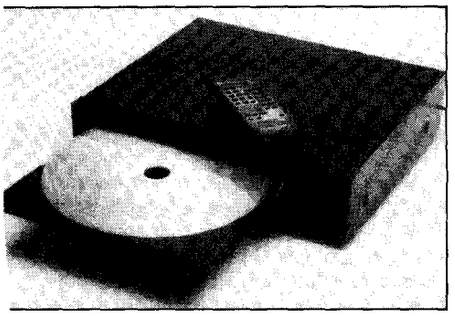
Louis Challis reviews the Marantz CV 55 Video Player and concludes it is an exciting medium which will present a dilemma in the future for consumers. For the moment though, he recommends you lie back and enjoy it!

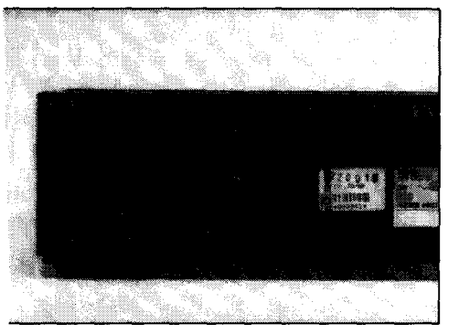
In the early 1970s when Pioneer released its first generation video recorder, the technical world 'gooed and gaahed' at the quality of the picture and the complementary quality of the audio signal. What very few people realised at the time was that the Pioneer technology had been developed in the research laboratories of Phillips at Eindhoven, Holland and what they thought was Japanese technology was, in point of fact, Philips technology.

At the same time that Pioneer's video disc player was being marketed in America and Japan, a number of other manufacturers, including RCA and Philco, were developing alternative technologies. One interesting side issue relates to the stark differences in technology being applied. One of those systems was based on old technology, and is what I would describe as being in the horse and buggy era. I used a stylus tracking a high speed analogue disc, and, although capable of achieving reasonable performance when new, was subject to a short life because of the vulnerability of the disc. Competing head on with that old technology was the Pioneer video disc using the same basic technology that we have in the latest generation of CD and CDV discs. The magnitude of the difference between those technologies was clear for all to see because the quality of the picture, quite apart from the quality of the sound, was incomparably better.

Although each of the competing systems was subject to different technical problems,

DIMENSIONS	
Width	420mm
Height	100mm
Depth	400mm
Weight	8kg
RRP	$1999





they were all subject to similar financial constraints – primarily because of the subsequent release of first generation Beta VCRs from Sony in Japan.

The first generation of video disc players were beset with relatively high costs, limited supplies of software, and, the most insidious problem of all, three different, incompatible competing systems. This incompatibility ensured the rapid demise of two of the systems and almost killed the third. Had it not been for a number of important professional users (firms like GMH, the US Defence Forces and some large international marketing firms whose training programs were based on the characteristics of the laser disc) the technology might well have become obsolescent.

About this time, the two most important innovators in the consumer electronic field, Philips at Eindhoven (whose latest

MEASURED PERFORMANCE OF MARANTZ CV-55 VIDEO PLAYER

Model No. CV-55
Serial No. 220015

1. **Frequency response** 5 Hz to 22.05 kHz ±0.1 dB

2. **Linearity** @ 1 kHz

Nominal level	Left ouput	Right output
0 dB	0.0	0.0
−1.0	−1.0	−1.0
−3.0	−3.0	−3.1
−6.0	−6.0	−6.0
−10.0	−10.0	−10.0
−20.0	−20.0	−20.0
−30.0	−30.0	−30.1
−40.0	−40.0	−40.0
−50.0	−50.0	−50.0
−60.0	−60.0	−60.0
−70.0	−70.2	−70.3
−80.0	−80.8	−81.0
−90.0	−95.1	−96.0

3. **Channel separation**

Frequency	Right into left dB	Left into right dB
100Hz	−97	−94.5
1kHz	−97	−100.0
10kHz	−94	−98.5
20kHz	−88.5	−92.0

4. **Distortion** @ 1 kHz

Level	2nd	3rd	4th	5th	THD%
0	−105.1	—	—	—	0.0016
−1.0	104.1	—	105.8	—	0.002
−3.0	106.7	—	107.4	—	0.0015
−6.0	104.4	—	—	—	0.0018
−10	99.0	—	103.3	101.8	0.0037
−20	88.7	90.4	89.4	—	0.013
−30	79.8	79.5	90.2	80.0	0.039
−40	97.4	72.0	75.3	76.9	0.059
−50	80.7	68.9	71.7	60.5	0.16
−60	71.8	60.1	67.1	56.3	0.30
−70	54.4	34.1	61.2	34.3	2.77
−80	48.2	39.7	—	26.7	4.75
−90	31.7	19.6	—	14.8	21.15
@ 100 Hz					
0	111.5	110.0	110.9	103.6	0.0014
−20	105.2	94.5	—	96.6	0.0045
−40	75.9	71.3	90.5	90.3	0.07
-60	—	57.0	73.1	64.6	0.28
@ 6.3 kHz					
0	—	100.3	101.7	—	0.0025

5. **Emphasis**

Frequency	Recorded Level	Output Level (L)	Output Level (R)
1 kHz	−0.37 dB	−0.4	−0.5
5 kHz	−4.53 dB	−4.6	−4.6
16 kHz	−9.04 dB	−8.3	−8.3

6. **Signal-to-noise-ratio**

Without Emphasis	95.5 (Lin)	111.0 dB(A)
With Emphasis	95.5 (Lin)	112.0 dB(A)

7. **Frequency accuracy**
(19,999 kHz) ±0.5 Hz for 20 kHz test signal.

8. **Square wave response**
(See photos)

9. **Impulse test**
(See photo)

technology we are about to describe) and the Sony Corporation of Japan, pooled their resources. They did so to circumvent a series of technical fiascos from which both of them had suffered in the late 1960 s and early 70 s.

They were acutely aware of the financial losses they had suffered, and realised that only by forcing competing manufacturers to thrash out common technical standards for new products, would they be able to reap the rewards of the new technology they had developed.

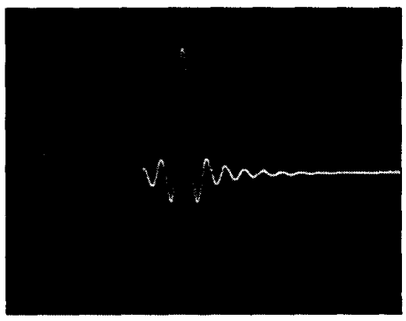
Philips and Sony laid down the standards for the new compact audio discs, and, more significantly, soon afterwards documented the standards for their new CDV or compact disc video systems. You might well ask why I have bothered to discuss the development of laser discs which are, when all is said and done, a different system.

Well, the first generation of laser disc technology came from the same stable. Because Philips realised that compatible systems sell well, while incompatible systems die a painful death, they sensibly decided to have an integrated marketing approach where the new generation of CDV players are capable of playing all of the old formats including the early generation laser discs.

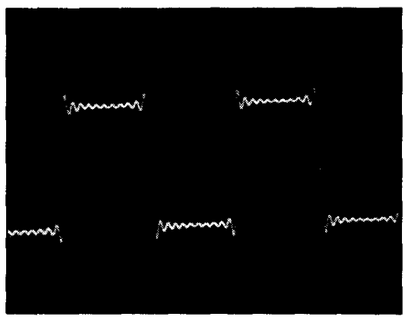
I first saw the prototype CDV players in Osaka in 1983 and was more than impressed by their potential. I subsequently saw production NTSC versions on sale in Japan in 1987 and was convinced that the PAL version (with its 625 line resolution) would upstage the NTSC version by a wide margin. The PAL versions of the CDV went on sale in Europe in late 1988. It has taken almost a year more for the first of these units to reach Australia.

It comes as no surprise to me that the Marantz CV 55 Video Player – and probably all the other multidisc players which will be released in Australia – is designed to play up to 5 different sized, different formats of laser discs. The most common disc likely to be played will be the 120mm diameter audio CD. These, of course, are soon to be complemented by the CDVs, which are not yet being marketed in volume by the record companies. A 120mm diameter gold coloured CDV is capable of providing 6 minutes of video with stereo digital sound, supplemented by an additional 20 minutes of conventional digital audio sound.

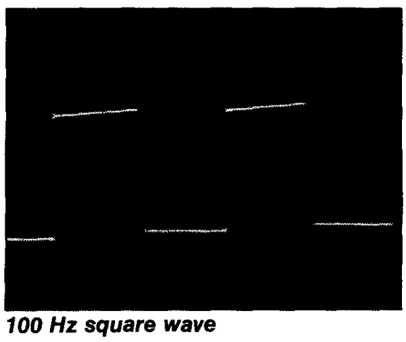
The CV 55 also plays 200 mm diameter single sided video discs which hold 40 minutes of video with matching digital sound. The latest generation of double sided 300 mm diameter laser discs hold up to 120 minutes of video and matching sound. Surprisingly, the slide-out disc tray was not designed to hold the new and relatively small 75 mm diameter CD singles. However, an adaptor is provided so that these may be



Impulse response

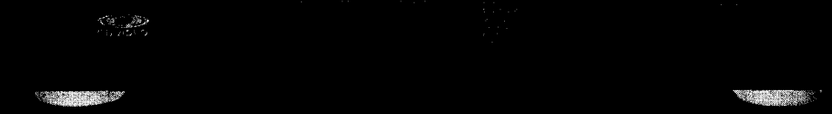


1 kHz square wave



100 Hz square wave

Dirty record test	
Using Philips NR4A (410-056-2)	
Interruption in Information Layer	
400 micrometer;	**Passed**
500 micrometer;	**Passed**
600 micrometer;	**Passed**
700 micrometer;	**Passed**
800 micrometer;	**Passed**
900 micrometer;	**Passed**
Black dot at read out side	
300 micrometer;	**Passed**
500 micrometer;	**Passed**
600 micrometer;	**Passed**
800 micrometer;	**Passed**
Black stripe test (passed)	
Output impedance	
Head phone amplifier output impedance 120 ohms	



For those who have enjoyed the thrill of true High Fidelity Compact Disc audio, Marantz has distilled a concept so perfect and durable, it will become a landmark in audio-visual innovation.

CD Video is a link between your present CD collection and your television screen, through which you will experience a world of visual perfection, now available on video disc.

For more information call
(02) 742-8322, or STD toll free (008) 22-6861.

marantz

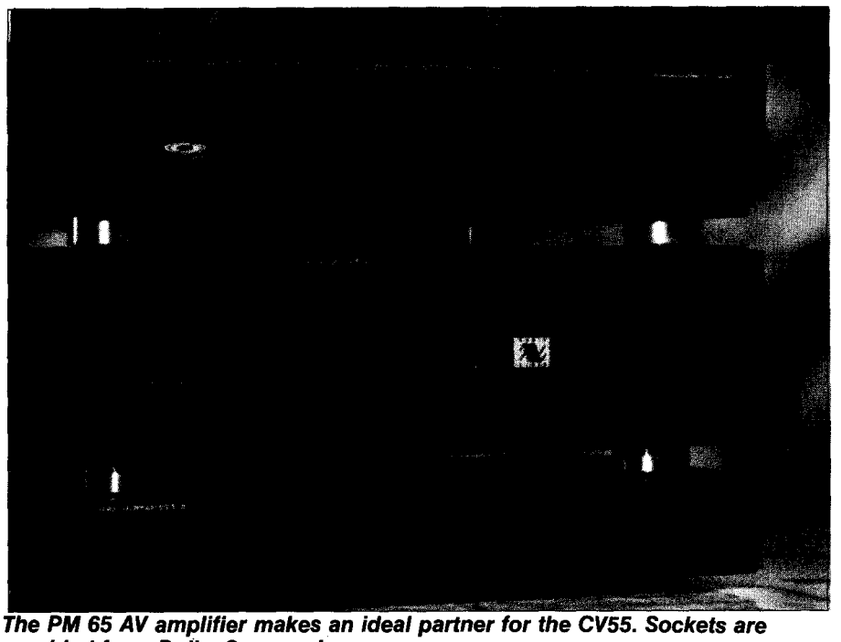
extra sensory perfection

played in the same machine.

The Marantz CV 55 is about the same size as a conventional VCR, has approximately the same weight, and even the same sort of output connections as a VCR. But that is where the similarities begin and end.

While a normal VCR is capable of both recording and playing, the CV 55 is only capable of replay, and it replays both CDs and CDVs with a quality that few other pieces of equipment can match. There are only 5 controls on the front panel of the CV 55. They are a POWER ON/STAND BY switch, a STOP/OPEN/CLOSE switch, a PLAY switch and a PAUSE switch. These four primary controls are supplemented by a head phone socket with its own volume control. On the back panel of the unit there are more sockets and connections than I would have expected.

Foremost is the SCART socket, which Marantz describes a TV EUROCONNECTOR (CVBS) socket. This socket, and the matching double ended cable provided, allows you to simply interconnect the player with an RGB monitor or TV set to interconnect all control and patching functions without fiddling or confusion. It is unquestionably the best way of interconnecting this unit, and, of course, being just as lazy as any of you, that is precisely what I did. There is also a pair of standard AUDIO OUTPUT co-axial sockets, a separate VIDEO OUTPUT socket and, much to my surprise, a direct connection for taking a TV aerial into the unit and a matching output socket for feeding the signal back out to a TV set. In addition to these sockets, the unit is fitted with remote control sockets so you can operate an audio/visual system with compatible remote controls. The player also allows you to select the correct channel on a TV set for receiving the video output (channel 36) and provides a fine tuning potentiometer control for the precise setting of the output frequency.



The PM 65 AV amplifier makes an ideal partner for the CV55. Sockets are provided for a Dolby Surround processor.

Apart from the primary functional controls described above, all the other major functions are accessed by means of a small, hand-held, and very convenient remote control unit Type RMC55. This control provides the same basic controls as the front panels, supplemented by a large number of functional controls for the display, so that you can display them on the monitor or TV set screen. The primary controls of STAND-BY, a numeric key pad with 1-10 supplemented by a CLEAR and a MEMORY function, provide convenient access to CD tracks or laser disc tracks.

There are additional FORWARD and REVERSE controls for playing speed of active play discs (reducing or increasing), slow for FORWARD or REVERSE play-back of the slow motion function, STILL for holding a particular video frame and SCAN for searching out a particular passage in either the FORWARD or REVERSE mode. A PREVIOUS or NEXT function is provided for moving forward by one or more tracks on CDs or CDVs, and supplementary controls for TRACK/CHAPTER and FRAME/TIME are provided primarily for video discs. At the lower margin of the remote control functions are A↔B for cyclical repetition of two selected points on the audio or video disc, and a CONTINUOUS REPEAT button for repeating a disc from one end to the other.

The last control is the BI-LINGUAL switch which switches the audio signal between stereo sound tracks one and two when bi-lingual sound tracks are incorporated on video laser discs.

The player automatically displays a number of important cues on the video display. These include, COMPACT DISC, CD VIDEO SINGLE, CD VIDEO, OPEN, CLOSE, NO DISC, ERROR, DISC READ IN, TRACK EX-SEARCH, STEREO, LEFT CHANNEL or RIGHT CHANNEL, PAUSE, REPEAT SEARCH, END DISC, END SIDE 1, END SIDE 2, STANDBY and, most importantly, TRANSPORT which indicates that you have forgotten to remove the transport locking hardware as instructed by the hand book.

BOSE®

The Bose® 601™ Series III Direct/Reflecting® Loudspeaker System

Bose engineers have invested more than 25 years of ongoing research seeking one goal—recreating the illusion of a live performance.

The next best thing to hearing music live is hearing it through a Bose® Direct/Reflecting® speaker.

Drawing on the heritage of the internationally acclaimed Bose 901® speaker, the 601™ speaker gives you the best seat in the house—wherever you sit or stand.

The research: three dimensional sound.

Through our extensive acoustical research into live sound, we learned that focusing on only one musical parameter such as frequency response and expecting realistic sound is like trying to create a lifelike painting by concentrating solely on colour. As with visual images, live sound has perspective, clarity and proportion.

We designed our speakers based on the natural combination of direct and reflected sound. The difference between listening to conventional speakers and Bose Direct/Reflecting® speakers is like the difference between viewing a movie on a television versus experiencing it in a theatre.

The 601 system brings a three dimensional sensation to music—giving the sound depth, height and width. In short, it seems to come alive!

In a live performance, the majority of sound reaches your ears after being reflected off the walls, floors and ceiling. With conventional speakers, you mainly hear only direct sound. Bose Direct/Reflecting® speakers add the missing elements of music by bringing you the natural combination of direct and reflected sound (see diagrams at right). The result is a lifelike soundstage that's practically like being there.

The performance: ideal for audio, video and digital.

With most conventional speakers, you hear stereo in one or two parts of the room. Everywhere else, you hear primarily one speaker. The 601 system allows you to hear true stereo everywhere in the room—even when you are directly in front of one of the speakers.

The 601 system is the ideal cornerstone for a complete home entertainment system. It unleashes the full potential of your sound system, efficiently produces excellent sound and easily handles high power. This rare performance combination allows you to enjoy today's power-demanding sound sources such as digital audio at true-to-life volume levels.

The Bose 601 system also makes it possible to use your stereo system in a new way: as part of a total audio/video system. It is designed to produce greater realism with all video sound sources—especially stereo televisions, hi-fi VCRs and video disc players.

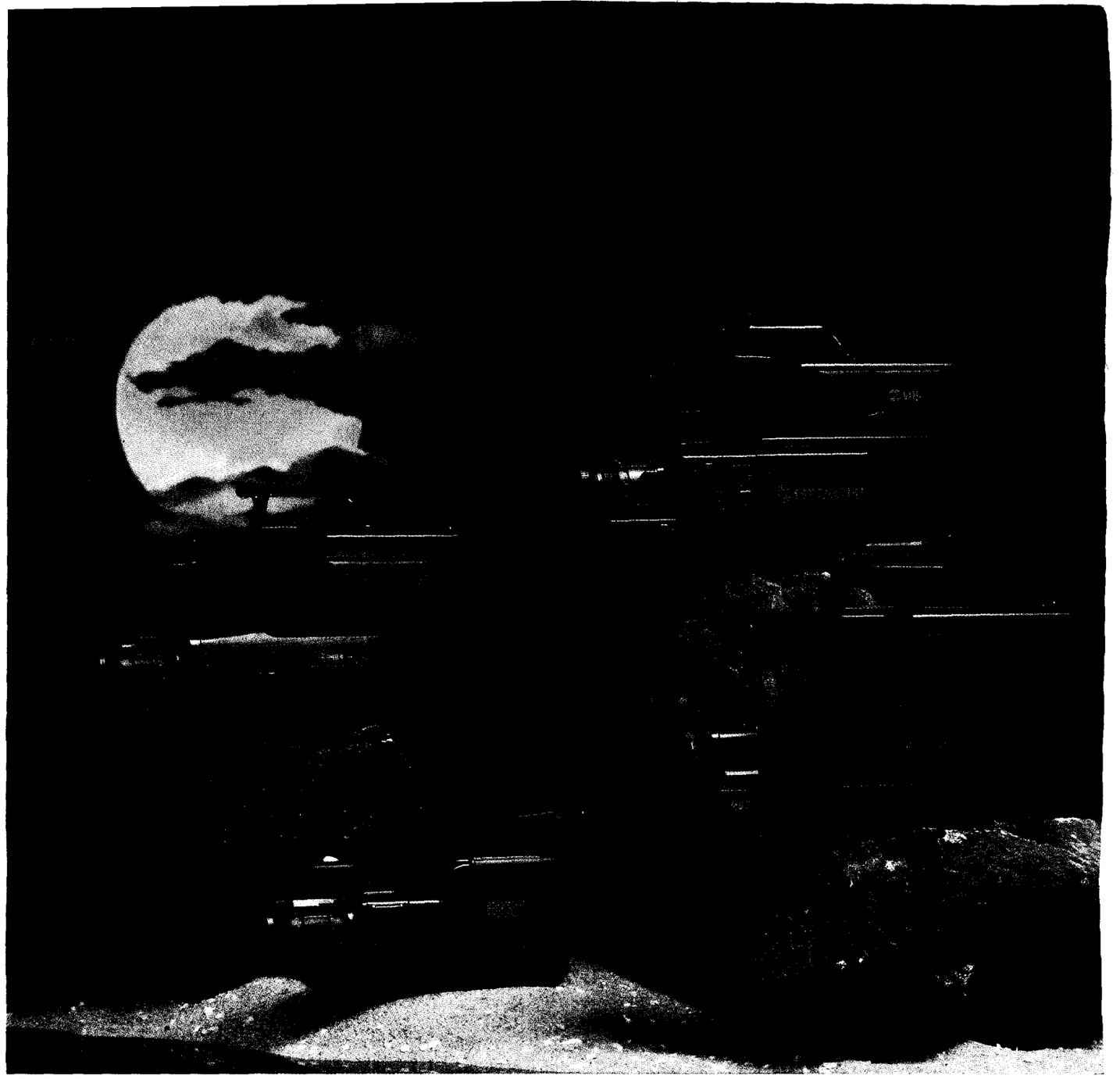
Bose 601 Direct/Reflecting® system.

Conventional speaker system.

Bose Australia Inc., 11 Muriel Avenue, Rydalmere, NSW 2116. Telephone: (02) 684 1022, 684 1255.

Bose Distributors:
NSW and VIC: Bose Australia (Reverse charge (02) 684 1022); QLD: Stereo Supplies (07) 229 7930; WA: Prosound (09) 325 1066; SA: Blackwood Sound (08) 278 1291; TAS: Ohnesman Distributors (003) 26 4622

READER INFO No. 51



THE AUTOMATIC CHOICE.

The dynamic new range of Hitachi video cameras offer a selection to suit the most discerning enthusiasts.

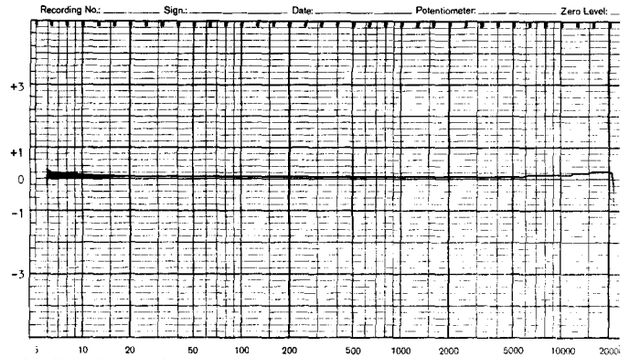
Ranging from the VM-C528E compact VHS C 625 weighing 1.2kg through to the VM-S7280E full size S VHS 625 Camera with in-built colour character generator. All models feature electronic image sensor recording, providing brilliant picture reproduction. Low Light performance is exceptional with minimum illumination sensitivity from 10 to 7 lux.

HITACHI

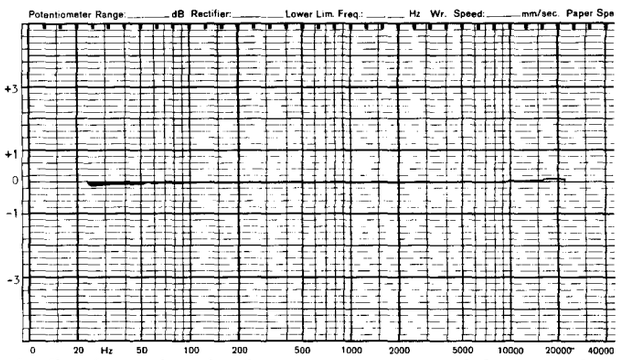
Other features include • Auto-focus, white balance and exposure • High speed shutters • Fade control • Flying erase head • Interval recording and an array of accessories — complete with carry case. The ergonomic design provides greater user control and handling comfort. Hitachi video cameras, the choice is Automatic.

Victoria: (03) 555 8722 New South Wales: (02) 666 3088 Queensland: (07) 260 1344 South Australia: (08) 268 7670 Western Australia: (09) 277 9955 Tasmania: (002) 72 5651

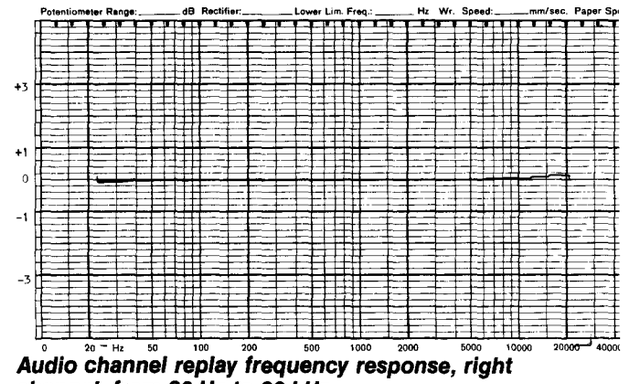
READER INFO No. 52



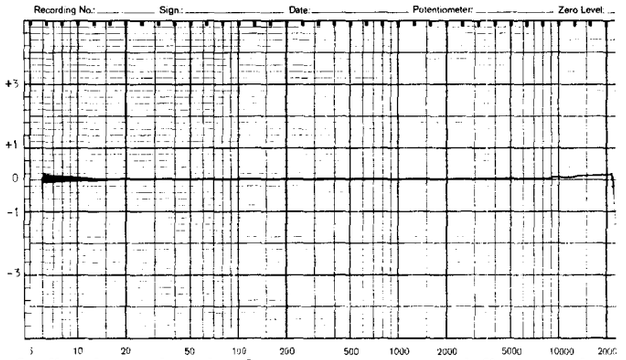
Audio channel replay frequency response, right channel, from 5 Hz to 22.05 kHz.



Audio channel replay frequency response, left channel, from 20 Hz to 20 kHz.



Audio channel replay frequency response, right channel, from 20 Hz to 20 kHz.



Audio channel replay frequency response, left channel, from 5 Hz to 22.05 kHz.

There is very little by way of formal video testing software currently available in Australia. Neither Marantz Australia nor Philips Australia were able to assist us, so I approached Sony Australia who were extremely co-operative and provided us with a Pioneer Laser Vision Reference Disc Type Q1 which provided the wherewithal to assess the video performance. Utilising the V-Sweep signal, we were able to confirm that the video output bandwidth extends beyond 5MHz and that the linearity characteristics of the CV 55 were significantly better than any VCR which I have yet evaluated. The quality of the recorded picture on tracks 38 to 42 was impeccable and I needed no further convincing that the video section of the player is exemplary.

The second stage of our evaluation of the CV 55 used our standard CD test software which facilitated a comprehensive evaluation of the audio channels which are, in effect, basically a conventional CD player integrated into a multi-disc format video player.

The frequency linearity of the audio channel is exemplary with a frequency response that is −0, +0.1 dB from 5 Hz to 22 kHz. That frequency performance is equal to the best that we have yet recorded, and is a sure sign that the electronic manufacturers are now close to a level of perfection.

The conversion linearity is also very good, although not as good as the best CD players we have recently tested – not surprisingly, as those CD players costs as much, or more than, this video player.

The channel separation performance is excellent, being better than 88.5 dB at all frequencies, and the total harmonic distortion figures are also exceptionally good being less than 1% at −65 dB and only 4.75% at −80 dB. The signal-to-noise performance of the player is exceptionally good at −111 dB(A) without emphasis, which is on a par with the top of the line CD players. Even the frequency accuracy is exemplary being only −0.5 Hz for a 20 kHz test signal.

The electronic circuitry is based on a 16-bit 4 x oversampling chip with digital filtering using dual 16-bit digital to analogue converts. The digital filtering has proven to be a practical, efficient system which provides excellent audible quality and reasonable suppression of the potential inter-modulation problem.

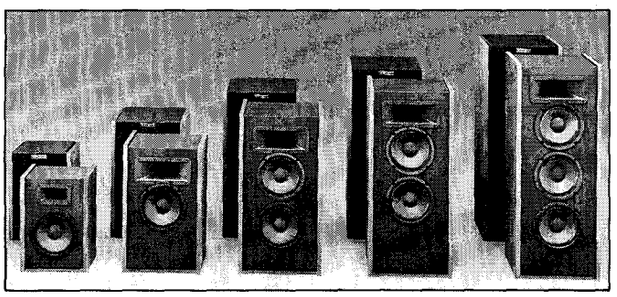
My first attempt to evaluate the player was to play some sample CDV discs that I had purchased in Tokyo, circa 1987. I was a trifle surprised when the CV 55 curtly displayed 'NTSC DISC' on the display monitor and unceremoniously rejected my disc. Oh well, if it wouldn't play what it wasn't supposed to play, I would try with some it could. The first disc I tried was a CD video single with stereo digital sound from Polygram Music Video entitled Cameo. The music I enjoyed, but the video content left me disappointed. The second disc I played was a Decca Unitel, Rubinstein in concert with André Previn and the LSO. The pieces being presented were Grieg's Piano Concerto in A Minor (Opus 16), Chopin's Piano Concerto No 2 in F Minor (Opus 21) and Saint-Saans Piano Concerto No 2 in C Minor (Opus 22). The quality of the sound and the video surpassed the content of the video single and convinced me that this medium provides an alternative with superlative sound.

The other disc which I played was Richard Strauss' Opera Elektra, which provided a dramatic, extremely well produced opera with visual angles and perspective that could never be created by the original – unless you had the freedom to wander around the stage, as the film producer obviously did.

This medium is exciting. The flexibility that this player provides constitutes something of a dilemma, for if you are prepared to spend a little more money on your CD player (and to purchase a CD video player), you open Pandora's box, and of course then have access to both video and audio for a cost which seems quite reasonable.

It would appear that the consumer electronics industry is once more at a crossroads. As you know, they have been very reticent about introducing DAT because of its potential impact on CD. The dilemma is, if the CDV market takes off in the way they hope, will it supplement the market for CDs or ultimately usurp it?

While only time will tell, for the moment you may as well lie back and enjoy it!



Tangent speakers return ▲

THE Tangent series of speakers from American-based manufacturer Klipsch and Associates are soon to be marketed in Australia. They consist of five models, the Tangent 10, 20, 30, 40 and 50.

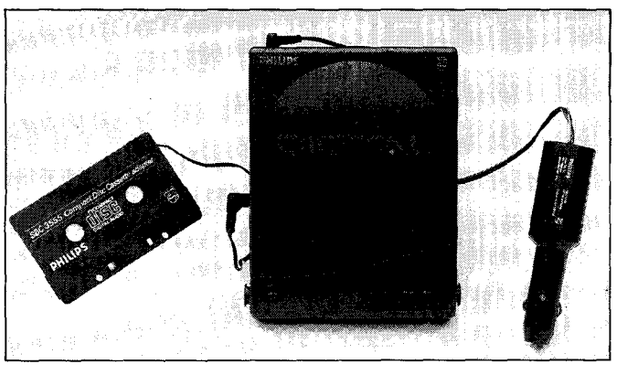
The existing frequency componentry used in Klipsch equipment, plus new low frequency drivers, have been employed in the Tangent range.

The Model 10 is the smallest, with efficiency of 94 dB SPL 1 watt 1 meter with continuous power handling of 100 watts.

Sources at Klipsch claim the Tangent series is arguably the most technologically advanced series made available since the advent of the compact disc.

More details are available from The Australian Sound Company, 133 Market Street, South Melbourne, Vic 3205. ☎ (03) 696-2277.

READER INFO No. 260



Adapter for CD portables ▲

PHILIPS has produced an adapter 'cassette' which links any portable CD player to a car's tape cassette deck.

Without the need for any permanent wiring, the adapter can be inserted into the tape deck and the 1.5 m cable connected to the adapter is plugged into the portable CD's headphone socket.

Electro-magnetic induction transfers the sound signal from the cassette adapter output to the cassette deck. A power connector for this device plugs into the car cigarette lighter.

For more information contact Philips Accessories, 3 Figtree Drive, Homebush NSW 2140. ☎ (02) 742-8311.

READER INFO No. 261

Sennheiser microphones

SENNHEISER Electronics has made available a range of three new amateur microphones. The MD43 has a cardoid pick-up pattern and good damping of structural sound which makes it suitable for a range of applications.

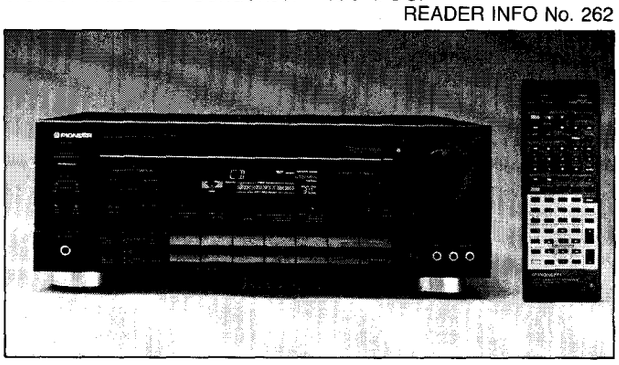
The Model MKE46 is a condenser microphone and uses the electret transducer principle employed in studio models. This gives better sound fidelity and reduces sensitivity to structure-borne sound.

Third in the range is the MK46 stereo. Also a condenser microphone, it has two separate microphone capsules for stereo recordings of high acoustic quality and a battery test capability.

All three models come in a rugged design. Numerous accessories can also be obtained, including cables, windshields, table base and tripod adapters.

For more details contact the Australian distributor, Syntec International, 60 Gibbes Street, Chatswood, NSW 2067. ☎ (02) 406-4700.

READER INFO No. 262



Video surround amplifiers ▲

THE Video Surround Amplifier's VSA1000 from Pioneer Electronics can accept and control seven video inputs and six audio inputs, with the VSA500 able to take four video and five audio inputs.

The VSA1000 also has a facility for 'S' video, which encompasses splitting the video signal to the monitor for high definition pictures from pre-produced videos offering this quality.

It has a Multi-Room Remote control which can be pre-programmed to operate almost any electronic component. It also has the capability to control the system from any part of the home.

The VSA1000 includes acoustic memory, sound field memory, VCR audio noise filter, sleep timer, pre-amp out and pre-amp in terminals and on screen display.

Hi-Fi sound is provided through the 100 watt per channel front speakers, with a variational delay through the 30 watt per channel rear speakers.

Both the VSA1000 and VSA500 have Dolby, Stadium, Studio and Simulated surround sound.

For further information contact, Paul Clarke or Robert Costello at Pioneer Electronics. ☎ (03) 580-9911.

READER INFO No. 263

Rock speakers ▲

ROCKUSTICS speakers are said to be completely water and weather proof. Designed from natural materials, they are the first simulated stone outdoor speaker system. They can be colour-matched to whatever rock is in your garden, so they blend into the landscape.

The set comprises two speakers; a 165mm (6.5") bass driver and a 25mm (1") high frequency tweeter, fluid cooled for high power. They are 100 watt, and apparently need no servicing.

The Rockustics are now being handled by Len Wallis Audio, of Lane Cove in Sydney, and cost around $600 each. More details from them on ☎ (02)427-6755.

READER INFO No. 264

Sennheiser headphones ▲

SENNHEISER Electronic has added two new models to its 'Sound and Style' range of headphones. The HD 520 and the HD 530 models incorporate neodymium which is the most strongly magnetic material known to man so far.

It is used to make the membrane follow faithfully the electrical signal and prevent any self-resonant vibration.

Both models are dynamic wideband systems with large driver coils., are of 600 ohm impedance and are designed for use with a Hi-Fi amplifier. They are also sensitive enough to be directly connected to a component like a CD player while supplying adequate volume.

The HD 520 headphone has driver coils made of copper. This is said to tune the system and provide a well balanced tone. With aluminium driver coils which are half the weight, the HD 530 apparently delivers an airy and transparent tonal colour.

Because its drivers weigh less, the lightweight membrane system can follow the electrical impulses more rapidly.

For more information contact Syntec International, 60 Gibbes Street, Chatswood NSW 2067. ☎ (02) 406-4700.

READER INFO No. 265

A sleek, seductive, slick performer is Akai's top-line model AT-93 stereo tuner. It's so good, some radio stations are going to have to lift their game, says Roger Harrison.

AKAI'S FLAGSHIP TUNER

The radio ratings tell the story: FM is winning over AM. For at-home listening, it has many advantages over AM – better bandwidth,which brings better fidelity (more bass, more treble!), better signal-to-noise ratio, lower inherent distortion, wider dynamic range (not that too many stations make use of it...), and certainly, better stereo separation. Some venture to suggest non-technical advantages, too, such as better personalities (announcers). But that depends on whether you think Doug Mulray is better than Mike Carlton.

We're discussing largely technical things here, personalities are definitely not a factor which tuner manufacturers can influence.

It stands to reason that, if you're prepared to pay a comparatively large sum of money for a tuner, and by that I mean $700 or more, then you should expect to get some pretty good bells and whistles for your money along with commensurate performance. A $1000 tuner should have notable (not just noticeable) performance differences when compared A-B with say, a $500 tuner, and it should have some operating conveniences and facilities beyond that offered on the lower-priced tuner.

Rundown on the AT-93

Akai's flagship, the AT-93 AM/FM stereo hi-fi tuner, incorporates a number of automatic operating features designed, Akai says, to optimise performance. These include; two antenna inputs, the tuner deciding which of the two inputs provides the best signal; selectable wide or narrow IF bandwidths, the tuner deciding which gives the best recovered audio; stereo blend facility to reduce noise from a weak stereo signal, and a high cut filter to further reduce noise and interference. These automatic facilities can simply be overridden by a manual-select control. All these features are controlled by an internal microprocessor.

Additionally, a sequential station-call function, which Akai claims is unique, allows for automatic selection of up to three different stations. It also allows desired stations to be memorised and then recalled when the tuner is turned on via a timer. Just the trick for absentee recording, in the same way you use your VCR.

The AT-93 has dual-gate MOSFETs in the RF stage for both improved sensitivity and lower noise, Akai claims. The tuner also has separate power-supply circuits for both the digital and audio sections, obviating digital switching noise leaking into the audio circuits.

All modes of operation are clearly indicated on the front panel fluorescent display. Tuning is either selected manually – to pre-select, auto scan through the pre-sets, auto-scan to next station up or down – or tune up/down in 100 kHz increments.

The AT-93 incorporates a switchable IF bandwidth, a feature not widely found on FM tuners. By being able to switch the bandwidth – using narrow when the FM band is crowded and wide when there is no other station on a nearby frequency, adjacent channel interference can be eliminated.

A two-stage blend feature effectively cancels unwanted noise. This is achieved by effectively combining the stereo channels according to a preset formula – thereby gradually approaching mono operation as the FM signal becomes noisier or weaker. This results in a much clearer signal but with some compromise in stereo separation on weaker signals.

Dual FM antenna inputs allows automatic selection for the strongest FM signal if you install two antennas, say a dipole and a beam, or an indoor and an outdoor antenna. Akai claims this feature is ideal in both city and rural areas where FM broadcasts may be coming from different locations. Previously, rotation of the aerial or putting up with a much noisier, weaker signal on some stations was the only answer.

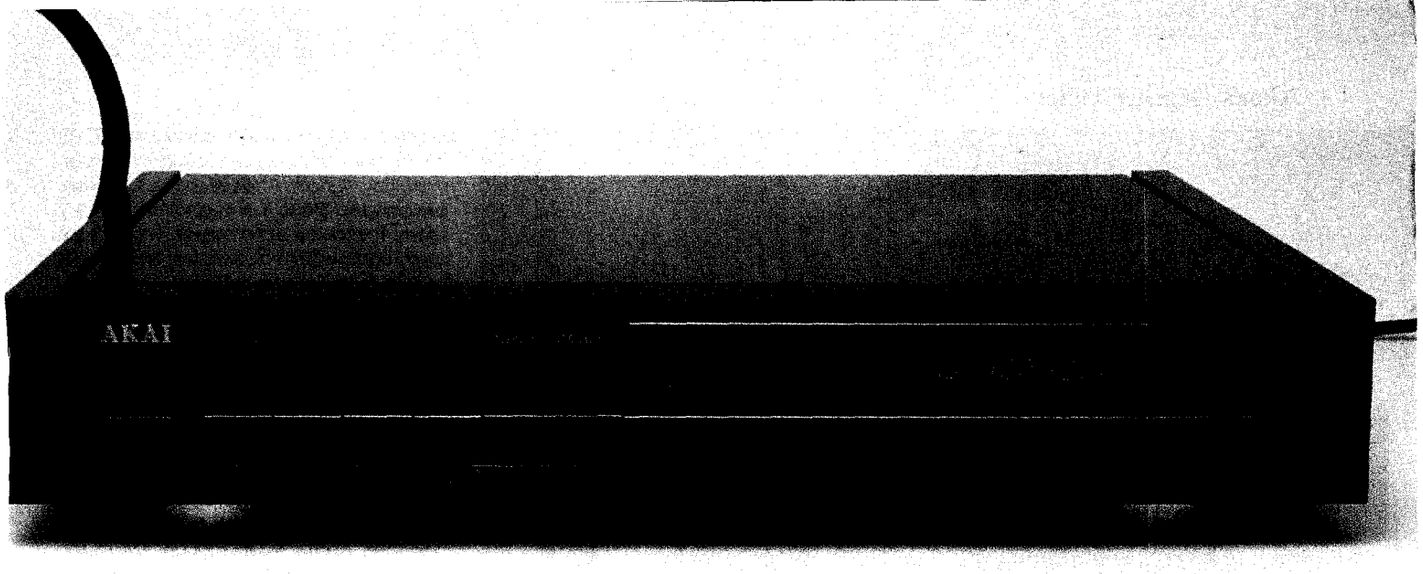
A separate auto-muting function allows inter-station noise to be muted, obviating potential speaker damage. Akai claims this separate muting function is advantageous because in most tuners the muting control is tied to the stereo/mono switch.

Frequency synthesis tuning allows frequency changes in discrete steps in either direction – for Australian conditions this is 50 kHz for FM, and 9 kHz for AM. The manual tuning control allows either a single step at a time or rapid tuning if the station select is held down. Auto-tuning allows station scanning in either direction, stopping at the station with sufficient signal strength to un-mute the tuner.

Up to 10 stations can be stored in the memory for each band, allowing any combination of a total of 20 AM or FM stations to be stored. A high gain, low noise circular loop aerial is supplied for AM broadcast reception.

It's mains-powered, naturally, with a two-wire cord and two-pin plug (no earth). A mains input selector on the rear permits 220-240 V or 110-120 V operation.

The AT-93 measures 461 mm wide by 87 mm high (including feet, the front panel is only 70 mm high) by 344 mm deep. It weighs just 6.3 kg.



The Akai AT-93 tuner — sleek and sophisticated. The circular object at the rear is the AM loop antenna.

Styling

The AT-93 has a sleek, black, satin-finish, brushed aluminium front panel. The cabinet sides are veneered chipboard, the chassis and top cover being pressed steel. The top cover is painted black. The comprehensive display panel occupies the upper right hand half of the unit's front panel. The right hand portion of this incorporates the fluorescent tuning information display (frequency, band, mode, stereo reception, etc). The left hand portion comprises an array of LED indicators showing signal strength, operating mode and which operating facilities are activated (antenna in use, IF bandwidth, mono-stereo blend, hi-cut in or out).

SPECIFICATIONS — AKAI AT-93 FM/AM STEREO TUNER

FM Section

Frequency range.87.5 MHz to 108.0 MHz.
Usable sensitivity .....10 uV.
Capture ratio.....1.3 dB.
Selectivity (+/– 400 kHz).wide — 60 dB, narrow – 80 dB
Image rejection ratio.....90 dB
Signal-to-noise ratio .....mono — 90 dB at 60 dBu.
stereo — 76 dB at 60 dBu.
Distortion (THD at 1 kHz) .....0.02% mono, 0.07% stereo.
Frequency response .....30 Hz to 15 kHz, +/– 0.5 dB.
Hi-cut ..... – 6 dB at 10 kHz

AM Section

Frequency range.....530 to 1612 kHz.
Sensitivity .....300 uV/m.
Image rejection ratio.....40 dB.
Selectivity (+/– 9 kHz) .....40 dB

Running almost the full panel width, right along the bottom of the front panel are all the operating switches. The push-on/push-off power switch is at far left.

On the rear panel, from left to right in order, are the two FM antenna connectors, AM band loop antenna connector, stereo output RCA sockets, AM band synthesiser step switch (set to 9 kHz for Australia), the mains voltage selector and mains input cable.

Akai provides a coax plug, for an external FM antenna, that requires no soldering. A thoughtful inclusion.

Getting the feel of it

Despite its sophistication and apparent complexity, the AT-93 tuner is remarkably simple to operate. There were no little surprises to shock me with bursts of noise or whatever while I found my way around the controls and function switches.

Within the space of about 15 minutes I had found out how almost everything worked – including setting it up for entire auto operation. After that I read the handbook! Doesn't everyone?

The instructions indicate that an AM loop antenna and a wire dipole for FM are supplied. While the loop antenna was there, the dipole for FM wasn't. But, as I already had one on-hand, I substituted that. In any case, in my experience, the wire dipoles for FM reception supplied with stereo tuners and receivers are substantially similar.

Tuning around on FM I quickly located all the major Sydney FM broadcasters, plus several of the community FM stations. I also located a few weak signals on known station frequencies, which a better antenna would have pulled in.

I also found a very strong crossmodulation product, where the audio of two stations could be heard – 2MBS and 2DAY. These two stations are 700 kHz apart and the crossmod. product was 700 kHz below 2MBS. I confirmed it was being produced within the AT-93's front end by checking the frequency with another tuner.

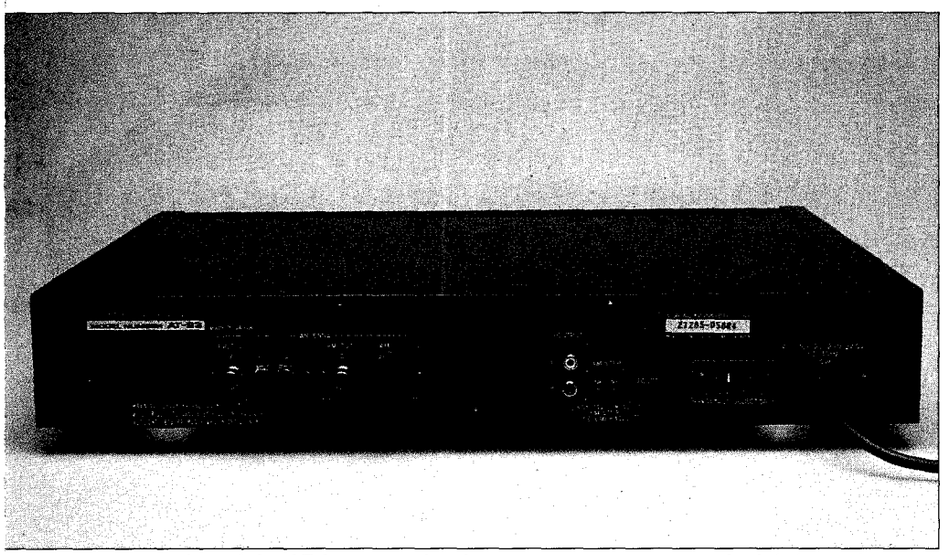
All tuners have this problem to a greater or lesser extent, showing up in areas where very strong signals are received from several stations. Used in a different location, the tuner will behave quite differently, crossmod. products appearing or disappearing according to the particular local conditions.

Every tuner I've ever used has exhibited the problem, so no particular blame or shame should fall on the AT-93. That crossmod. product located was the only one I found. Other tuners I've used generally had a number of them. Once you know where they are, you can avoid them.

Being located in Balmain, high on the suburb's peninsular ridge that juts into Sydney harbour a kilometre or so west of the Harbour Bridge, we're in a real hotspot, many of the FM stations' transmitting masts being but a few kilometres away, line-of-sight. With no antenna connected, perfect reception was had on all the major local stations. And there was no sign of any crossmod. products.

If you were located between a large city and a regional centre, with FM stations located in each, and you wanted the facility of receiving programs from both areas, then two antennas would be a necessity, each oriented to pick up from one area. Here's an application where the AT-93's two antenna inputs would come in handy. With FM stations set to boom in the near future, it's clear that many listeners will be placed in the position where they want to listen to different FM stations scattered over a wide geographical area.

On AM, reception on all local stations using the loop antenna was excellent. At night,



Rear view of the AT-93 tuner, showing antenna connectors at the left (note the two FM inputs), the output sockets etc at the right.

when distant stations crowd the band and adjacent channel interference gives rise to 9 kHz whistles owing to the beating of the wanted station's carrier with that of the unwanted station 9 kHz away, the loop antenna I found could be used to quite good effect to null or attenuate the interference.

The AM loop antenna is simply a plastic ring about 150 mm in diameter with a number of turns of hookup wire wound around its rim, the two ends being twisted tightly together for a length before being terminated for connection to the AM section's balanced input terminals.

For the exercise, I hooked up two other AM loop antennas, as supplied with two other tuner brands, and compared them to the Akai's loop. The latter proved somewhat better, particularly when it came to reducing interference at night; it has a much deeper null and this is more effective in this application.

The Hi-cut filter puts a gentle roll-off on the response, dropping it 6 dB at 10 kHz. It's effective on signals which are a little weak and noisy, and perhaps showing a little treble edginess. When you operate the Hi-cut switch, there's a slight delay during which the audio cuts out. When it cuts in again there's a noticeable pop, which is a little disconcerting.

The memory facility is easy to use and a handy adjunct, although few people would be able to remember all 20 stations they may have programmed in an enthusiastic burst of effort, I'll bet. The tuning and scanning functions all operate in an intuitive fashion, making the AT-93 a very user friendly machine. Quite a contrast to your average VCR!

To the ear

The sound quality on FM is very good. It is remarkably easy to discern whether the prerecorded source being played by a station is analogue or digital, tape or vinyl disc. I notice one of 2MMM's cartridge machines is particularly noisy. They may have fixed it by the time you read this. And it's easy to tell which announcers like to eat the mic on various stations. Ah well, such is the ambience of live broadcasting, I suppose.

I gave the AT-93 a good workout on a variety of stations, commercial and non-commercial. On 2MBS's late-night (well, early for me!) "Stormy Monday" program, the quality (surface noise, variable top-cut, etc) of the discs being played came right through – an essential part of the blues tradition, I feel! The clarity of digital source material played on 2ABC, while not matching the real thing, is quite remarkable nonetheless. If you like your boogie-woogie or rock-n-roll with the wick wound up, then the AT-93 certainly delivers the goods with surprising oomph in the bass, I felt.

As yet, Australia's FM band is hardly crowded with stations, so the dual bandwidth IF filter of the AT-93 would only see limited application in reducing adjacent channel interference. But that situation looks like it's going to change with more commercial and community FM stations starting up soon.

I found on stations which were weak and a little marginal, selecting the narrow bandwidth improved reception. It wasn't dramatic, but certainly noticeable and, I judged, worthwhile.

The Blend facility reduces the stereo separation to 20 dB for Blend 1, and to 10 dB for Blend 2. With a normal stereo separation quoted as 62 dB (wide IF bandwidth, 55 dB on narrow), that's quite a reduction. But, on marginal signals, it does help. Curiously, switching to Blend 1 and again to Blend 2 seems to provide some bass lift, which drops away again when you switch to mono. I was unable to investigate why this occurs.

AM stations are fundamentally limited in bandwidth, and the audio quality on AM reception is largely determined by that. The AT-93 gave a good account of itself on AM, with effortless reception day and night.

So many otherwise good stereo hi-fi tuners fall down by neglecting the AM department. But the AT-93 does not fall into that category of tuner. The only negative here with the AT-93, though, is the lack of an AM stereo decoder. A pity, even though AM stereo programming is pitched largely at the in-car listener.

Points of note

The main features of the dial can be read from across the room, but most of the indicators and annunciators can only be read when you're within a metre's distance. As, for the most part, you only need to read them when setting or re-setting the tuner, it's of little consequence.

While the AM loop antenna gave a good account of itself, the indoor FM antenna has always struck me as being a bit of a problem. You have to stick it somewhere. Putting it down the back of the equipment rack, while getting it out of sight, often gives poor results because of shielding by the equipment. Pinning or taping it up on a wall is decidedly unaesthetic, although it might work well enough.

They usually don't have sufficient lead length, either, to allow placing the dipole in some unobtrusive position which is well away from the equipment. It seems most people put up with the compromise they get. There has to be a better way, some day.

In all my listening tests, I could find no trace of multipath effects – something which certainly plagues other FM receivers around here.

The handbook supplied with the AT-93 is clear, well-written and simple to follow.

Summary

The Akai AT-93 stereo FM/AM tuner is a very sophisticated, high performance piece of equipment, delivering excellent sound within the constraints of the medium. For all its sophistication, it is very simple to operate, and very simple to learn to operate – which is perhaps a slightly more important point. Learning to operate a sophisticated and complex piece of equipment often proves a hurdle that most people baulk at, taking the edge and the enjoyment off the investment made. Not so with the AT-93!

For a price of $1099 rrp, you should expect a lot of a tuner. The AT-93 delivers it. eti