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INFORMATION TECHNOLOGY MAGAZINE

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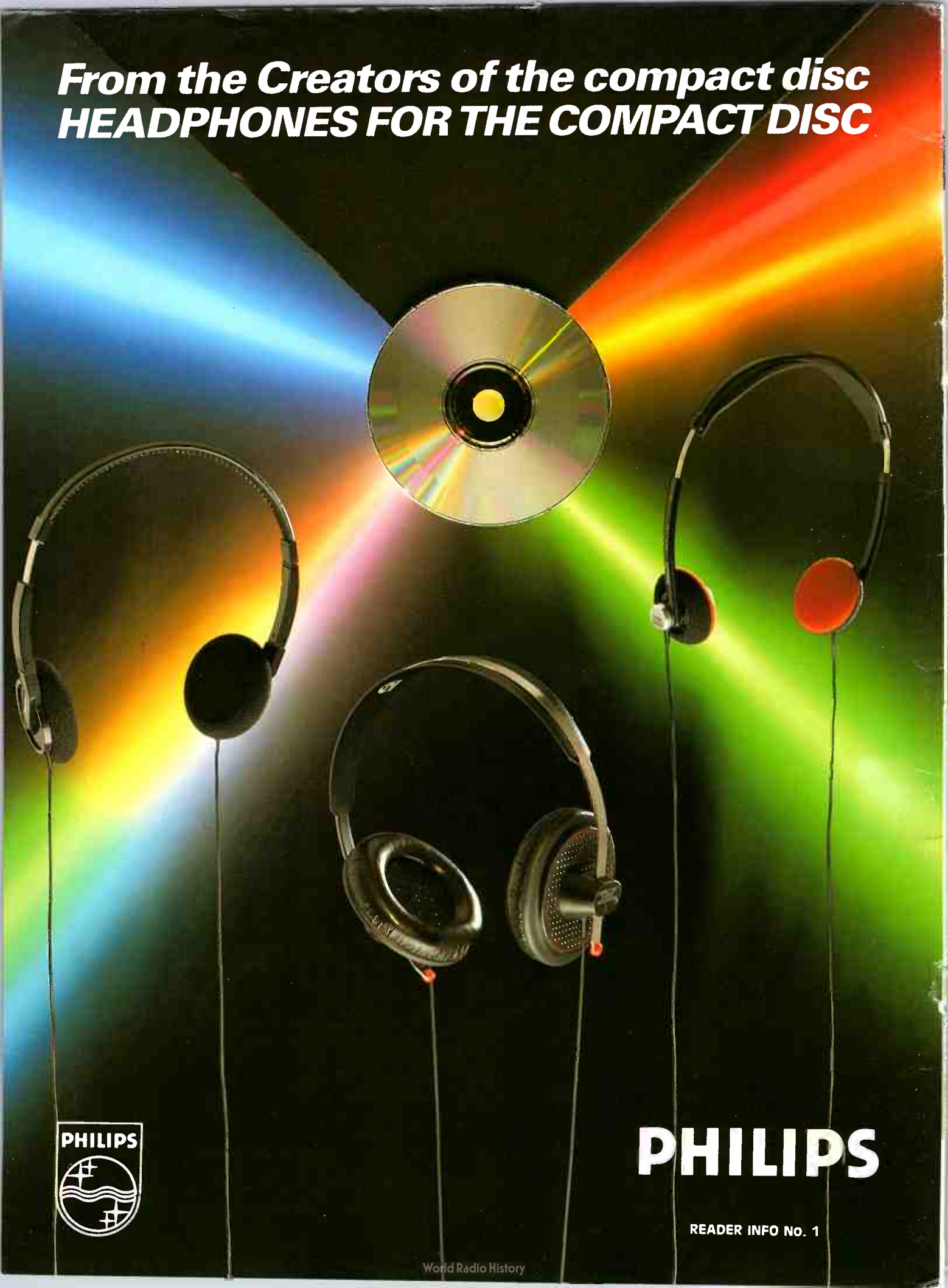

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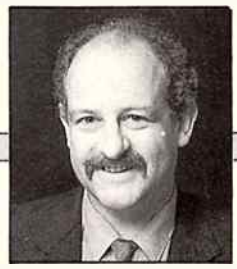

KIM BUCKNOLE

Hub at the Core of ETI

This issue of **ETI** includes a 32-page bonus magazine called **HUB**. **HUB** is Australia's leading information technology **(IT)** title for management. **HUB** will be a permanent feature of **ETI**.

We have made this exciting magazine available to you because **ETI** readers are predominantly employed in, or undergoing education for, what we may broadly term the electronics industries. Such is the pace of development within this sector that it now encompasses consumer electronics, communications electronics, broadcast electronics, computing and more, highly-specialised sub-divisions. **ETI** believes that the **IT** area will have the greatest impact on our lives today and tomorrow. Since 1971, **ETI** has covered **IT** developments for the technically literate, but we have not provided detailed consideration of the implications those developments have for the end user, whether that be the individual or the corporate player. Those implications are superbly covered by **HUB**.

If you are embarking on a career path through education, or already climbing the professional, or corporate ladders, you are tomorrow's decision makers. As such, we know you will embrace the inclusion of **HUB** in **ETI** on a regular basis since **HUB** offers insights into the decision making process in the context of the acquisition and deployment of pace-setting technologies.

HUB will keep you informed as to the strategic commercial considerations which induce your customers to buy from you if you are employed in **IT**. If you are not, **HUB** will make clear how the products and services you yourself use are exploited in various commercial environments. Whether you are involved in commerce, education, the public or private sectors, **IT** is, or will be, so central to all our lives that every **ETI** reader should find **HUB** an absorbing read.

Technology is defined (by Chambers) as the "practice, description and terminology of any or all of the applied sciences of commercial value". We intend editorially to discuss all the elements of that definition. **HUB** enables us to discourse on the "commercial value" of **IT** and associated topics. **ETI** will continue to deal with the "practice, description and terminology".

Thus, **ETI**, with **HUB**, will bring you the complete picture in **IT**. **HUB** has a uniquely accessible applications approach which we trust you will find stimulating and informative.

HUB is currently read by the decision makers in companies which are the current or potential clients of **IT** providers. Now we bring you the opportunity to read what they read as a continuing bonus in **ETI**. We look forward to your feedback on this new venture so that we may fine-tune and develop the application-side story presented in **HUB**.

We have taken this opportunity to highlight our successful computer supplement – **WORKSTATION.** It is now presented as a separate magazine within **HUB**. We have bound **HUB** and **WORKSTATION** separately and drilled them for ring binding to make it easy to retain each issue as a reference source.

Wedding of the Year?

Yes, to us in this industry, **ETI** with **HUB**, is even bigger news than the Bulletin/Newsweek marriage.

ETI now covers consumer electronics through **SOUND INSIGHTS**, computing through **WORKSTATION, IT** through **HUB**, home construction through our **PROJECTS** section, together with our varied and stimulating features, stories, profiles, product and industry news. We believe you will agree that **ETI** is now the most comprehensive electronics technology magazine available in Australia.

Not so dusty

At this time of year, the season of goodwill, Philips Accessories has most generously provided a Christmas gift for all ETI readers. Although we live in the age of cassette tape and compact disc, most of us have a collection of vinyl recordings. With this issue you will find a cleaning cloth for your record collection. It comes with the best wishes of Philips Accessories and ETI.

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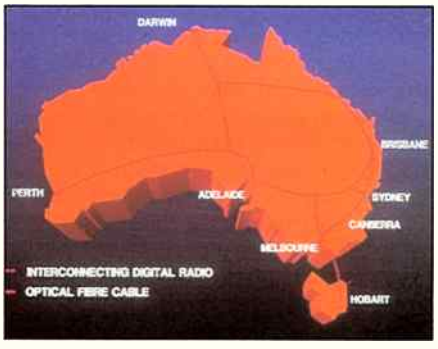

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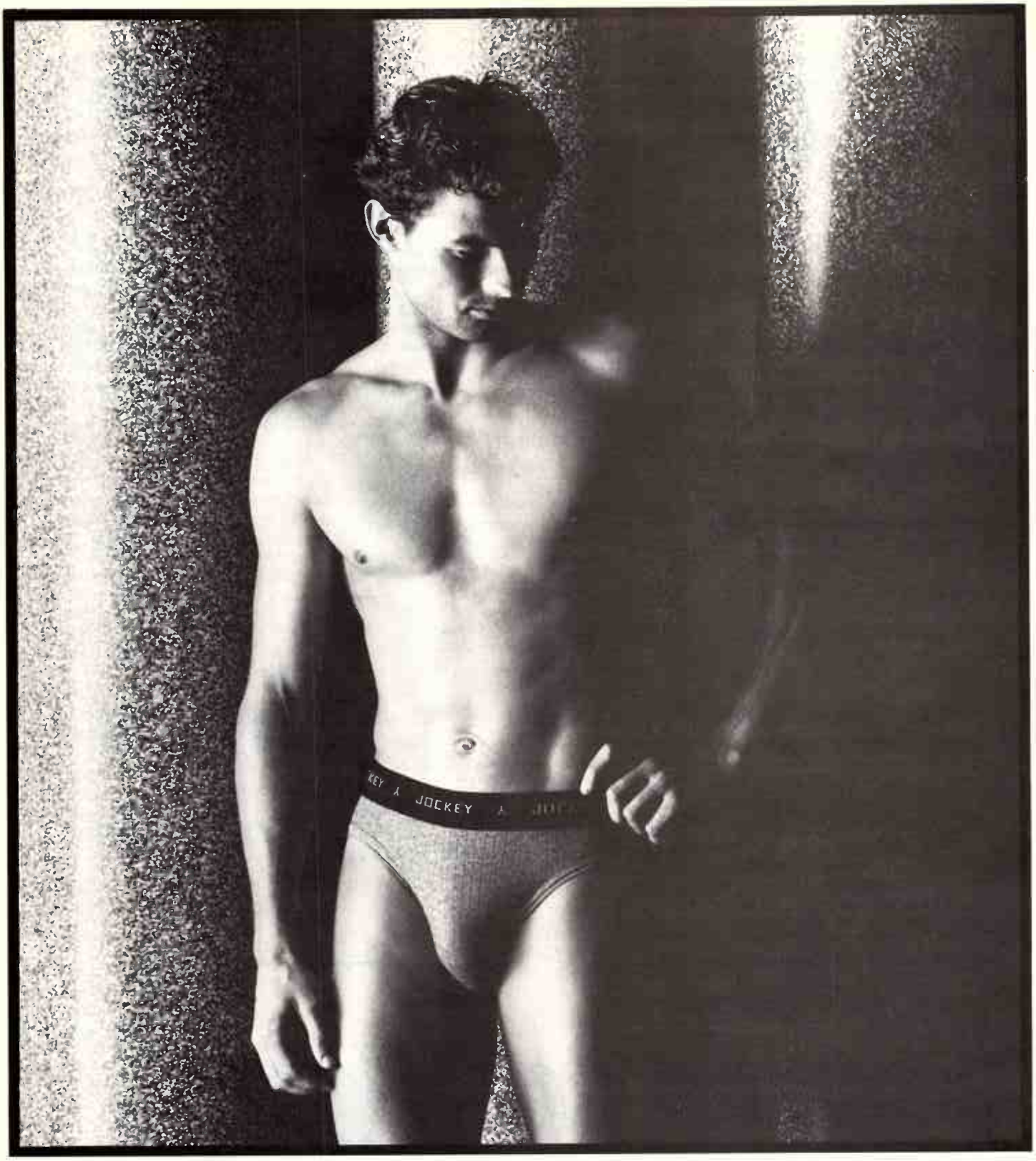
Cover pic courtesy of BP Solar Australia.



MARL BIKINI 100% COTTON

Another famous Australian jockey.

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TECHNOLOGY

POWER SOURCES WHEN THE GRID'S NOT HANDY

Roger Harrison takes a look at the various technologies employed to provide electric power when the electricity authority's grid is not handily located nearby.

So much equipment that is part and parcel of everyday life depends on electric current as a source of energy for its operation. Reticulated mains power is very much a substantial thread underpinning the infrastructure of modern day life. But it has only become so in the latter half of this century. The chorus of a contemporary folk song of the 1960s ran:

Put a light in every country window High speed pumps where now the windmill stands Get in and lay the cable So that one day we'll be able To have electricity all over this wide land...

Well, it hasn't happened. Not completely. Why? It's simply not economically possible. In many instances, it's logistically and/or geographically impossible.

So, other sources of electric power have been sought where it is required to operate equipment, or whatever, remote from mains power. These sources of electric power are generally grouped under the "generic" title of *remote area power supplies*, abbreviated to RAPS.

Most people conjure up an image of a bush or outback home with power provided by such sources – a wind generator, solar panels and such things. While powering a home is one application, there are dozens of others.

Power sources

Electric power can be derived from a number of sources:

1. The Sun. Photovoltaic modules (solar cell panels) generate dc directly from the Sun's energy.
2. The wind. A propeller or turbine driven by the wind drives an electric generator.
3. Fuel. A petrol or diesel motor is used to drive an electric generator. In this category we must also include thermo-electric generators which burn a gas and produce electricity from thermocouples.
4. Water. A flowing stream or river is used to turn a wheel or shaft, which drives an electric generator (microhydroelectric system).

Figure 1 illustrates the use of these various sources. A means of storing the generated electric energy is often used in conjunction with all these sources. This means storage batteries, lead-acid types being typical – your car battery is a good example.

Photovoltaic modules, or solar cell panels, have been in wide use for the best part of 20 years and are manufactured in a range of power outputs to suit widely varying applications and conditions.

Wind generators have been around for 50-60 years or more. They were once quite common in rural Australia. Wind generators are still manufactured in Australia and are available in a considerable range of power outputs.

Petrol and diesel motor-generator sets are also not new and are available in a very wide range of powers and capacities, from small and light portable units for intermittent use, to substantial sets for fixed, continuous operation.

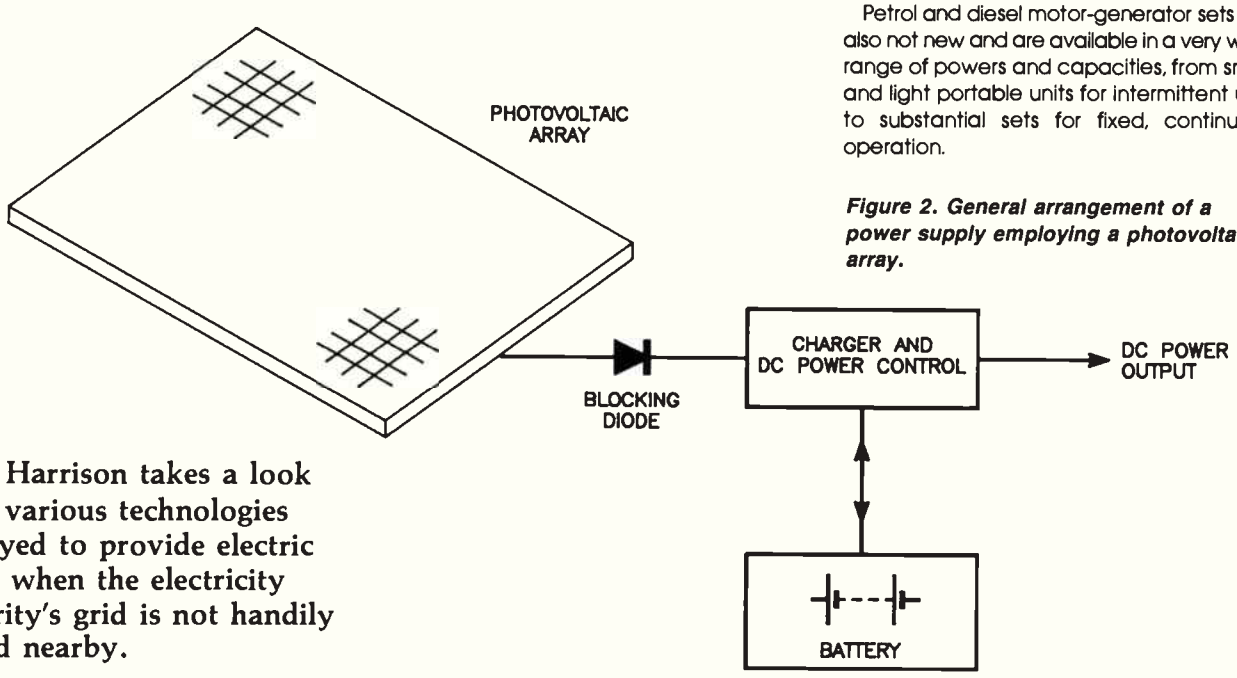


Figure 2. General arrangement of a power supply employing a photovoltaic array.

Thermo-electric generators, based on a principle discovered by Seebeck in Germany in 1821, produce electricity by heating an array of dissimilar metal junctions, which generates current directly. They have not found wide application because other methods in the past have proved more economic or were more widely exploited. Nevertheless, low-powered portable thermo-electric generators which burn propane, methane or hydrogen are commercially available. Typically, they're used for battery charging, or supplementary battery charging, where a gas source is available.

Most Australians think of the Snowy River scheme when hydroelectric power is mentioned. But almost any source of running water can be tapped as a source of energy to turn a wheel and drive a small generator. Microhydroelectric systems, as they're called, are available in a small range of power outputs.

Photovoltaic modules

These are an array of silicon solar cells, which are basically flat, large area silicon diodes (see accompanying panel). All the cells in an array, or panel, are connected so as to provide a useful voltage, the number of cells in the array (and thus its size) being chosen to provide a convenient current or power output.

The Sun is an incredible source of energy. It is, in fact, the world's primary energy source. On a clear day, about one kilowatt of solar energy falls on a square metre of the Earth's surface at mid- to low-latitudes. About 30 per cent is reflected back into space, 47 per cent is converted into heat, the hygroscopic cycle (rain and weather) uses 23 per cent and the wind, waves and convection currents draw some 0.25 per cent.

Photovoltaic arrays or modules provide electric power in clean, transportable, convenient form. There are no moving parts involved; they can be mounted close to the point of consumption and they require an absolute minimum of maintenance.

The array of cells in a module are encapsulated in a clear, weather-resistant laminate of epoxy resin sandwiched between sheets of glass. This assembly is enclosed by a sturdy frame made from a corrosion-resistant metal, such as anodised aluminium, making a very robust, weatherproof unit. As a consequence, they have very long lifetimes. The capital cost of purchasing the module or modules and ancillary equipment is the main cost involved; maintenance costs are virtually zero.

Photovoltaic modules can withstand shorts and open circuits under most conditions. They produce direct current and can charge storage batteries directly. Used in conjunction with petrol or diesel generators, they can reduce their running times and fuel and maintenance costs.

Modules are manufactured to provide specific dc output to suit battery systems, typically 12 V, 24 V and 36 V, at differing design current levels. The module has to be aligned to maximise its exposure, depending on local latitude. Power output varies with time of day, being maximum at local noon, and with season – daily energy output being higher in summer than in winter, as you'd expect.

Despite falling real cost over the past decade, photovoltaic modules are comparatively expensive when rated against other systems. Depending on the energy requirements of whatever's being powered, supplementary energy from another source may be required in addition to a photovoltaic array for a power supply system. This may be a particular requirement to bridge the lowered energy output during

New light load invert-a-power

SELECTRONICS has released the latest addition to the Invert-A-Power Series of Australian designed and built inverters.

The new unit, the SPI-200, is available in 12 or 24 volt versions, both of which provide 200VA continuous power and intermittent output power of 425VA and 600VA respectively.

The SPI-200 has been developed in direct response to the demand for a light load model for use in applications such as boating, camping, caravanning, outdoors and weekend holiday homes.

With this new unit, the user can operate a wide variety of domestic 240 volt appliances from a deep cycle 12 or 24 volt lead/acid battery. Typically, items such as TVs, lighting, calculators, computers, mixers, shavers etc, are all within the capacity of the SPI-200.

Weighing only 4.5kg and completely portable, the unit connects to the battery with conventional jumper leads. The appliance is then simply plugged in to the standard switched power point on the inverter. The SPI-200 is equally at home in fixed installations.

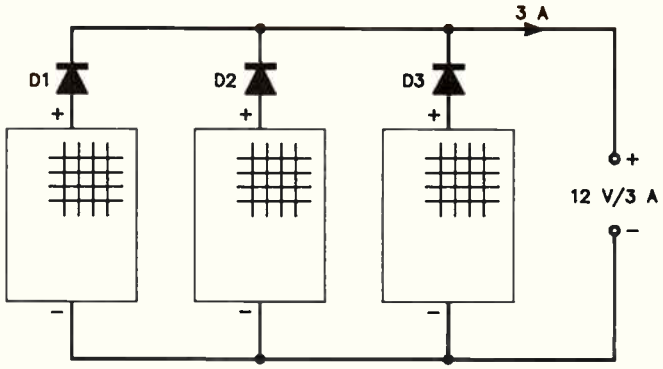
The SPI-200 has most of the features of the larger models, including demand start, built-in protection against wrong way connection and automatic shutdown in the event of overload or short circuit. The unit continues to operate when the overload is removed (there are no fuses to replace).

Designed and built in Australia by Selectronics and incorporating solid state components, the Invert-A-Power SPI-200 is virtually maintenance free, says the manufacturer, and is fully supported by a 12 month warranty.

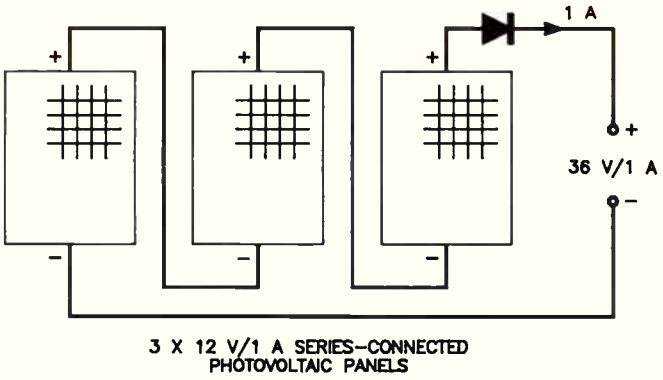
There are now eight models in the Invert-A-Power range: 480 watt 12 volt, 480 watt 24 volt, 600 watt 24 volt, 980 watt 12 volt (modular), 1100 watt 24 volt (modular), 1200 watt 48 volt (modular) and the new 200 watt 12 or 24 volt units.

The following Invert-A-Power models have been accepted by the Energy Authority of NSW for use under the Remote Area Power Assistance Scheme (RAPS): 980 watt - 12 volt, 1100 watt - 24 volt and 1200 watt - 48 volt.

For further information contact Mr Ken Scott, Selectronic Components Pty Ltd, 25 Holloway Drive, Bayswater, Vic. ☎ (03) 762 4822.



3 X 12 V/1 A PARALLEL–CONNECTED PHOTOVOLTAIC PANELS



3 X 12 V/1 A SERIES–CONNECTED PHOTOVOLTAIC PANELS

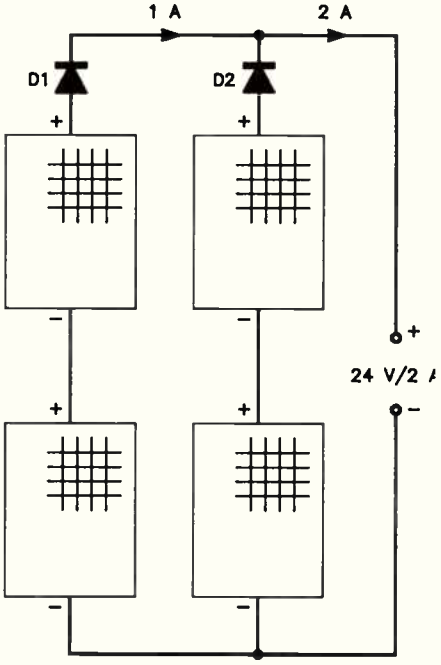
wet and cloudy periods, or during winter at higher latitudes. In the installation of some systems, a means of varying the array's tilt angle is included so that it may be set to maximise the output during each season of the year as the Sun's angle in the sky varies. A shallower tilt angle is required in summer, a steeper angle in winter. Schemes to automatically vary the array's tilt angle to follow the Sun have been devised.

Photovoltaic arrays are principally used in conjunction with a storage battery system. Generally some means of regulating the charge and/or the output is involved, too. This prevents overcharging of the battery and may additionally provide some voltage regulation for the output. Figure 2 illustrates the general system. The blocking diode shown is to prevent the battery discharging via the array (which is just a bunch of diodes, after all!) during the night.

Single modules may be assembled into an array in a variety of ways to deliver the voltage/current requirements of the system. Figure 3 shows typical parallel-connected, series-connected and series-parallel connected arrays. Note the blocking diode arrangements with each.

Solar cell arrays are used in a huge variety of terrestrial applications, from battery charging on boats and for remote homes, to solar powered street lights. Solar-powered water pumps, electric fence controllers and radio-telephones are just some of the other applications.

As I indicated earlier, capital cost is your biggest outlay with a photovoltaic system. A module delivering 20-30 watts will set you back between $300 and $400. A 40-50 watt module (12 V/4 A peak output) is in the $500-plus bracket. Even second-hand prices remain high because of their longevity. Then you need to add the cost of ancillaries, like the charger/regulator. A complete array delivering around 300-400 watts (peak) output will leave little, if any, change from $5000.



4 X 12 V/1 A SERIES–PARALLEL CONNECTED PHOTOVOLTAIC PANELS

Figure 3. Showing the various general arrangements for interconnecting photovoltaic panels to produce different voltage/current outputs.

Wind generators

Wind farms have sprung up in the USA and Europe, but have yet to appear in Australia. Individual application of wind generators prevails here.

Wind generators involve a bladed propeller or other rotating turbine system coupled to an ac or dc electric generator. They are invariably mounted on a tower, to best take advantage of the wind, and come in two basic types: horizontal axis and vertical axis.

Horizontal axis machines are reminiscent of windmills, having a rear tail which positions the blades into the wind. The blades may be mounted upwind of the generator and tower, or downwind. Vertical axis generators are not common in Australia, but have the advantage that they do not need to swivel in the wind and the generator itself may be more conveniently positioned.

With such a long history of manufacture and development in Australia, wind generator power systems are readily available, have competitive capital costs and comparatively low maintenance costs.

However, reasonably regular, reliable winds

need to be available, not too far distant from the point of consumption. Coastal regions usually experience more regular winds than inland regions. In general, local annual average wind speed needs to exceed about four metres/second (8 knots).

Siting of wind generators is much more critical than for photovoltaic modules. They need to be located on an elevated site, clear of obstructions – such as trees, buildings etc – for some distance. They also need to be sited clear of other wind generators.

A generator's performance characteristics need to be matched to the site and the application. Knowing the load, or power requirements, generator size and turbine specifications are chosen to suit. Often, a gearbox is required between the turbine and the generator to increase the shaft speed because wind speed is too low for the generator.

A wind generator has a minimum wind speed at which it will commence to deliver power, a rated wind speed at which it delivers its rated power output, and a cut-out speed at which it is shut down for protection in high winds. Once the generator reaches rated speed, power output is fairly 'flat' up to cut-out speed.

Control equipment for a wind generator is more elaborate than for solar cell modules. A start-up and shut-down mechanism is

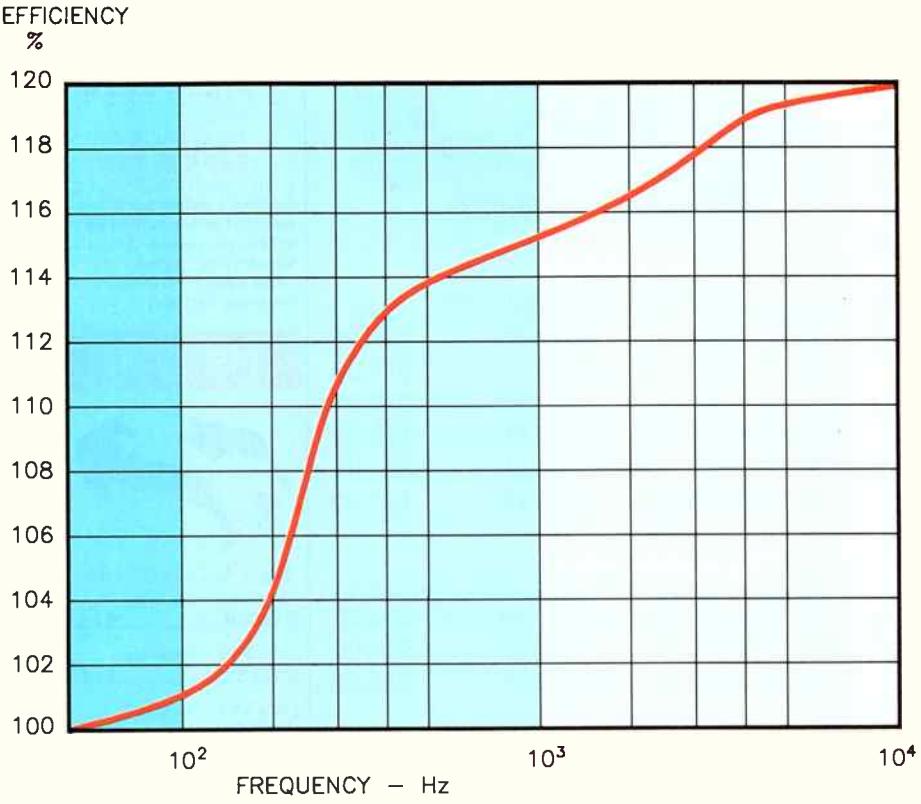


Figure 4. The light output of a fluorescent tube increases with increasing supply frequency. This can be exploited in dc-ac squarewave inverters for lighting.

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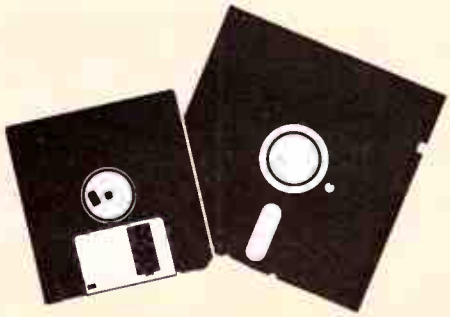

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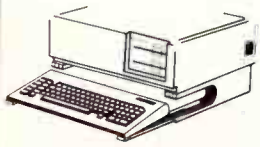

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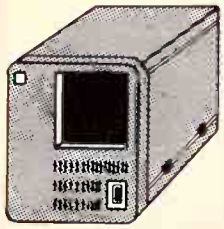

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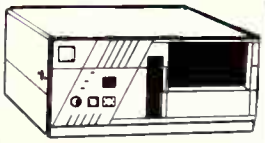

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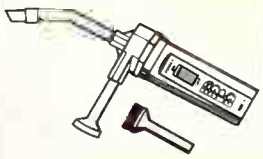

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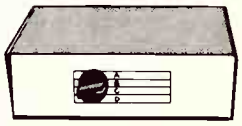

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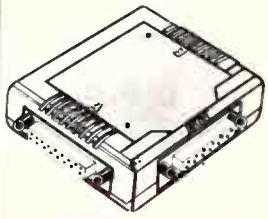

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Energy for the future

FISCAR Pty Ltd is a small development company whose direction has been in renewable energy over the last few years.

The company has developed a low speed generator which is said to be unique in that it produces 1kW of power at 180 rpm. It can be tailored to suit the client's application. There is no gearing involved in the generator; it is direct drive, minimising losses and possible breakdown from gearbox associated generators.

Fiscar also makes a pure sine wave inverter which is capable of starting induction and brush type motors; sizes range from 1kW to 8kW and prices are very competitive with square wave technology. Some features supplied as standard are normal optional extras.

Wind power is a source of energy which, if applied properly with other resources of power input such as solar or diesel, can be made a viable resource at present and for the future. Telecom Australia has shown interest in Fiscar's systems and has funded a number to be placed around Australia and monitored over a period of 12 months to determine accurate readings of production in various wind condition sites. Telecom's involvement means indepth evaluation both of technology and market possibilities.

Development is continuing with the goal of quality at a reasonable price.

Further information from Fiscar, 2 Oaklands Avenue, Fern Tree Gully, Vic. 3156. ☎ (03) 758 2324.

required. Mechanical and air brakes are used, as well as blade feathering (pitch variation). A manually- or electrically-operated swinging tail may be used to swing the turbine out of the wind. A mechanical brake allows stopping the machine for maintenance.

A voltage regulator is essential to maintain output voltage with varying wind and turbine speed. Electrical protection to prevent overcurrent or reverse current is also included. In direct battery-charging applications, battery over-voltage protection is generally included. In prolonged high winds, when the generator's output may not be needed, a load dump may be connected. This is a resistive load which dissipates the excess energy as heat.

Wind generators are noisy. Wind passing over the blades, vibrating the tower, noise from gears, brushes and bearings all contribute. Because of the moving parts, regular maintenance is essential.

Wind generator powered battery chargers, wind-generator powered electric pump systems and lighting/ac power systems are all common applications.

Low-power battery-charging wind generator systems, delivering around 25-50 watts output cost much the same as comparable power output photovoltaic systems. But once the power output rises to 200 watts and more, the price per watt rapidly drops. A 400-500 watt wind generator costs around $2000.

Motor generator systems

Of the 1 kW/square metre of solar energy that falls on the Earth, a minuscule 0.025 per cent or so is stored in plants through photosynthesis. Eventually, through geophysical and geochemical action, plant matter is turned into coal and oil – the so-called fossil fuels. This trickle of energy into photosynthesis has acoumulated over millions of years. It has been estimated that it takes some six million years of accumulated photosynthesis to provide the world with six months' worth of coal and oil! Think about it. For the moment, anyway, power from burning fuel is a major source of energy.

Petrol and diesel motors linked to dc or ac electric generators have provided electric power sources of various capacities for the best part of this century.

For remote power applications, both portable and fixed systems are available. Small, portable motor generator sets generally use petrol motors, while the larger, fixed systems generally employ diesel motors. The generator may be an alternator – producing ac output, or a dc generator. The ac output types generally provide 240 Vac, while the dc output types are obtainable in a variety of output voltages, generally for direct battery charging.

Motor generator power supplies have the great advantage that power is available virtually on demand. They are reliable and robust. Capital cost is comparatively low. They can provide large currents and have good temporary overload characteristics. A motor run at a constant speed is very fuel efficient. The ac (alternator) type can be used to power mains-operated appliances directly and charge batteries through a charger; the dc output type may be preferred for direct battery charging, eliminating the battery charger in a remote power system.

Against motor generators is their high operating and maintenance costs, particularly when compared to photovoltaic arrays. There is the need to store fuel and the necessity of siting them away from the consumption source for safety and noise reasons. They produce fumes and waste fuel if not run at or near full load.

Petrol and diesel engines require different starting and stopping systems; petrol engines have an electrical ignition system, diesels do not. Petrol engines are stopped by cutting off the ignition system, diesel engines are stopped by cutting off the fuel supply.

Control systems include engine speed regulation, high temperature shutdown, low oil pressure shutdown, over- and reverse-current protection for the generator and over-voltage/under-voltage protection for dc battery charger generators.

Most motor generator systems have outputs starting in the 100s of watts area, ranging to tens of kilowatts. Petrol motor sets are much less expensive than diesel sets, but have shorter lives and higher running costs. Portable petrol generator sets are quite cheap ($600 to $1500)and cost effective where intermittent use is only required. Larger, fixed installation diesel units are generally more cost effective per kW capacity. For a fixed installation diesel generator, up to 10 kVA output, cost will be around $1000 per kVA; from 10-30 kVA, this figure rapidly halves.

Inverters

There is often a requirement to power ac mains-operated appliances and, with dc power supply systems, this means generating 240 Vac/50 Hz from some dc voltage – usually 12 V or 24 V. An electronic dc-ac inverter is used for such applications.

Three approaches to generating the required 240 Vac at 50 Hz are taken: generate a square wave of the appropriate amplitude, or derive a sinewave or pseudo-

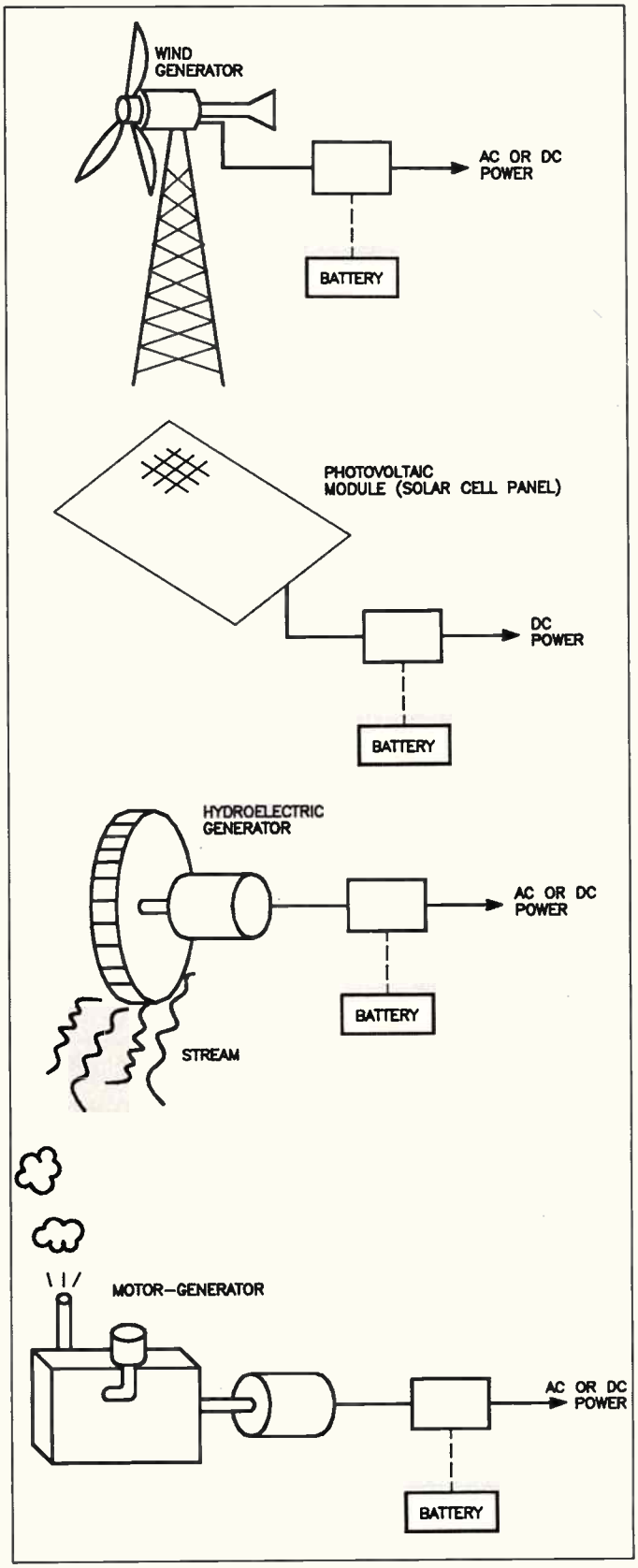


Figure 1. The various sources exploited for generating electric power remote from the mains power grid.

sinewave supply of appropriate amplitude.

A square wave dc-ac inverter has the advantage of simplicity and efficiency. Some appliances will not operate correctly, if at all, from a square wave source, however.

Sinewave inverters provide a pure sinewave, but are not very efficient as essentially they are an oscillator/power amplifier arrangement. They are rarely seen. However, pseudo-sinewave inverters overcome the problem. These generate a square wave output that has a "step" at the zero-crossing point, providing a very crude approximation to a sinewave.

Square wave inverters are often used to provide power for low-powered appliances and for lighting. In lighting applications however, 50 Hz inverters are a liability. The most efficient lighting, for light output versus energy input, is provided by fluorescent tubes. When operated from frequencies higher than 50 Hz, their light output actually increases! Figure 4 tells the story. Fluorescent lights with individual high frequency dc-ac inverters are the most efficient way to obtain electric lighting from a remote area dc power system.

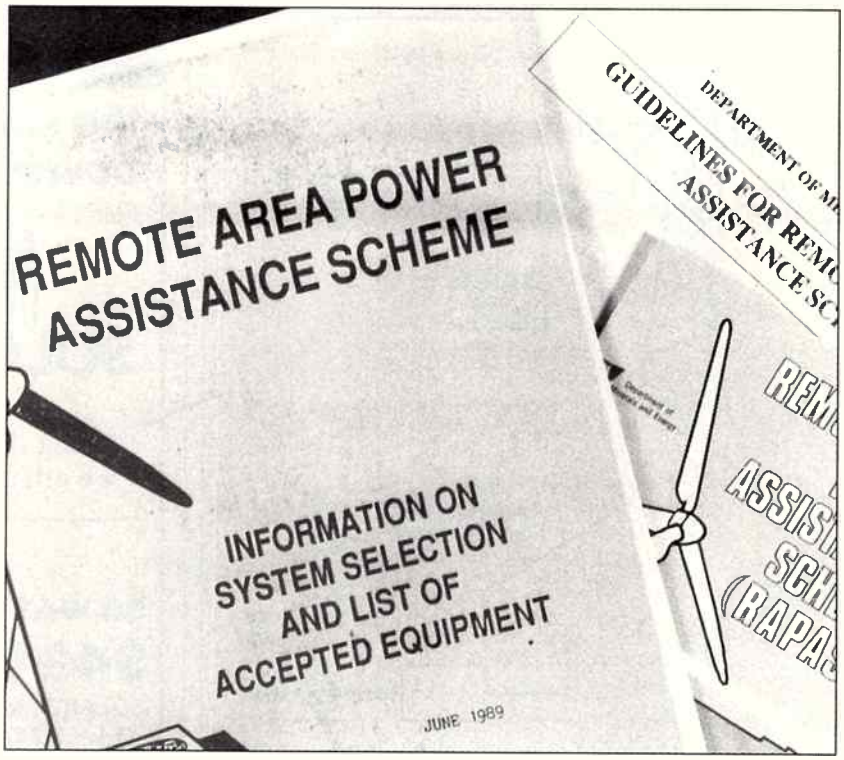
Hybrid systems

Where the application is to provide light and power for a dwelling remote from the power grid, a hybrid system is established, using a combination of sources, as illustrated in Figure 5. Only part of this system may be implemented, using whichever sources are appropriate or available, or whatever can be afforded. Lifestyle in a house remote from the power grid has to be very different from that where reticulated mains is on tap. Electric heating is out, for a start.

In the illustration shown here, the wind generator may be replaced by a microhydroelectric generator. The dwelling's lighting system may be powered from the dc side, while appliances are powered from the ac side. The motor generator may be absent, or the solar cell panel may be absent.

Wrap up

Unfortunately, there's insufficient space to go into remote area power supplies in more depth in one magazine article. Coverage of storage battery requirements and their technology would take a complete article of this size alone! I hope this has provided an overview of the subject and the technologies involved. eti



RAPS and RAPAS

IN NSW, the Department of Minerals and Energy runs a Remote Area Power Assistance Scheme (RAPAS). Other states run similar schemes. Readers who are interested may write to RAPAS, Dept of Minerals and Energy, PO Box 485, Sydney, NSW 2002 ☎ (02) 234 444 for further information. The department can provide brochures outlining the scheme, the eligibility for and availability of grants, and information on system selection, with a list of accepted equipment which may be eligible for subsidy. Discussion of the scheme is without the ambit of this article, but if the literature provided by the NSW Government is typical, interested readers will readily be able to inform themselves. (KB)

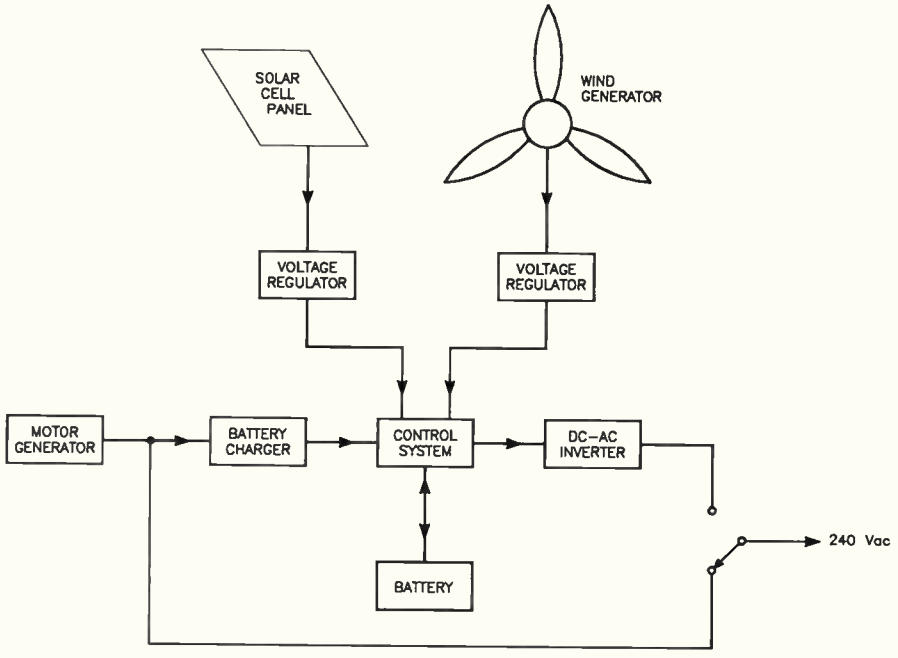


Figure 5. A hybrid system is generally put together to provide light and power for a dwelling remote from the power grid.

ARTHUR CUSHEN

NO CUTS FOR RADIO FRANCE INTERNATIONAL

Radio France International is planning to upgrade its transmitters and relay bases at home and overseas. By Arthur Cushen.

Many international services are faced with budget cuts, but not so Radio France International. All their transmitters located in France and relay bases overseas are being upgraded, while new bases are being built in Thailand and Djibouti.

According to the Shortwave Frequency Manager of Radio France International, plans are underway to upgrade at the transmitting stations at Allouis and Issoudun. The present 100 kW transmitters were installed in 1962 and are being replaced by 500kW units. Radio France International, in its expansion of overseas relay bases, has made an agreement with the Thai Government to build a relay station with a maximum of four 300kW or 500kW transmitters being installed. This would enable Radio France International to cover most of Asia. At the same time, plans are underway for a new relay base in Djibouti. This will have similar capacity, but the decision of which base is to be built first is still to be made.

Earlier, Radio France International had announced plans for relay stations in Reunion and New Caledonia, but these are not going ahead. The projects were originally promoted by the former French Prime Minister, but after two years it was decided to cancel. The proposed Reunion project has been cancelled in favour of the new relay base at Djibouti, while plans for New Caledonia to serve the Pacific as well as Australia have also been left in abeyance.

The existing transmitter complex at Montsinery, French Guiana, is to be expanded with a further 500kW transmitter which will bring the total to four located at this South American transmitting site.

Radio France International operates 24 hours a day in French, while English broadcasts are 0315-0345 on 9790, 11700, 11995, 15300kHz; 1230-1330 9805, 11670 while the broadcast 1600-1700 is on 11705, 15630, 17620, 17795kHz. Broadcasts in French are best received in this area at 0600 on 6175, 7135, 9790, 11800, 15300, 17850 and 21620kHz.

Voice of hope for Guam

THE Voice of Hope is well known to shortwave listeners for its broadcasts from Lebanon operated by High Adventure Ministry. The Lebanon transmitters operate on 6280kHz and, with a low powered signal, on 6215kHz. The transmitters in Lebanon are near the Israel border. The antenna on shortwave has been changed to cover North Africa and the Soviet Union, and this will be coupled to a new 25kW transmitter.

In California, KVOH is well known as the base of High Adventure Ministry, using a 100kW transmitter. As this transmitter cannot reach into China, however, a new transmitter on Guam is expected to commence operation this month. It will use the callsign KHBN and 100kW of power. High Adventure Ministry has been operating for ten years and the Guam transmitter will be its third area of operation, enabling the station to cover China and South East Asia.

The organisation has had several ideas for its broadcasting role in the Pacific, including operation from a ship, then broadcasts from Singapore or the Philippines, but both of these proved difficult. So, Guam, being a United States possession, was chosen for the final site.

DX programs

MOST international stations have special programs for the shortwave listener, and this list covers only a few of those well received in the South Pacific. In all cases repeat broadcasts of these sessions are heard at other listening times.

Sunday: 0230 Radio Australia 15240, 17795kHz, 0750 BBC 7150, 17710kHz

Monday: 0800 HCJB 9745, 11925 kHz

Wednesday: 0230 Radio Sweden 9695, 11705kHz

Thursday: 0750 Radio Nederland 9630, 15560kHz, 1050 Radio Nederland 9505kHz

Saturday: 0800 HCJB 9745, 11925kHz, 0845 Swiss Radio 9560, 13685kHz

1000 KTWR 11805kHz, 2100 Radio Canada 15325, 17875kHz.

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.

Palpable power in your palm

THE GOSSEN HANDHELD MULTISCOPE

Would you believe — a dual-channel, digital storage oscilloscope, digital voltmeter, frequency counter and signal computer could all fit in the palm of your hand? You'd better, because here it is! Reviewed by Roger Harrison.

I was intrigued when, earlier this year, a press release on this instrument arrived in our offices, accompanied by the obligatory photograph. It looked like a calculator with a graphics display and three BNC connectors protruding from the top skirt.

A brief browse of the literature supplied quickly convinced me I was looking at something out of the ordinary. But it gave me a faint feeling of deja vu. I then dimly remembered reading about the release of such an instrument a year or two back in a German electronics magazine. Probably an earlier Gossen Multiscope, for the Gossen Multiscope 100 is, indeed, made in Germany.

INSTRUMENTATION

The basics

It's a half-book sized instrument, measuring 260 mm tall by 105 mm wide by 39 mm thick. It weighs 700 grams. The top of the front panel is dominated by the liquid crystal display which is about 60 mm square. Beneath this is a 50-key calculator-like keyboard. On each of the left and right hand side panels are a pair of slide switches. The upper ones are for selecting the input coupling mode on each channel, the lower ones are the input range selectors for each channel.

Three BNC connectors on the top skirt provide the two channel inputs, at left and right, and a trigger input in the centre.

The Multiscope 100 boasts no less than four microprocessors in the works, plus a pair of analogue instrumentation amplifiers, flash A-D converter and high speed memory.

The instrument is powered from a plugpack supply that delivers +5 V, +12 V and −12 V. The review instrument was not battery operated, although the literature indicates this is possible.

It is supplied with a perspex stand that allows tilting the instrument at various angles. This also doubles as a protective cover. It has two 'ears' which simply snap onto two 10-sided capstans at either side of the instrument's base.

Features and functions

Get ready for the list. Basically, it has six functions:

1. Digital storage oscilloscope – two channels at that; for the usual sort of oscilloscope applications measuring aperiodic signals at a maximum sampling rate of 20 MHz.

2. Sampling oscilloscope – for measuring periodic signals with a maximum sweep rate of 50 ns/division and bandwidth of 0-10 MHz.

3. Transient recorder – for capturing and storing waveforms, boasting nine signal memories and a dedicated instrument setup memory.

4. Digital voltmeter – for both channels, it will read and display a signal's true RMS value, mean value (dc component), and peak-to-peak value.

5. Counter/timer – boasting auto frequency and period measurement from 1 Hz through 5 MHz.

6. Signal processor – for carrying out direct mathematical manipulation of signals, such as obtaining the sum and difference of two signals, multiplying or dividing two signal functions.

The liquid crystal display is an array of 128 × 128 pixels with just over six divisions vertically and horizontally. The handbook reveals the pixels are addressed in a time multiplexed mode, allowing both graphical and alphanumeric information to be shown simultaneously. A contrast ratio adjustment is provided, operated by a screwdriver.

In oscilloscope operation the data fields for each channel are shown at the top (channel 1) and bottom (channel 2) of the display. In voltmeter mode, the display can show all the voltage, frequency and period parameters, and percentage accuracy – all at once, and with simultaneous waveform display! You can put cursors on the display and set them to obtain readout of required parameters.

The two input channels are chopped, or multiplexed. Maximum sampling rate is quoted as 20 MHz. The maximum resolution for periodic input signals is 50 ns/division or 2.5 ns/pixel. The analogue channel bandwidth is 10 MHz. In the timebase department, it's no slouch. It boasts two independent timebases, so you can display totally unrelated signals if need be. Horizontal sweep rates (for periodic signals) range from 1.3 hours.div to 50 ns/div. For aperiodic signals, it ranges from 1.3 hrs/div to 1 us/div. And, like its larger counterparts, you can 'zoom' the display. The screen buffer memory capacity is 256 samples for channels 1 and 2 individually, or 128 samples each in chop mode.

It has a fully digital trigger, the trigger point being definable in terms of both X and Y axes via numeric parameter entry. The pre-trigger range is two screen widths (256 pixels); post-trigger range is 31 screen widths (4000 pixels). Maximum jitter is quoted as +/− 2 pixels for signal trigger edge gradients greater than two vertical divisions for every three horizontal divisions.

The Multiscope 100 gives you auto trigger control where it automatically defines the optimum trigger level (smart!); a normal mode (manual, according to set parameters); a roll mode (free running) and

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1230P9073/1

READER INFO No. 6

single shot. You can select from Internal trigger (ch.1 or ch.2 can trigger itself, or both channels); internal alternating trigger in which both channels trigger themselves independently, and external trigger. With the latter, ch.1 and/or ch.2 are externally triggered, or ch1. is triggered externally and ch.2 internally, or vice-versa. Naturally, you can select ac or dc trigger input, or TTL standard; rising edge or falling edge. All trigger parameters can be set by straightforward programming, and the setting can be stored in memory and recalled.

Nine trace and data memories are included in the Multiscope 100, and it has a mode memory as well, which allows you to store an array of operational settings which can be recalled later, saving time in setting up oft-used operating modes. Nice touch, and very handy!

You can use the data memories to store waveforms for later comparison with live signals. This is a great feature in servicing and production testing applications. Since all input parameters are held in the memory, actual waveforms can be compared with setpoint characteristics. The mode or setup memory will show the various basic settings and can be programmed with the later mode and corresponding setpoint waveform.

The signal processor, or computer as Gossen refers to it, is an interesting facility. You can, for example, arithmetically correlate two live signals in channels 1 and 2, or a live signal in one channel with respect to a stored signal. You can take the sum of two input signals, or the difference. You can multiply them or divide one into the other.

There's no space here to go through the full keyboard operation, more's the pity. And one small point before I move on – it sports auto-calibration.

On the bench

It doesn't take up much room! If you're used to a normal oscilloscope or digital storage 'scope, the Gossen will seem strange at first. The slide switches on the side of the case I found to be somewhat unsatisfactory in an ergonomic sense. You either have to put your hand under the instrument and operate them with a thumb or finger, or brace your thumb on the top of the case and operate them with one or two fingers. Awkward either way. But, I guess that's the sort of operational compromise necessary when you're trying to package an instrument such as this. Electronic toggle switches would have been better, but how you'd fit the electronics inside, I don't know. (Yet more miniaturisation?).

The keyboard is simple to use, the keys having plenty of clearance between them, and they're well annotated. The keyboard is clearly laid-out, the different operational areas being colour-coded. Good thinking, Gossen.

The display is adequate for the tasks this instrument would generally be called on to perform. In some instances, it is a little dotty, but eyeball interpolation makes up for that. Really glitchy signals may present a problem, however. The data fields displayed at the top and bottom of the screen in oscilloscope operation are very useful; nay, essential.

The intelligent trigger functions and facilities I would judge to be one of the best features of the Multiscope 100.

The display reacts quickly in operation – a rather unexpected trait, given my experience with other liquid crystal displays. It provides a readily visible and readable display under a wide range of lighting conditions and over a fair range of viewing angles. But, in use, you must be mindful of the limitations of LCDs. The handbook, I note, is not shy of cautioning users about this.

The multimeter (volts/frequency/period) functions are a bonus. With the one instrument you can do so many things. It won't provide the sort of accuracy you get from individual, dedicated instruments, but for many applications and situations I can see it would be quite adequate.

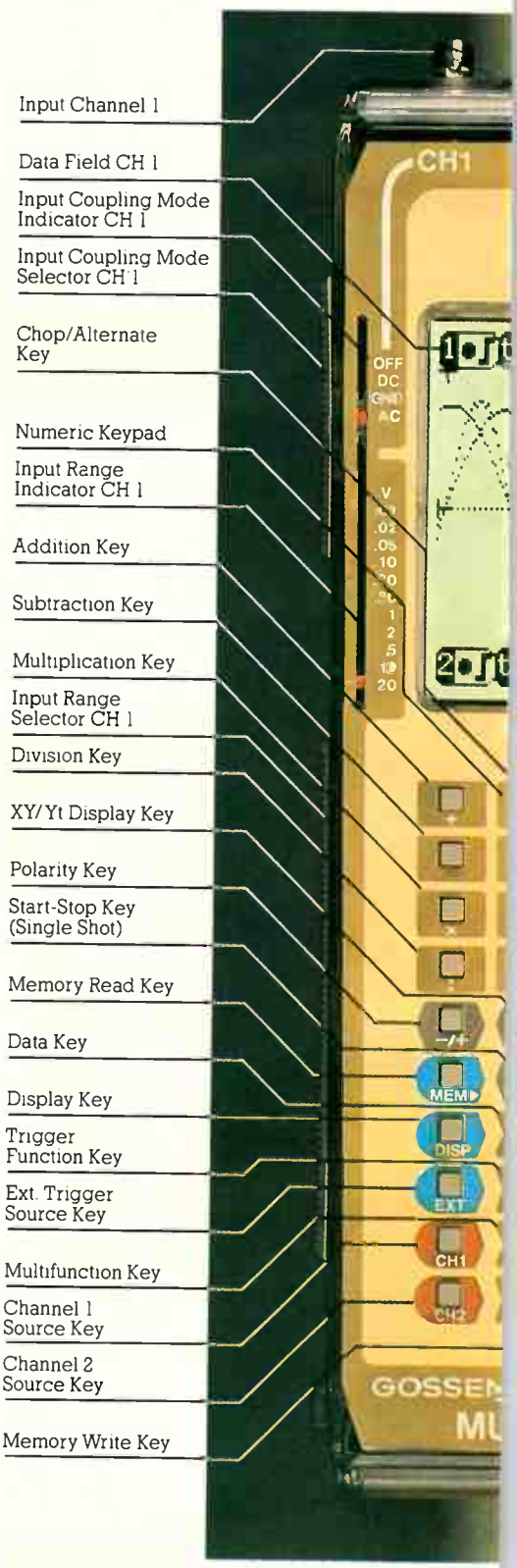
I felt the plastic stand was a little flimsy for my liking and would expect this to be an early casualty if the instrument were used in field service applications. But I may be wrong. That the demonstration model supplied for us to review had survived thus far and through many hands, probably means it's more robust than it seems.

The placement of the input BNC connectors at the top is convenient and logical. The placement of the powerpack connector at the bottom proved a little awkward, but probably unavoidable. Battery operation obviates this problem. The supplied literature indicates the unit will give four hours of cordless operation from the optional rechargeable battery pack.

Like any complex, feature-packed instrument, there's a learning curve involved before you become proficient with it. This instrument, like any digital storage oscilloscope, is not for the tyro.

The documentation that comes with it is comprehensive and well written – but the typesetting is *very* small. I could read it OK, but I know some people who'd have trouble with it. A handy key sequence chart is provided. It's about one metre long, 195 mm wide, and printed on both sides and fan-folded. It's a necessity, and therefore a welcome inclusion.

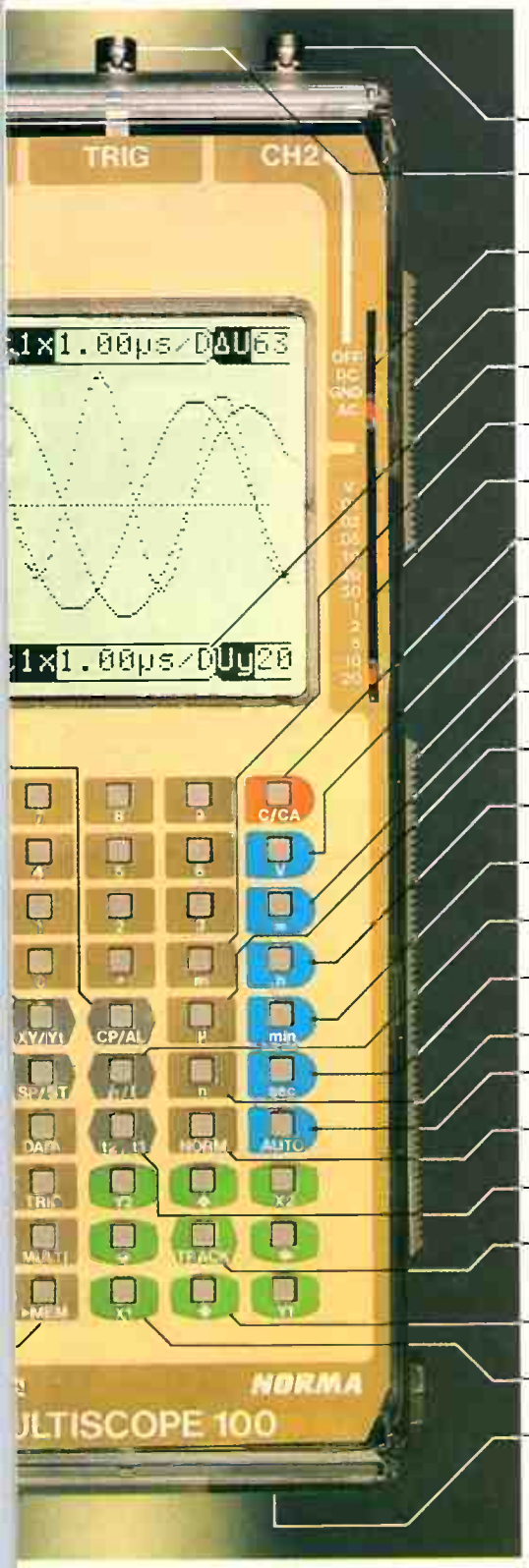
The instrument sent for review was supplied in a robust aluminium road case about the size of a small school case. It had compartments for the instrument itself (naturally!), probes, power pack and manual. A very handy accessory.



Summary

Gossen has done a remarkable job in packaging so much into such a small, highly portable instrument. Where you need such portability and require the power of its facilities, the compromises are unimportant.

The Multiscope 100 is priced at $2530 ex.



Input Channel 2
Input External Trigger
Input Coupling Mode Indicator CH 2
Input Coupling Mode Selector CH 2
Data Field CH 2
Milli Multiplication Factor Key
Input Range Indicator CH 2
Clear Key
Volt Unit Key
Input Range Selector CH 2
Result Key
Micro Multiplication Factor Key
Hour Unit Key
Minute Unit Key
Frequency / Period Selector Key
Second Unit Key
Nano Multiplication Factor Key
AUTO Function Key
Reset Key
Alt. Timebase Selector Key
Track Key
Positioning Key
Cursor Keys
DC Power Connector

tax, $3036 inc. tax. It comes with a 12 month warranty. eti

Review unit kindly supplied by the distributors, University Paton Instruments Pty Ltd, 106 Belmore Rd North, Riverwood NSW 2210. ☎ (02)53-0644.

THE IWATSU DS-8600 PORTABLE DIGITAL STORAGESCOPE

Portable digital storage oscilloscopes have boomed in the past couple of years. This new offering from Iwatsu should find a ready market for itself. Reviewed by Roger Harrison.

Portable oscilloscopes are getting smaller and handier, there's no doubt about it. As in-the-field servicing demands have increased over the past decade, so has the need for portable instruments and the consequent demand for better specifications and more features.

Vacuum cathode ray tube technology, which has dominated the bench and portable oscilloscope display methodology since day one, is now giving way to liquid crystal display technology in the portable oscilloscope field. This development permits much lowered power consumption compared to conventional CRT displays and calls for digital display circuitry where CRT displays have conventionally employed analogue circuitry in portable units. This has resulted in another important advantage – the exploitation of digitising 'scope technology.

To briefly review: in digital storage oscilloscope technology, the incoming waveform is amplified in the same way as in an analogue 'scope, then passed to an analogue-to-digital converter (ADC). This samples the waveform at intervals and stores the digitised values in a memory. To display it, the values are recalled from memory and then mapped onto a display in the required time sequence with the required display amplitude.

A powerful advantage offered by a digitising storage oscilloscope (DSO) is the ability to view – in close-up, as it were – sections of the stored signal. Because the samples of the input signal are sequentially stored in memory, you can electronically take out any section and display it. You can compress slowly varying events, you can zoom-in on small segments of a waveform. You can capture transient or one-off events and then view what's going on for a period before the trigger, and after it.

Because the incoming signal is sampled and digitised, a DSO can provide quite digital readout of waveform period and amplitude values to a known accuracy. Because the signal is stored, electronic cursors can be used to define points of interest on the waveform and values read off directly.

The foregoing details just some of the

prime differences between analogue and digital storage 'scopes. Altogether, DSOs offer improved functionality over their analogue counterparts. And, as digital circuitry is widely implemented in CMOS devices, instruments having incredibly low power consumption can be realised.

The DS-8600

The Iwatsu DS-8600 measures a meagre 213 mm wide by 145 mm high by 45 mm deep – about the size of a large paperback novel – and weighs about 1 kg. It is a two-channel instrument featuring a liquid crystal display measuring 77 mm wide by 97 mm high.

Vertical bandwidth is given as dc-to-2 MHz (at −3 dB), deflection factor (input attenuator range) as 5 mV/div to 20 V/div in twelve 1-2-5 steps. Maximum clock rate is 16 megasamples/second (MS/s); resolution is quoted as six bits. The horizontal display system boasts a memory length of 128 words per channel, data length of 6.4 Kwords per channel. Up to 50 waveforms can be stored and recalled. Sweep rate range extends from 1 us/div to 0.5 s/div in 18 steps at 1-2-5 intervals, in normal mode. In roll mode, it extends from 0.5 s/div to 10 s/div in five steps.

The display is 128 × 160 pixels (20,480), each pixel measuring 0.6 mm square. The waveform display area is eight divisions tall

and wide, one division being just under 10 mm. Beneath the waveform display area is a digital quantity readout area of four rows by 16 columns, providing an alphanumeric mode/function/readout display.

An internally generated calibration waveform is provided, being a 1 kHz waveform of 150 mV amplitude (+/– 30 per cent on both quantities).

The DS-8600 is powered from a 4.5 Vdc source, either 3 x C-cells (despite the fact that the handbook says AA-cells!) or a plugpack adaptor. Memory is backed up by an internal lithium battery. Two probes and a carrying strap are provided. Options obtainable include a logic probe, a dedicated printer and a carrying case.

Hands-on

The DS-8600 is a natty, well laid-out instrument. The Y-input and trigger input BNC connectors are located on the top skirt. The front panel is divided roughly in half, with the liquid crystal display taking up the left half and the 16-key function/mode selection keyboard on the right.

A tilt bail on the rear panel allows the unit to be stood up on a bench. The carry strap provided allows hanging the unit around your neck with the front panel facing upwards. Clearly, this is a well thought-out ergonomic design.

The function and mode keys are all well-spaced and clearly annotated, the markings being quite easily read even under low-contrast lighting conditions. The exception here is the input selector pushbuttons which select ac or dc coupled input, and input ground. Two small pot controls at the top of the keyboard area provide positioning of the two Y-channel traces.

Each Y-channel has an electronic step attenuator to set the volts/div. Likewise for the horizontal sweep (seconds/div). I liked these features. Many of the functions operate in the same manner as an analogue oscilloscope, making this unit fairly easy to understand and use if you're not used to a DSO.

The display is clear and has high contrast, with a blue trace against the LCD's greeny-grey background. It is easily seen under widely varying lighting conditions and over a wide angle, both vertically and horizontally. A finger-operated contrast control is on the rear panel, out of the way.

Waveforms such as sinewaves show in dot-fashion on the screen, squarewaves show interpolating dots on the verticals, except for high speed signals where just the tops and bottoms show. Triggering appears to perform well. When you expand a high speed waveform, leading and trailing edges are dotted in. This is normal.

The vertical bandwidth, at 2 MHz, is limited, but many field service applications don't require much more than that. If more is necessary, I guess it's time to call in the "big guns".

I ran over the various functions of the DS-8600 on different signals and it performed as expected, and as explained in the handbook. If you're used to an analogue CRO, display updating will appear a little slow at first, but it's not a drawback. It's only the display that's slow, not the signal capture! The display size is convenient and the digital function/quantity display below the waveform display area is a real boon.

The handbook is quite well-written, copiously and clearly illustrated – a delight!

In summary

Overall, I found the Iwatsu DS-8600 to be a well thought out, easy to use instrument with many features and functions rivalling its bench-bound counterparts. Priced at $1890 ex. tax, it's value for money and should find popular acceptance in the field service market. eti

Review instrument supplied by Nilsen Instruments, 200 Berkeley St, Carlton, Vic 3053. ☎ (03)347-9166. Offices in each state capital.

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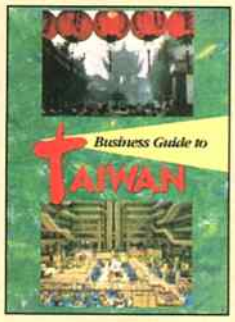
READER INFO No. 10

Industry News



Written by Australians for Australians the new Business Guide To Taiwan is an essential reference for anyone serious about business activities with one of Asia's economic "tigers".

Produced by the Australian Chamber of Commerce's Taiwan Market Service in conjunction with leading Australian law firm Mallesons Stephen Jaques, this full colour handbook provides up to date information and statistics on all the important aspects of conducting business in Taiwan.

The guide outlines the historical, political, economic and social factors that have influenced Taiwan's rapid growth to a major player in the international trading arena. A detailed "How to do Business" section explains local business practices, highlights cultural differences, and provides useful tips and contacts to help Australian business representatives achieve success in their dealings with the market.

The guide is written by Paul Hayden, a partner with Mallesons Stephen Jaques who has lived and worked in Taipei for a number of years. Hayden is fluent in Chinese and has also had considerable experience in other parts of Asia.

NSW Flying Doctor joins space age

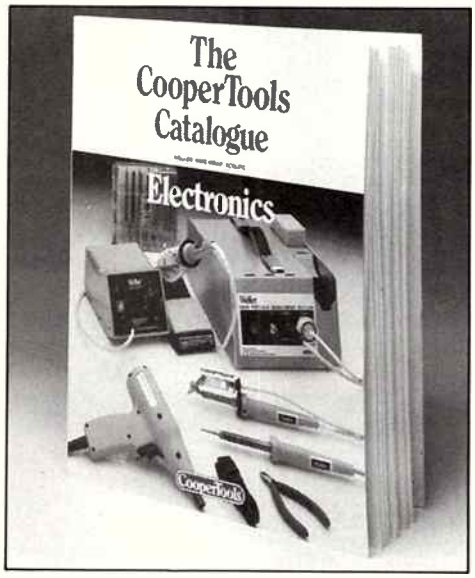
THE NSW Division of the Royal Flying Doctor Service (RFDS) has signed an agreement with AUSSAT to develop a satellite-based communications network using the mobile satellite service that will become available on AUSSAT's B-series satellites in early 1992.

Combining technologies of communications, medicine and aviation, the RFDS has provided a lifeline to the outback since its formation in 1928.

The RFDS MOBILESAT service will be able to offer high quality, reliable voice and data communications throughout the continent. Fax, computer data, ECG and EGG traces, x-rays and other medical data will be able to be swapped between medicos anywhere in the RFDS network.

The MOBILESAT signal is not subject to the vagaries of HF radio communications. Medical staff on board aircraft will be able to transmit real time patient medical data to specialists at bases, long before the aircraft reaches its destination.

Cooper Tools catalogue



COOPER Tools has released a new catalogue of its products for the electronics industry. Products listed include the famous Weller brand of soldering equipment, soldering and desoldering stations, SMT workstations etc.

A page is devoted to each of the Weller products, with a photograph, catalogue numbers for replacement parts, accessories and comprehensive description of the product and its uses.

Wire wrap products are also featured, along with Xcelite tools specially designed for electronics assembly work. Enquiries to Cooper Tools, ☎ (060)21 5511.

Radio 'heating' may repair ozone layer

DESTRUCTION of the ozone layer by reaction with CFCs in the atmosphere may be greatly slowed by electrically charging the atmosphere at the height of the ozone layer using high powered RF transmissions, according to a US researcher.

Alfred Wong of the University of California, Los Angeles, suggested a few months ago using radio waves to produce negatively charged chlorine ions in the stratosphere. Chlorine in the atmosphere, from CFCs, reacts with ozone, depleting it.

Chlorine atoms build up in the stratosphere when ultraviolet light from the Sun breaks down man-made chlorofluorocarbons (CFCs).

Wong believes that, by generating radio waves on the ground at a certain frequency, these radio waves will transfer energy to free electrons high in the atmosphere, around 50 to 80 km up.

By transmitting energy at the electron-cyclotron frequency (about 1.5 MHz), where electrons absorb energy most efficiently, Wong expects to create 10,000 to 100,000 electrons per cubic centimetre, creating an electric field between this heating region and the ozone layer, driving negatively-charged chlorine ions up out of the ozone layer.

By then using radio energy at the ion-cyclotron frequency, Wong expects the chlorine ions to spiral up the Earth's local magnetic field lines, out of harm's way. The drawback is, the scheme needs to deliver some 100 megawatts through an area of 100 square km at heights above 50 km.

Siemens becomes supplier to Aussat

AFTER lengthy negotiatons with Aussat, Siemens has become a supplier of high power Travelling Wave Tubes.

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

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

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

"Aussat is completely satisified with the ease of operation and performance of the Siemens' YH1421 and this, together with competitive prices, will give us an edge over our competitors," said Mr Robert Fontana, Siemens product manager in Electronic Components.

For further information please contact Siemens Ltd, Electronic Components Department, 544 Church Street, Richmond, Vic., 3121. ☎ (03) 420 7313.

$4 m Electro-Technology Centre for Petersham TAFE

A NEW $4m Electro-Technology Centre will be provided at Petersham College of TAFE, offering students training in Electrical Trades, Industrial Electronics, Instrumentation and Hydraulics.

Announcing the college's Stage 4 development, the Minister for Education and Youth Affairs, Dr Terry Metherell, said the new centre will emerge from a refurbishment of the old Applied Electricity building.

"The new centre will be an important component in the network of specialist, high-technology centres being established in inner-metropolitan Sydney TAFE colleges," he said.

"The centre will provide a range of facilities and state-of-the-art technology to provide both traditional trade, post-trade and specialist courses and innovative new courses to address the emergent training needs of industry."

Petersham College is located in the most densely populated and culturally diverse area in NSW and with its accessibility and good transport is an ideal location for the facility.

Dr Metherell said TAFE had liaised closely with industry in the development of this project and had received support from prominent organisations such as ICI, Wormald and Shell.

"This centre highlights the Government's commitment to expanding and strengthening TAFE's relationship with industry, at the same time ensuring that training areas of significiant need are given first-class educational facilities," Dr Metherell said.

The centre is being constructed with Commonwealth Government funding.

Siemens achieves two firsts

SIEMENS has secured two orders which are firsts on the Australian market for new equipment.

Mr Ed Muldins, acting manager PE & A Sydney, said that the first order, valued at $120,000, is for a complete Simadyn D system with associated DC converters. The Simadyn D system is a digital control system for electrical machines and the first in Australia will be used for the control, monitoring and diagnostics of a twin motor drive skip hoist drive, used to lift ingredients into the smelter at BHP's Port Kembla Steelworks.

The second order is for a 32 bit personal computer type PC32-20, a powerful industrial model, to be used for the monitoring and control of a boiler at BHP's plant in Temco, Tasmania.

For further details please contact Siemens Ltd, Power Engineering and Automation Department, 383 Pacific Highway, Artarmon, NSW 2064. ☎ (02) 436 8711.

Dial-a-BBC World Service

YOU are now able to dial the BBC World Service on 00555-1434 from any telephone anywhere in Australia. Described as "the premier international radio service", the dial-up service is a continuation of a project which began last year to upgrade BBC radio transmissions to Australia.

By dialling the 00555 Inpholine number callers can hear the service direct from the BBC in London.

Industry News

MicroHelp Computers & Communications has appointed Paul Willason as National Operations Manager. Mr Willason, who previously spent 10 years with Agfa as National Logistics Manager and later NSW branch manager, will coordinate MicroHelp's national purchasing, distribution and customer services.

Mr Willason's appointment follows the recent selection of Anthony Liddy, formerly financial controller of a national manufacturing company, as NSW General Manager for MicroHelp.

★ ★ ★

Promark Electronics (Australia) Pty Ltd has been appointed Australian distributor for Harris Semiconductor.

The appointment is significant, says Promark, in that it comprises the extensive range of products of Harris Semiconductor, GE, RCA, and Intersil. In December 1988, the General Electric Solid State Division was acquired by Harris, adding GE, RCA, and Intersil Semiconductor products to the Harris line.

★ ★ ★

A.J.Distributors has been appointed as Australian distributor for USA power supply manufacturer LH Research Inc. LH Research has been manufacturing switching power supplies since 1974 and boasts one of the largest ranges in the industry – from 15 to 2000 watts with up to nine outputs.

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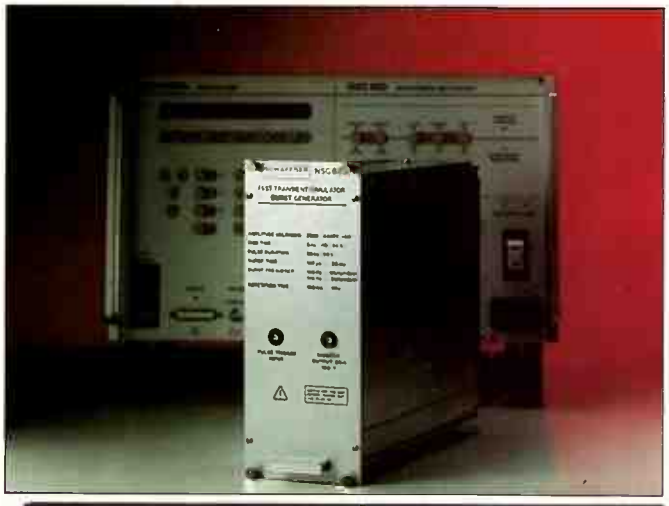
ND WIN THEM BOTH

New Burst Generator — a world first?



THE new Burst Generator NSG 625 from Schnaffner is a world first, claims the distributor Westinghouse Systems. For the very first time, it has been possible to produce an interference simulator with pulse rise times of 5ns and amplitudes of up to 4400V using only solid state techniques.

The instrument conforms to the IEC 801-4 EMC Standard (EMC: Electromagnetic Compatibility) as well as to the relevant National Standards, in many instances more than meeting the parameters called for.

The new technology ensures greater precision, better repeatability and improved long term stability of the pulses, yet the instrument is maintenance-free, says Westinghouse. The pulse burst parameters are programmable within wide limits and in fine steps right down to single pulses. This enables the interference susceptibility of devices and equipment under development to be precisely analysed.

The Generator is built as an insertion module for the NSG 600 system. Internal and external coupling devices cover the whole range of applications, from interference injection on single and three-phase mains supplies through to interference coupling into data and telecommunication lines.

Features such as computer control, automatic test result logging, test routine storage, etc., make it possible to integrate EMC testing fully into the concept of quality assurance.

More information from Westinghouse Systems, 80 Douglas Parade, Williamstown, Vic 3016. ☎ (03) 397 1033.

READER INFO No. 160

Time, gentlemen!

A RANGE of analogue panel clocks from Telenora (TN) of West Germany is available with either autonomous or master controlled secondary clocks.

The range includes three square analogue clocks with dials measuring 40 mm, 80 mm and 120 mm, a digital clock displaying figures 14.5 mm high, and a digital precision stop watch (count up/down) displaying figures 20 mm high.

Those other than the stop watch are for use in switch boards and control panels, etc. The stop watch is designed for TV and radio stations, labs, factories and sports venues.

They can be set to the right time from the front panel. Details from Hertz Electronics Pty Ltd. ☎ (02) 32-3029.

READER INFO No. 161

In September ETI, page 97, this photograph was incorrectly used to illustrate a story entitled "Conductivity, temp. measurement." We apologise for any inconvenience caused.

Vicom releases new interceptor

THE Vicom Group has released the new Bradley Interceptor I-264 channel access monitor onto the Australian market.

The Interceptor I-264 is designed specifically for the CCITT environment, and provides powerful monitoring and channel access capability to help isolate networks problems. The I-264 can monitor two 2048kbits/s circuits simultaneously, as well as drop and insert one or more 64kbit/s time slots of the high speed carrier. The Interceptor has a variety of status indicators, provides receive frequency measurements and displays the received byte for the selected channel. In addition, the I-264 allows access to signalling channels for modification, monitoring etc.

The Menu Select button allows selection from eight menus. There is a two-line 20 character display which provides the ability to configure the instrument, displays test and error results and lists the internally generated insert signals. The top line shows the current instrument configuration and may be modified by scrolling through the options and selecting the appropriate parameters.

Bradley Interceptor I-264.

There are a number of options available with the I-264; these include 2048kbps results, 64kbps G703 data port, RS-232 printer and remote control, IEEE remote control port, which allow results printing and remote configuration. A history printout of the last 100 signalling events is also available. A user plug-in memory card contains all the software needed to operate the unit, providing an easy way to upgrade the 264 when features are added.

The Interceptor is housed in a rugged aluminium case, designed to tightly seal the front panel when closed. The flexibility of the menu, combined with the software module's easy access, readily accommodates the addition of future interfaces.

The Interceptor is available from Vicom offices throughout Australia and New Zealand.

READER INFO No. 162

Autofocus SLR camera

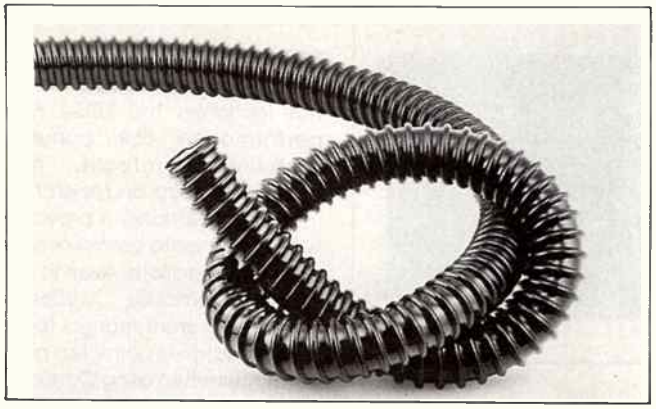
DESIGNED for the most demanding professional, Canon has launched the EOS-1 high performance SLR camera, featuring autofocus, plus electronic control and operation.

The photographer is provided with "...complete control over all camera operations, even in the automatic modes...", Canon says. Even instant manual focus compensation is permitted after autofocus when using Canon EF lenses equipped with ultrasonic (UM) motors.

The EOS-1 boasts five metering modes, automatic exposure bracketing, maximum shutter speed of 1/8000th second, built-in 2.5 fps motor drive, LCD display, depth of field auto-exposure, multiple exposure capability and rugged body design.

A 13-page press release fully describes this marvel of modern technology. Contact Canon Australia, ☎ (02)887-0166.

READER INFO No. 163



A flexible approach ▲

A NEW line of flexible, non-metallic, liquid-tight tubing for a wide range of electrical applications in computers and peripherals, fibreoptics, lab equipment, robotics and automotive equipment is now available from Nylon Products Australia.

Internal rigid spiral and flexible PVC construction offers maximum flexibility – the tubing can be bent back on itself – and offers resistance to corrosion, oil and water.

Five sizes are available (non-metric!) – 1/4, 3/8, 1/2, 3/4 and 1-inch. It can be cut with a knife or Heyco VF-28 cutting tool. Details from Nylon Products Australasia Pty Ltd, 287 Torrens Rd, West Croydon, SA 5008. ☎ (08)340-3088.

READER INFO No. 156

Digital tachos ▲

A NEW universal digital readout tachometer featuring two frequency inputs is offered by Jaquet of Switzerland through their Australian distributors, Electromark Pty Ltd.

Two models are available: the DFP952 with front panel press keys for input selection, and the DFP951 which has concealed programming keys for this purpose.

Each has a 5-digit, 7-segment red LED display with a digit height of 14 mm, which is easily read at a distance. Input frequency range extends from 0.1 Hz to 50 kHz for signal levels of 50 mV RMS to 80 V RMS.

Both feature programmable parameters, including: trigger level for both input channels, ratio or percentage difference between the two input channels, the measured absolute value of both inputs, measuring range, etc.

Further details from Electromark Pty Ltd, PO Box 184, Mortdale NSW 2223. ☎ (02)570-7287.

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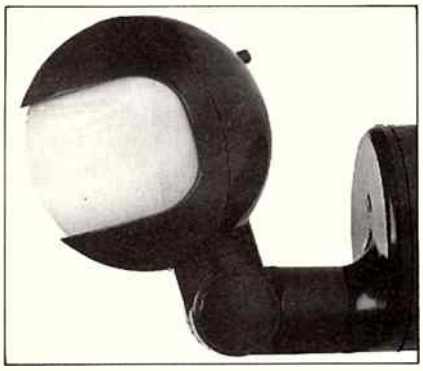

Smart light switch

AN outdoor light that detects infrared radiation from the body and turns on in response has been released here through Hertz Electronics.

Dubbed The Observer, it can also turn on additional lights. Hertz say it is ideal as a first defence against intruders, as well as a safety light and an automatic porch light (so you don't have to fumble for your keys/the switch in the dark).

To turn on additional lights when activated. The Observer can be linked to a transmitter which broadcasts a signal via the mains wiring in the building, activating the additional lights. This signal can also be used to activate an audible alarm, an audible/visual signal etc. It's not only functional, it's also smartly-styled. It is manufactured in West Germany and can be used indoors as well as outdoors.

Contact Hertz Electronics, PO Box 173, Edgecliff NSW 2027. ☎ (02)32-3029.

READER INFO No. 158

2.3 GHz counter

PHILIPS has extended its range of high precision microcomputer-based universal frequency counters with the release of the PM 6677, a top-of-the-line model which covers to 2.3 GHz.

This coverage suits the PM 6677 for application in maintenance and service in advanced telecommunications, military equipment, satellite communications systems, microwave links and global navigation systems.

The PM 6677 is light, but sturdy, says Philips, with an all-metal case. It features the reciprocal counting technique pioneered by Philips which ensures high resolution measurements even on low frequency signals.

The advanced front end includes an automatic PIN diode attenuator that allows automatic triggering and combines a wide dynamic range from 10 mV RMS to 12 V RMS with high overload protection.

Options include an analogue recorder output, GPIB/IEEE-488 interface, carrying case and battery pack. More details from Tom Nealon, Philips Test & Measurement, 25-27 Paul St, North Ryde NSW 2113. ☎ (02)888-0416.

READER INFO No. 159

Piezo guide

WARSASH in Sydney has released a user's handbook from Physik Instruments summarising the complete range of piezoelectric translators for the accurate micro-positioning of optical components.

The guide is divided into two parts – covering high voltage elements (to 1500 V) and low voltage elements (to 100 V). Copies obtainable from Warsash Pty Ltd, PO Box 217, Double Bay NSW 2028. ☎ (02)30-6815.

READER INFO No. 188

Total fibreoptics range

AS fibreoptic technology diversifies from its stronghold in telecommunications into a broad spectrum of the electronics industry, it is set on a fast track growth path.

3M has responded by launching a new system of fibreoptic products suited to a wide range of industrial and commercial applications, aiming to be Australia's only one-stop shop for fibreoptics by year's end, according to Derek Forsyth, National Product Specialist for 3M Australia's Fibre Optic Products Division.

Dorran Photonics Inc, EOTec Corporation, Photodyne Inc and Raycom Systems – all US fibreoptic specialists – were recently brought under 3M's banner, integrating their collective technological expertise and innovation.

3M's new division here provides technical support as well as a very broad product range. Customers receive free product education, technical advice from consultants and hands-on training at the 3M Resource Centre at St Mary's in Sydney. 3M has 16 sales offices throughout Australia.

The 3M fibreoptics range includes connectors, cable assemblies, distribution boxes, specialty fibres, sensors, PLC link modems, couplers and multiplexers, video and audio links, LAN bridge channel extenders and a complete range of test equipment including light sources, power meters, test sets and OTDRs.

3M held two successful seminars on fibreoptics innovation and applications recently in Sydney and Melbourne. Further details from 3M Fibre Optic Products Division. ☎ (02)623-0121.

READER INFO No. 187

Vicom is a company for today and tomorrow. A company that has and will remain at the forefront of technological development. A company with a superb range of quality test instruments for all aspects of telecommunications.

And Vicom is able to supply sophisticated antennas, HF equipment, broadcast, military and other products and services to Australia and the South West Pacific.

TTC–
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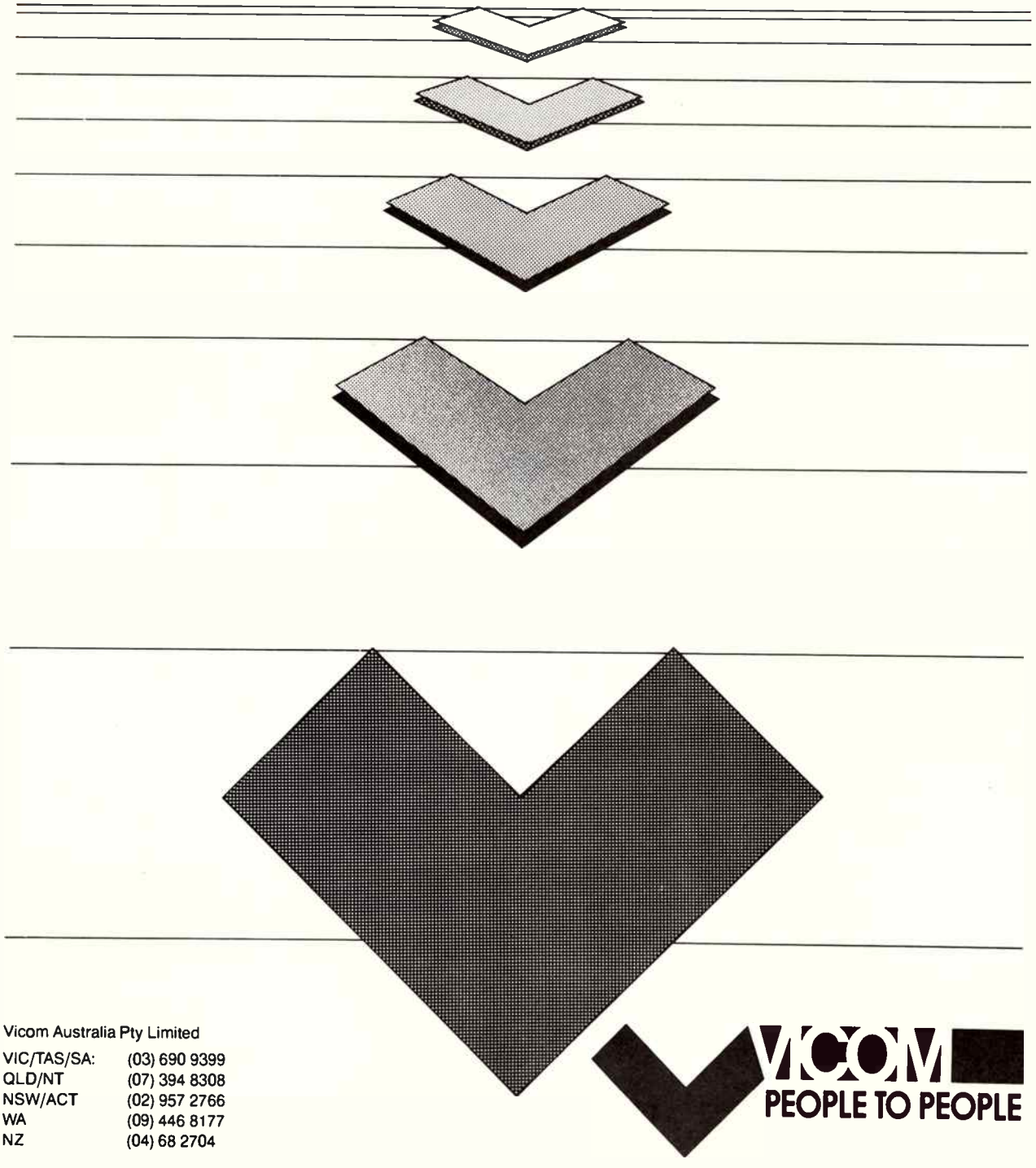
Vicom – Leading the way in Communication Electronics



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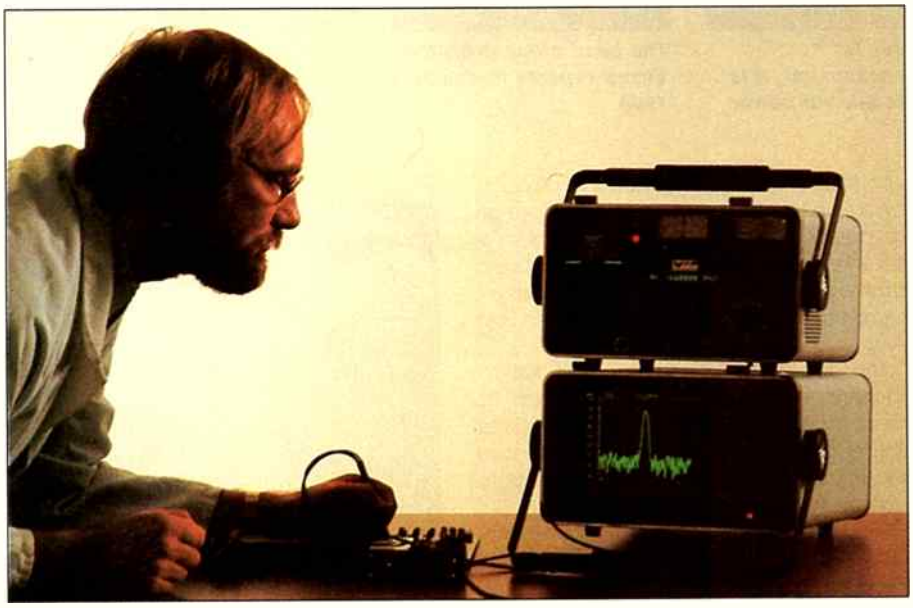
VICOM
PEOPLE TO PEOPLE

READER INFO No. 55

VICOM: PUTTING PEOPLE FIRST



Vicom has a strong commitment to development by Australian technology, its capacity to mix and match products and services, and its ability to remain at the leading edge of technological design and innovation.

The Vicom Group is well known in the electronic communications industry but it is not widely accepted that Vicom is Australian owned and managed with its headquarters in South Melbourne.

Starting from humble beginnings in 1974, with a shop front in Auburn, Victoria, Vicom has expanded into a respected force in the specialised high technology communications market.

Chairman and managing director, Russell Kelly, had a long term strategy for the company from the beginning and this has produced a dynamic, rapid-growth company with offices in Brisbane, Sydney, Melbourne, Perth and Wellington, New Zealand.

Russell Kelly was one of a group of four investors involved in the infant company, which Initially concentrated on consumer communications promoting imported amateur radio equipment throughout Australia.

"We saw amateur radio and the consumer market as being a stepping stone into the more viable, high technology professional electronic markets," Mr Kelly said.

"If made any mistakes during the first few years it was to spend too much time and too high a level of resources on the unprofitable ham radio business.

"We quickly came to our senses, left the consumer business to the backyarders and developed a plan to progressively enter the professional and Government markets."

Russell Kelly's objectives have obviously been fulfilled, since Vicom has enjoyed a successful growth rate and, this year, is looking for further growth in excess of 40%, even with threats of a national recession and a poor economic operating environment.

Kelly feels that a recession background is a time to be aggressive and take major expansion steps.

"We've had our best years during poor economic times," he said.

Vicom's company motto is "People to People" and, like many successful businesses, Vicom has come to realise that its resources and strength come from a highly committed and well qualified team.

"We make an effort to employ above-average people, though, disappointingly, in the current labour market that is not always possible."

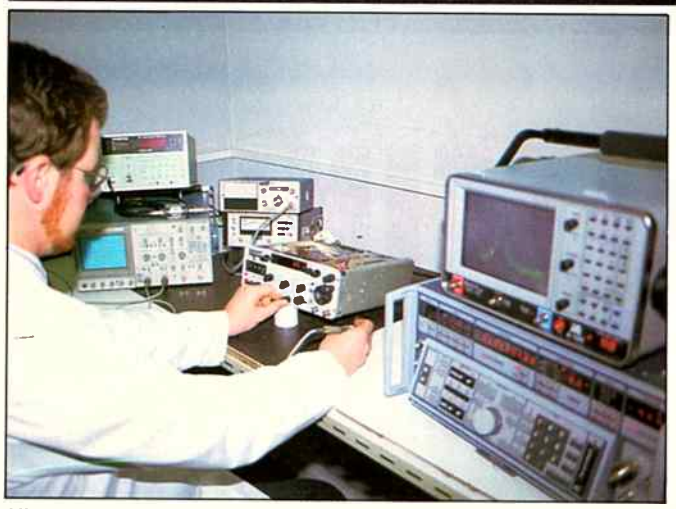
In fact, Vicom claims that its expansion could be considerably greater if it was able to acquire appropriately qualified engineers, technicians and managers within Australia. "Our sales team are all technically competent and whilst this may seem a strange boast, some of our competitors prefer to have the technical resource back at the home office," he said.

Vicom is probably best known for its range of top-shelf test and measurement equipment for the radio communications, data and fibre optic markets. Kelly claims that Vicom's success formula has been predicated on importing and marketing only the best products and going for major market share. Some of the brands supported incluced IFR, Laser Precision and Telecommunications Techniques (TTS). Most of Vicom's test and measurement equipment is sold to Governments in Australia and the South West Pacific and to the larger communications companies. A recent addition to the test instrument stable is the range of products manufactured by Bird Corporation of USA.

Vicom has designed specialised products for HF applications in Australia and overseas and has recently been active in field trials with the Department of Defence, testing frequency management systems aimed at better utilising the Ionospheric conditions.

A rapidly developing division of Vicom incorporates HF communications and Defence communications equipment and the company has achieved major success

Company profile



Vicom's NATA registered laboratory is available for calibration services in frequency and time measurement. It is currently being expanded to handle fibre optic and RF power measurement.

The head office executive team discuss future strategies. Vicom expects to double its turnover to $20 m per annum in 1990.

in large scale contracts in these areas.

Vicom's Engineering Research and Development division, based at South Melbourne, has contracts with Government for consulting and R & D projects and is also engaged in developing export markets. The company's R & D program ensures on the one hand that, when a client encounters a problem, Vicom provides the solution and (perhaps more importantly) on the other, that Vicom can help define possible system problems in advance.

A recent acquisition to the Vicom Group is Scalar Antennas, which Vicom took over early in 1988. The company, now known as Vicom Scalar Pty Limited, is being revamped with the R & D of new, sophisticated products enabling it to compete with foreign competitors. Russell Kelly said that Scalar will be entering the lucrative broadcast antenna business, which will enhance Scalar's excellent export opportunities to South East Asia.

The Scalar factory is based at Kilsyth, Victoria and has recently had its manufacturing processes updated with the introduction of computerised design and modelling and an injection of capital to update machinery and methods.

Vicom has introduced a Total Quality Control (TQC) program throughout the Group and its methodology meets Australian Standard AS1822. As a result, Vicom is on the Australian Defence Register of Authorised Suppliers (DRAS) which enables the company to properly respond to the needs of the Department of Defence.

To meet its obligation to service, maintain, calibrate and otherwise support every instrument and product line it represents, the company has established a comprehensive service centre in Melbourne to cater for Australia, New Zealand, PNG and the Pacific Region.

Additionally, a calibration laboratory has been established to provide traceable metrology standards for a range of RF parameters. The laboratory is registered with the National Association of Testing Laboratories, Australia (NATA).

The customer service support cell is managed by Mark Isherwood, who has a team of trained technicians dedicated to providing high quality service with a fast turnaround.

Russell Kelly feels that a high level of technical support is essential to making successful sales. "When our support has slipped our sales results are immediately effected," he said.

Vicom's Melbourne 12,000 sq ft head office and R & D centre. Due to rapid expansion this is the fourth building Vicom has occupied in 15 years.

Russell Kelly, chairman and managing director of the Vicom Group.

Fred Grossman controls the day to day activities of Vicom as Group General Manager and, with a diverse background from Motorola, is more than able to keep up with Vicom's dynamic pace.

Vicom sees its further expansion with a greater emphasis on value added activities and the international export market. Of considerable concern to Russell Kelly is the stranglehold on the industry by Telecom Australia.

"Telecom consumes 67% of the telecommunications output in Australia and our industry is highly dependent on the Telecom monolith. It is essential that Telecom behaves as a responsible corporate citizen and that more than lip service is given to supporting Australian industry," he said.

"We are also very mindful that as a company gets bigger there are risks and pressures associated with providing adequate performance to our customer base. Big is not beautiful if there is any diminution of service to the customer."

It is a challenge Vicom takes seriously.

eti PROJECTS

The projects presented in ETI are chosen to appeal to a wide variety of reader interests. They range from simple, fun but practical, low-cost entry level devices, through interesting, useful and often challenging projects for more experienced enthusiasts, to technology demonstration projects that introduce emerging, new and exciting technological developments for constructors at all levels. Often, ETI projects will present engineering solutions to real problems or market needs. Over a year, we aim to publish a balanced selection, to cater to readers' wide interests and levels of experience.

This month we include:

- ***ETI-782 Cubical Quad Antenna***
- ***ETI-1625 2400 BPS PC In-modem (Part 2)***
- ***ETI-1547 8-Bit Flash A-D/D-A Converter***

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Send orders to **Reader Services, ETI Magazine, 180 Bourke Rd., Alexandria, NSW 2015 Australia.** Please note that phone orders cannot be accepted.

Unfortunately we are also unable to handle technical enquiries on projects and articles on the telephone. We are happy, however, to handle such enquiries by mail. Please address such enquiries to: **Technical Enquiries, ETI Magazine, 180 Bourke Rd., Alexandria, NSW 2015 Australia.** We will endeavour to deal with them as promptly as possible.

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BUILDING BLOCKS OF ELECTRONICS

And so to active blocks

Completing some final details on power supplies, Jack Middlehurst moves on to the first active blocks.

Younger triodes you will encounter: two 9-pin miniature all-glass valves; an ECC88 (encountered in audio and RF circuits) is at left and a 6CG7 (encountered in audio and TV circuitry) is at right.

A major problem in running valve radios in motor cars was the difficulty of deriving the necessary 250 Vdc from the 12 V battery supply. Most sets ran from vibrators.

Vibrator power supplies

A vibrator is simply a tuned metal reed, electrically excited to vibrate at its mechanical resonance (about 50 to 100 Hz), and having several sets of electrical contacts mounted on it. The circuit of Figure 5.1 shows the way in which it works.

The battery voltage is applied through contact K1 to the driving coil which creates a magnetic field pulling the reed towards it. This breaks the contact K1 so the magnetic field collapses and the reed swings away from the coil, remaking contact K1, whereupon it is again attracted to the coil, and so on.

The battery is also connected to the centre of the primary winding of the transformer, and when the reed is not attracted to the coil, contact K4 connects one side of the primary to earth. When the reed is attracted, contact K4 is broken and contact K5 connects the 12 V to the other side of the primary. This alternate connection of the 12 V to the transformer effectively supplies it with a 24 V peak-to-peak (Vp-p) square wave. The secondary of the transformer is tuned to the reed frequency by the two 0.05 uF (47n in 'modern' times) capacitors in series, and its output is about 600 Vp-p.

Contacts K2 and K3 act as the high voltage rectifier, alternately connecting to the output that side of the transformer that is going positive. The 100 Ohm resistors are to prevent excessive current should a tuning capacitor short out, the 470 Ohm resistor is for damping, the shorted coil coupled to the driving coil is to reduce transients in the driving coil, and the various radio frequency chokes (RFCs) and filter capacitors are to reduce the considerable radio frequency

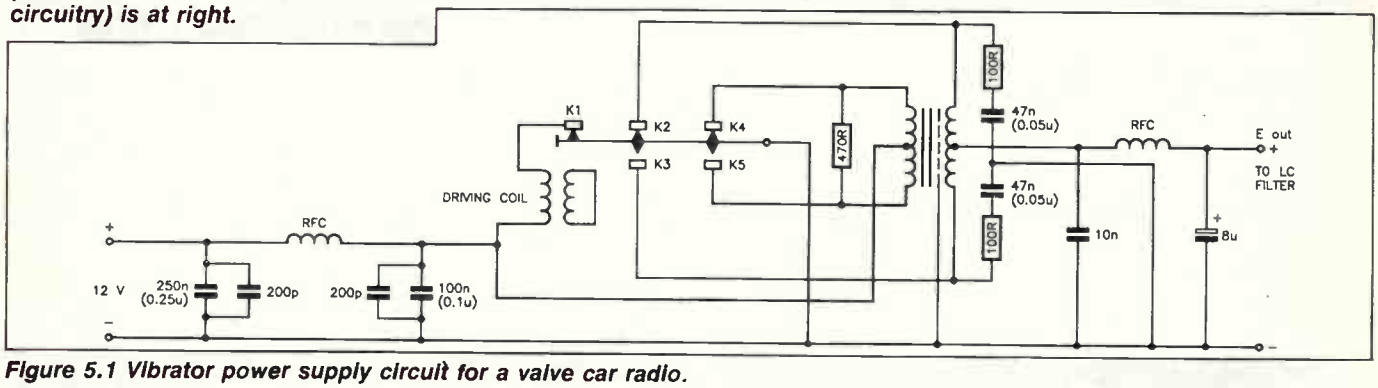


Figure 5.1 Vibrator power supply circuit for a valve car radio.

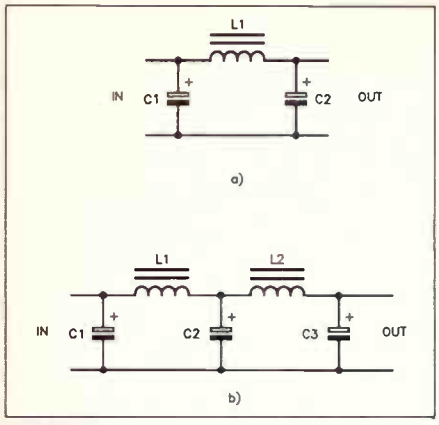


Figure 5.2 Power supply filters. (a) LC power supply filter, (b) 2-stage LC filter.

hash that these vibrators produce. If the damping resistor opens circuits, very high voltages are induced in the transformer, leading to the breakdown of its insulation. Because the incoming waveform is not a sinewave but is close to a squarewave, the design of these transformers is quite difficult. They usually have an air gap, so if you have a faulty transformer, do not try to replace it with an ordinary transformer of about the same size and voltage; it won't work. The only solution is to rewind the original.

Testing vibrator supplies involves connecting a car battery to the input, turning the radio on, and listening to the vibrator. If it is vibrating, you will hear it humming. If the transformer has broken down, you will hear the sparking noise and/or smell the smoke. If all appears well, check the output under load. If the output voltage is low, replace the normal load with a 5k, 20 W resistor and recheck. If the voltage is still low, the contacts on the vibrator are worn, so it will have to be replaced. Finding a replacement can be difficult, so a transistorised inverter may have to be used in place of the vibrator power supply. Plug-in transistorised vibrator replacements became available in the 1960s.

Power supply filters

For valve equipment, LC power supply filters are invariably used. Radios often use the field coil of the loudspeaker as the choke L1, in the type of filter shown in Figure 5.2a. Valve radiograms aspiring to higher fidelity than the average, often add another stage of filtering as in Figure 5.2b. In these two Figures, C1 is the filter capacitor immediately following the rectifier. There are many power supplies that do not use C1. The filter is then known as a choke input filter.

Such a filter has an output voltage that is much more constant with load current than a filter using C1, called, as you guessed, a capacitor input filter. Choke input filters are popular with valve audio amplifiers using class AB or class B audio stages in which there is considerable fluctuation in the load current. To avoid the cost of an extra choke, but at the same time get a similar filtering effect, cancellation filters became popular for low current power supplies. Such a filter is shown in Figure 5.3. They rely on the fact that a class A output stage is used, so the power supply current is constant. By careful selection of R3, quite good cancellation of the ripple at 100 Hz can be obtained. Such a filter needs a fairly high Q choke.

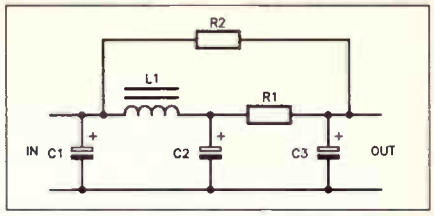


Figure 5.3 Circuit of the so-called cancellation filter.

If you come across a cancellation filter and there is a hum problem, the first thing to do is to check the capacitance of the filter capacitors. Since the cancellation effect depends on the capacitors having a particular value, replace any that are more than about 10% off their marked value. Then check that R1 has its correct value, and replace R2 with a good quality wire-wound variable resistor of about twice the original value of R2. Adjust the variable resistor for minimum hum output and then remove it and measure its resistance setting. Then make R2 a fixed resistor having this measured value of resistance.

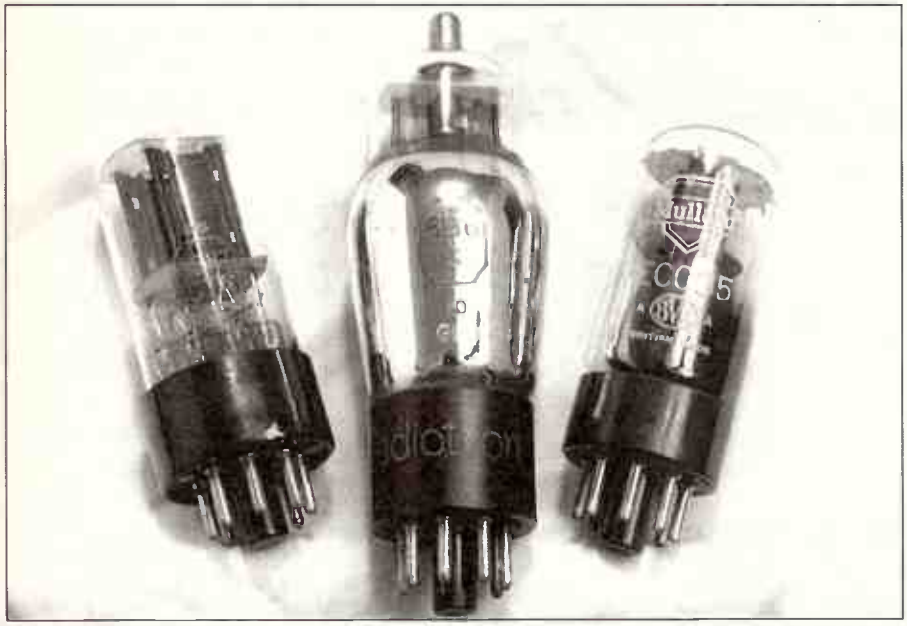
Note that, since this resistor may have to pass considerable ripple current, the wattage will have to be at least the same as that of the original R2, i.e. don't use a half watt resistor for R2 if the original was clearly a 2 W. It is preferable to use a wire-wound resistor.

The power supply filters associated with transistor equipment usually consist of the main power supply input capacitor, which is often several thousand uF, either by itself or followed by a voltage regulator that acts as a filter. Voltage regulators will be discussed after we have looked at the necessary amplifiers and feedback loops.

Single active blocks

A single active block is an amplifier that amplifies voltage, current, or both. Such a block can have a single active device such as a valve, transistor, or FET, or can be a single IC amplifier (even though this latter may contain hundreds of individual active devices). We will not cover special circuit blocks used at high frequencies such as klystrons, magnetrons, travelling wave tubes and so on. To keep the series in proportion we will limit ourselves to the frequency range from dc to about 20 MHz.

Any active block needs a passive input block and a passive output block. Since the design of an active block depends on the input and output blocks and vice-versa, we will look at the properties of various



Older triodes you will encounter: in the centre is a widely-used old triode, the 6B6. At left is a somewhat younger twin-triode. At right is another twin-triode, the ECC35.

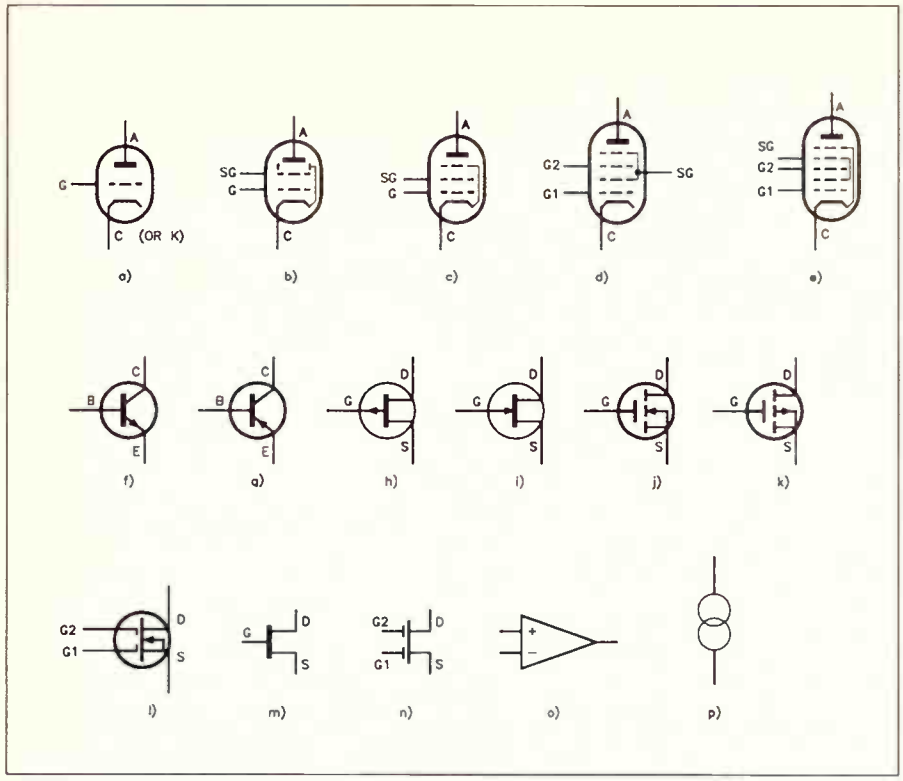


Figure 5.4 Symbols used for active devices.
(a) triode valve. G = control grid, A = anode, C = cathode.
(b) beam tetrode. SG = screen grid.
(c) pentode. The suppressor grid is internally connected to the cathode.
(d) hexode. G1 and G2 are control grids.
(e) heptode.
(f) NPN transistor. B = base, C = collector, E = emitter.
(g) PNP transistor.
(h) N-channel junction FET (JFET). G = gate, D = drain, S = source.
(i) P-channel junction FET.
(j) enhancement mode MOSFET.
(k) depletion mode MOSFET.
(l) dual-gate MOSFET. G1 and G2 are gates.
(m) general symbol for a JFET, also used for insulated-gate FETs (IGFETs).
(n) general symbol for a dual-gate FET.
(o) general symbol for an amplifier, often an integrated circuit (IC). The + and - represent the non-inverting and inverting inputs respectively; the other lead is the output.
(p) constant current source.

combinations of an active block with different passive blocks. Where it is appropriate in the Figures, typical dc voltages and the ac properties of the circuit are given.

The amplifier may have negative feedback, though this is not common with old single-stage designs. Some modern designs use both positive and negative feedback to tailor the input and output impedances to the designer's wishes. The amplifier can also be configured as an oscillator by having enough positive feedback. All superheterodyne receivers (e.g. all transistor radios and most valve radios) have to have such an oscillator to change the incoming frequency to a constant intermediate frequency (IF) that is usually in the range 450 to 470 kHz.

The symbols used for the various active devices that we will be describing are shown in Figure 5.4.

Taking measurements on active blocks

Most measurements on active blocks are simple and can be made with an ordinary VOM-meter and the signal injector/tracer. There are a few occasions on which the input impedance of the VOM-meter or signal tracer will affect the answer that you get. The way in which this comes about is shown in Figure 5.5a. This form of circuit occurs when measuring the dc voltage on the plate or screen grid of a valve (as shown in Figure 5.5b), the collector of a transistor, or the drain of a FET. In the circuit, R represents the internal impedance of the active device.

Suppose you have a 1000 Ohms/Volt VOM-meter. Using the 1000 V range, Rm is 1M. Since Rm in parallel with R is less than R, the measured voltage (Vmeas) will be less than the true voltage, Vtrue, that would be there without Rm. We can measure Rc, but R can be inside a valve or transistor and therefore not measurable. However, by knowing Vplus, Vmeas, Rc, and Rm, we can calculate Vtrue from:

Vtrue = Vmeas/(1 − Rc x Vmeas/Rm/Vplus)

For example, if Vplus is 250 V and Rc is 270k, then if Vmeas is 110 V, the true voltage would have been 125 V.

A similar situation occurs using the signal tracer. Figure 5.6a shows what happens when measuring the signal output of a circuit block that has an impedance Rc feeding a load of resistance Rload. The input impedance Rm of the injector is in parallel with Rload. Such a situation occurs when

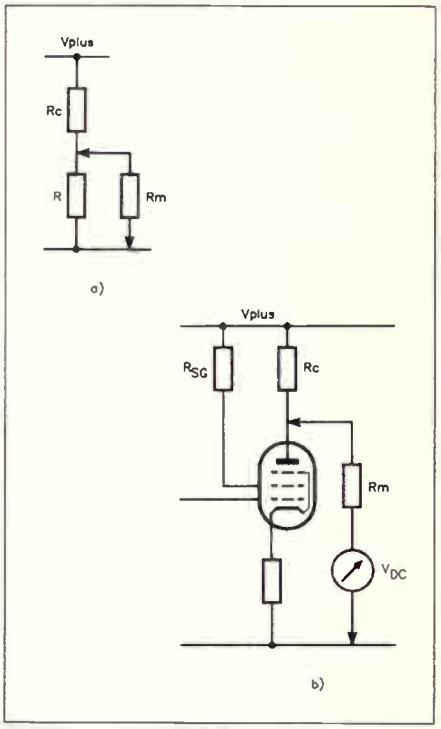


Figure 5.5. Showing meter loading effects in a circuit. (a) Circuit for calculating the loading effect of a dc voltmeter. (b) Anode and screen grid connections of a pentode where meter loading effect can be serious.

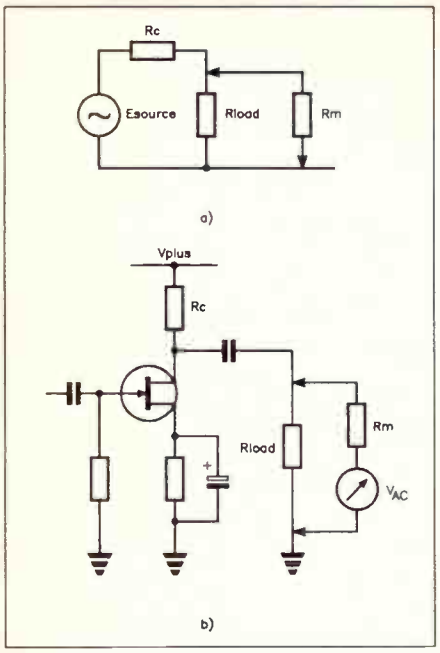


Figure 5.6. More on meter loading effects. (a) Circuit for calculating the loading effect of an ac voltmeter. (b) FET circuit where meter loading effect can be serious.

measuring the output voltage of most active devices, for example a FET, as shown in Figure 5.6b. This time, Esource cannot be measured, but we can calculate Etrue from:

Etrue = Emeas x (1 + Rload x Rc/Rm/(Rc + Rload))

For example, if Rc is 12k and Rload is 12k, and the 1 Vac range is used (Rm = 1k), then if Emeas is 0.60 Vac, the true output before the meter was connected must have been 4.2 Vac, the loading effect of the meter producing a very low apparent answer. Switching to the 10 V scale changes Rm to 10k but now Emeas becomes 2.62 V, the formula again giving Etrue = 4.2 V.

a) AUDIO VOLTAGE AMPLIFIERS

1) Triodes. Figure 5.7 shows a single triode audio valve amplifier. Typical triodes would be the directly-heated A415 and the indirectly heated 6J5, 6C4, 6B6, and 6AT6. Later valves incorporated two triodes in the one envelope, examples being the 12AU7, 12AT7, 12AX7, and the ECC88 and its high reliability version, the E88CC.

Special high amplification factor triodes such as the 6B6 use a grid resistor of 10M which provides self-biasing, so this and similar valves are often used without a cathode resistor.

The input block is a simple CR coupling to prevent any dc from the preceding stage getting to the input of the active block. The output block is simply the resistor Rl, with a capacitor that is part of the input block for the next stage.

To prevent interaction between stages, it is common to use an RC filter, consisting of Rf and Cf, in the power supply lead to each stage. Also, in wideband amplifiers there may be an inductor in series with Rl close to the anode connection. A small amount of negative feedback is sometimes introduced by omitting the bypass capacitor across the cathode resistor. This can lead to excessive hum if the resistance between the heater and cathode drifts down too far as the valve ages.

A glorious old triode! Such are rarities, but triode circuit building blocks were developed using devices such as this. The filament connections run down the bulb to the Edison screw base; the grid and anode (plate) connections are made to wire brought out at the top.

There are a number of simple tests that can be made to check the operation of this circuit. First, the high voltage supply Vplus should be in the range 180 to 300 V for mains equipment and 30 to 135 V for battery equipment. If a supply filter is used, the voltage Vf at F should be 2 to 20 V less than Vplus. If Vf is equal to Vplus, the valve is drawing no current, so there is an open circuit filament or an open circuit in one of the resistors (anode or cathode).

If Rf is used, it is easy to calculate the anode current being drawn by the valve as (Vplus – Vf)/Rf; indeed if there is no filter, it is worthwhile inserting an Rf of 1k just to take this measurement.

For the triode, Vc measured at the cathode C should be Rc times the anode current; if it is higher than this, the valve is probably faulty. For most designs, the voltage Va measured at the anode A will be about 60 per cent of Vf.

If the dc voltages are close to the expected values, the circuit should work unless its output is shorted to earth in the following stage. This can be checked by applying 100 mV from the signal injector to the grid and measuring or listening to the output using the signal tracer. The gain of medium amplification factor triodes such as the 6C5, 12AU7, or ECC88 will be 5 to 20; the higher amplification factor triodes such as the 12AT7 can have gains to about 45 and the 6B6 and 12AX7 can have gains up to about 60.

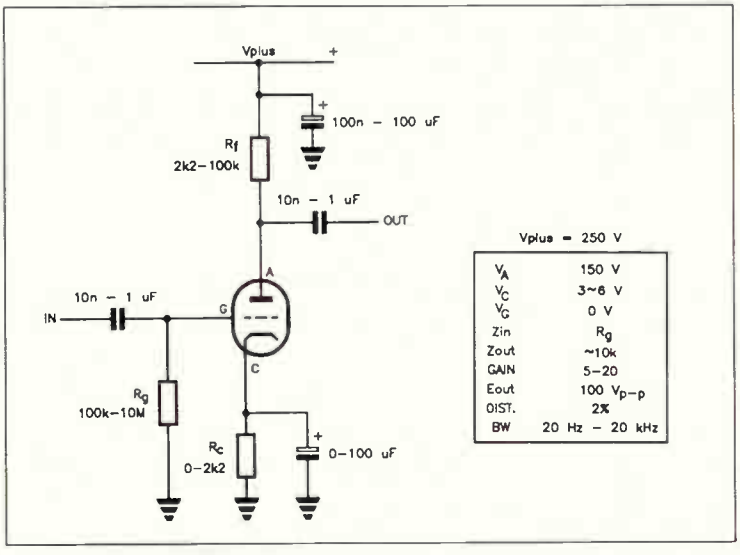
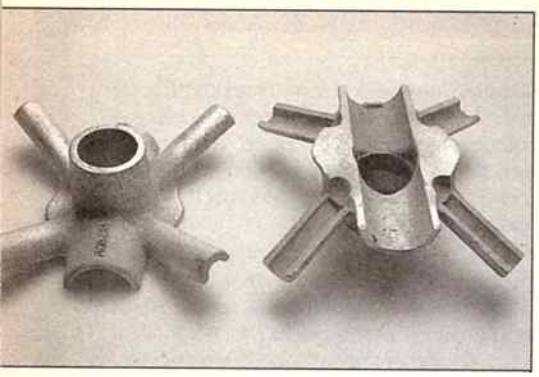
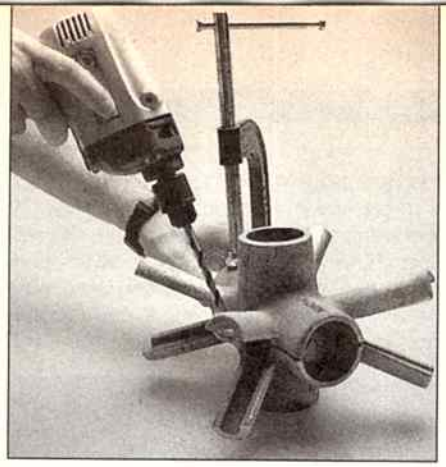


Figure 5.7. RC-coupled single triode audio voltage amplifier block.



Two 'Bandit' hub castings are the heart of this project. Available from Ashpoint Industries.



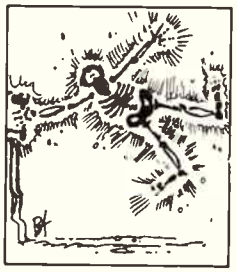
Drilling holes for the hub clamping bolts. A G-clamp holds the two castings together while you drill. Hold the drill vertical!

First step — seal each of the wooden spreaders.

Radio amateurs, shortwave listeners, CBers —

BUILD A CUBICAL QUAD ANTENNA

With the sunspot cycle at its peak right now, the HF bands are hot with DX from all round the world, and will remain so for a few years yet. The cubical quad has been acclaimed as one of the most effective DX antennas for many years. But they can be mechanically unwieldy. A locally-made hub solves that problem. By Roger Harrison VK2ZTB.



ELECTRONICS
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The quad antenna, according to several sources, has been around since the late 1940s and was originally designed by an American radio amateur. The South American shortwave broadcast station, HCJB – The Voice of the Andes – in Ecuador, used one for years.

Probably the most popular form has been the so-called cubical quad beam, comprising two square loops, each loop being about one wavelength long at the design frequency (that is, a quarter wavelength per side) spaced between one-fifth and one-quarter wavelength apart. One loop is driven (it has the feedline connected to it) and hence is called the driven element, the other loop is not connected – a parasitic element. If this is slightly longer than a wavelength, then it becomes a parasitic reflector. Thus you have a two element parasitic beam antenna, the two elements in space delineating the sides of an imaginary box, or cube. The loops, being square, have four sides – a quad. Hence, cubical quad.

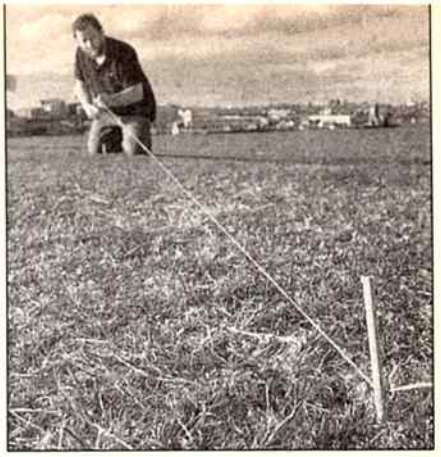
When compared to that other popular parasitic beam antenna, the Yagi, a quad exhibits slightly more gain, all else being equal. Controversy over this has raged for years. However, the ARRL Antenna Book reports that a lot of practical work comparing quads and Yagis shows that, for the same array length, the quad has a gain of approximately two decibels (2 dB) over a Yagi. In addition, a quad has a smaller turning circle because it is only a quarter wavelength wide.

A variety of methods for constructing quads for the HF bands have been devised and described over the years. By far one of the most ingenious was the spider hub. In this arrangement, the corners of each quad element are supported by spreader arms which radiate from the centre of the cube formed by the elements. A hub at the centre provided support for the spreaders and a method of attachment to a mast and rotator. No boom is required and it results in an assembly of the lightest possible weight and using the least amount of materials. The first ones I saw comprised a very complex, welded assembly of steel angle and tube. Building a HF quad remained the province of the determined and/or mechanically skilled constructor for many years.

The general arrangement of such a cubical quad is shown in Figure 1. The forward and rearward rake angle of the spreaders is arranged to achieve a desired or optimised spacing for the elements. The large arrow shows the direction of the beam. This form of construction has another advantage: you can nest elements for other bands inside the outer loops, the rake angle of the spreaders maintaining the required spacing, in wavelength terms, between the elements. See Figure 2.

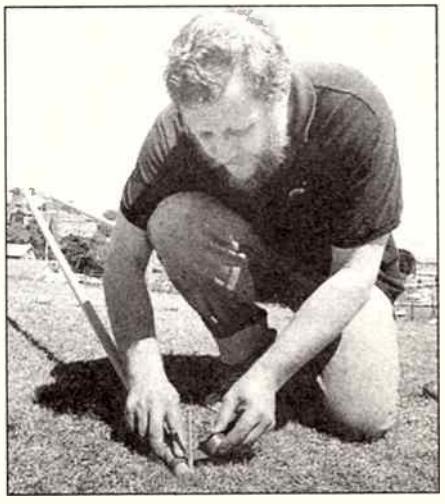
The sealed spreaders are secured in the hub piece arms using hose clamps.

Measure out a square on the ground, the size of the element you're building. Hammer short pegs into the ground to mark the corners.



With the surface for the quad element pegged-out on the ground, run string between diagonally-opposite corners, marking the centre where they cross.

Lay the completed 'spider' over the pegged-out square. The corner pegs will indicate where to drill the spreaders.



Marking where to drill the spiders.

Drill each spreader to pass the quad element wire through.

Experience also shows that the quad is less critical when it comes to tuning and matching, making it more forgiving of construction tolerances.

The hub solution

Back in the years of the CB boom in Australia, when quite a number of enthusiasts gained their introduction to the wonderful world of electronics and communications, interest in antennas was very high – it was the means of getting "the best bang for the buck" from 5 W CB rigs. Many enthusiasts built their own.

Among them was Mike Rychter who, then, as now, is a metallurgist by trade and proprietor of a metal foundry, Ashpoint Industries Pty Ltd. Mike designed and made a set of castings for a quad hub. After a little experience and further evolution of the design, he made a quantity and sold them to fellow enthusiasts. It was dubbed the "Bandit". He has been quietly making and selling them ever since. Mike went on to get

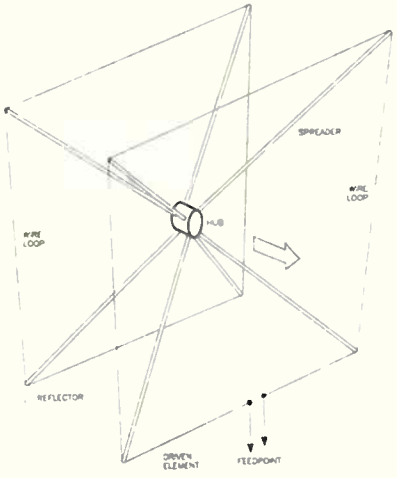


Figure 1. General arrangement of a cubical quad using the spider method of construction based on a single, central hub.

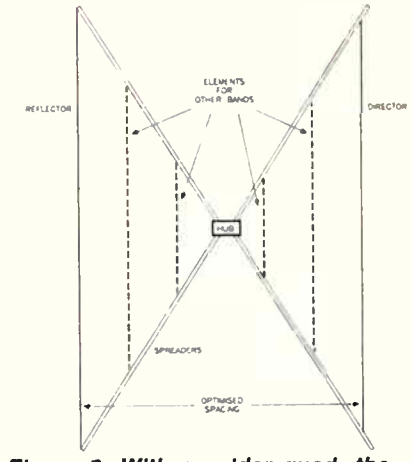


Figure 2. With a spider quad, the forward and rearward rake angle of the spreaders is such that reflector and director are placed at the required spacing. There's a bonus, in that elements for other bands may be nested inside the outer loops and are automatically positioned at the correct spacing.

Cubical quad antenna

his Novice amateur licence and, later, his Limited licence and now signs on the air as VK2NOW (on HF) or VK2YUX (on VHF). His Novice callsign is impressed in the casting. In recent years, Mike also gained a little fame (but little fortune!) from a casting he designed for a discone-type scanner antenna.

The accompanying photographs show what the Bandit hub looks like. Two castings, both the same, make up one hub. The castings are made from corrosion resistant grade aluminium. Each single hub piece has four short arms which are grooved to take a 19-20 mm diameter spreader. These can be lengths of wooden dowel, readily obtainable at your local hardware store, or glass fibre rod such as fishing rod blanks. The spreaders are clamped into position with worm-drive hose clamps which are widely available from garages and hardware stores.

Two castings fit, like a clamp, around a standard 50 mm outside diameter pipe which is used as a mast. Note the lug at the 'top' end of the casting. The two castings are clamped at the top of the mast pipe such that the lug on each one prevents the hub from slipping down the mast.

When the spreaders are mounted, they project out at the required angles to each other so that by stringing a wire loop to each set of spreaders at points equidistant from the hub, you end up with a cubical quad.

The size of the quad loop is determined according to a formula so that the length of wire is very close to one complete wavelength at the frequency of operation. The two loops are automatically placed at the correct spacing.

From the photographs, you can see that a casting also has a cylindrical protrusion, projecting from the centre of the four arms. This enables you to mount the castings on a standard 50 mm diameter pipe boom to form a multi-element quad.

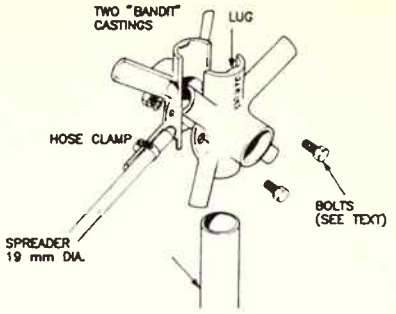


Figure 3. How the two hub pieces are mounted to a mast.

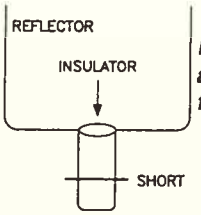


Figure 4. Stub tuning arrangement for the reflector.

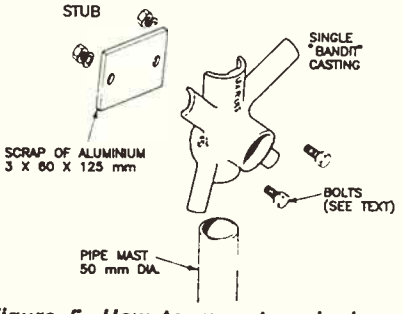


Figure 5. How to mount a single quad loop antenna.

A single Bandit casting costs $30 tax paid, including postage anywhere in Australia. A pair, for a cubical quad, will cost you $60. Contact Ashpoint Industries, 38 Birmingham St, Alexandria NSW 2015. Phone ☎ (02)693-1866, Fax ☎ (02)317-5629.

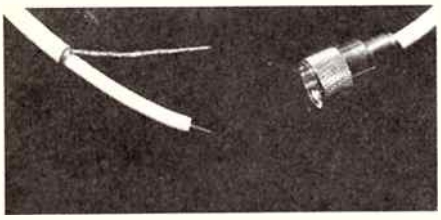
Building it

Constructing a cubical quad using this can use ordinary enamelled coil winding wire and harden it by firmly securing one end, then reeling out the whole length and giving it a firm stretch.

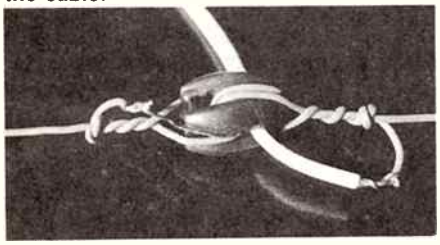
Cubical Quad — Required items, 28 MHz design

- A pair of Bandit Universal Quad Hub castings.
- Two 6.4 mm (1/4 inch) by 38 mm long (1 1/2 inch) hex-head bolts, two nuts and two spring washers to suit.
- Eight lengths of 19 mm (3/4 inch) diameter wooden dowel rod, two metres long. You may need to cut these to length from standard-length dowels obtainable at hardware stores.
- Eight worm-drive hose clamps. (e.g. Utilux, or similar)
- Approximately 24-25 metres of 16 or 18 gauge copper wire, or the same length of plastic insulated, stranded hookup wire, either heavy duty (23 x 0.2 mm) or very heavy duty (32 x 0.2 mm). If you wish to use copper wire, the hard-drawn type is preferred. You
- Coax for the matching section (see the panel on Matching).
- Coax connectors to suit.
- Enough 50 Ohm coax (RG8, RG213 or RG58) to run from your final antenna mounting position to your transceiver installation.
- 50 mm diameter pipe for mast; length to suit.
- Linseed oil or other wood-sealing compound.
- One small reel of insulation tape.
- One small reel of self-amalgamating tape, or plumber's Teflon tape.

Terminate the driven element in the centre of one side by tying-off the wire ends to an egg insulator, or dipole centre insulator, etc.



Prepare the 70 Ohm matching section cable by terminating one end with a coax plug and stripping back the other 50 mm. The required cable length is measured between the tip of the coax plug and the point where you strip it back to — so allow an extra 50 mm when cutting the cable!



Temporarily terminate the end of the matching cable to the driven element feedpoint, passing the cable through the holes of the egg insulator, etc.

method is almost foolproof. The cast Bandit hub pieces remove all the mechanical headaches. The accompanying panel (required items) details everything you'll need to construct the quad, apart from tools. I have described here the construction of a quad for the 28 MHz (10 metre) amateur band. For other bands, the procedure is the same, only the dimensions change. You will need a large, clear area in which to work.

The first thing to do is to clamp the two hub pieces together and drill holes for the clamping bolts. A G-clamp is good for this.

Or securely tape or tie them. Make sure you line them up properly. The ends with the Bandit embossing should be opposite one another. Drill through the "ears", as shown in the illustration, using an 8 mm (5/16 inch) drill. This gives the 6.4 mm (1/4 inch) bolts a little clearance. If your drill chuck won't take a bit larger than 6.4 mm, then use that and either ream or file out the holes a little.

Having done that, you can proceed with assembly of the driven element, as follows:

1. Each of the wooden spreaders needs to be sealed against moisture and the effects of weathering by treating them thoroughly with linseed oil or other suitable wood preserving product.
2. Once treated, place each spreader in turn in an arm of the hub and secure with a hose clamp. The end of the spreader should butt up against the lug at the inner end of the hub arm as shown in the illustration. This ensures that the spreader will be held firmly. You now have one completed spider.
3. Carefully measure out a square on the ground of 268.5 cm per side (1074 cm circumference) and hammer some small pegs or posts into the ground at each corner. This marks out the dimensions of the driven element. It is important to get the dimensions right. Don't be sloppy. Now, using some string, mark out the diagonals and find the centre.
4. Lay the completed spider, legs down – hub upwards, over this square, with the hub above the centre so that you can sight the crossed strings through the boom hole. Using some insulation tape or a carpenter's soft-lead pencil, mark the spreaders where the corner pegs indicate. (You may trim back the spreaders to within 25 mm of the marks if you wish).
5. Drill a 3 mm (1/8 inch) hole through each spreader at the point just determined. Use the tip of a 6 mm drill, or a countersink bit, to counter sink the two ends of each hole. This avoids a sharp bend in the wire. Soak with linseed (or whatever you are using) to waterproof the exposed wood.
6. Thread the required length of wire through the holes in the spreaders. Terminate the square of wire by tying off the loop ends to a small egg insulator as shown in the accompanying illustration. Draw the wire fairly tight but not so tight as to distort the spreaders.
7. Now for the matching section. Taking your 1765 mm length of RG59 75 Ohm coax, put a coax connector on one end. Measure back 50 mm and, using a penknife or hobby knife, remove the outer plastic sheath of the coax to expose the braid. Take care not to nick the braid. Separate the braid and centre conductor.
8. Push this end of the 75 Ohm cable through the two holes of the egg insulator and solder the coax braid and centre conductor to the two ends of the quad loop termination as shown in the accompanying illustration. Do not seal the open end of the coax yet, as you may need to trim it to adjust the match to improve the SWR.
9. Your driven element is now completed. It is a good idea to add a 'lockwire' where the quad wire passes through the spreader arm as shown in a photograph here.

Quad Dimensions

You can calculate the required loop lengths for any frequency by using the following formulae:

Driven Element = 30632/f

Reflector = 31394/f

where f is in MHz. The result is in centimetres (cm). I have chosen cm because that's all the accuracy you need, even at 50 MHz.

If you're contemplating a three or four element array (or more!), director length can be calculated from:

Director = 29718/f

The ARRL Handbook gives tables of dimensions for a variety of quad array combinations.

Here are dimensions for the popular amateur bands:

FREQUENCY	REFLECTOR	DRIVEN ELEMENT
14.15 MHz	2219 cm	2165 cm
21.20 MHz	1480 cm	1448 cm
28.5 MHz	1100 cm	1074 cm
50.10 MHz	627 cm	611 cm

The reflector

The assembly procedure is basically the same as for the driven element. This time, mark out a square of 275 cm a side. In

Cubical quad antenna

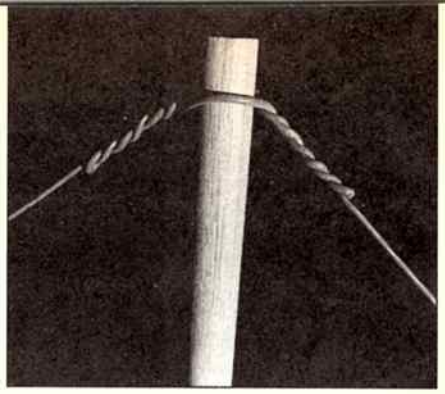
completing the reflector loop, join the ends of the wire at a corner, twisting them around each other in the manner used for installing a lockwire to obviate tension on the joint itself. Solder the wire ends together.

The driven element and reflector hub pieces are secured to a 50 mm diameter pipe mast, as shown in Figure 3. Use spring washers beneath the securing nuts.

SWRing-in

Temporarily mount your quad on a mast at a convenient height – ideally, this should be at least five or six metres off the ground and well clear of any buildings etc. You'll need access to the driven element's feedpoint to trim the length of the matching line.

Connect it up to your rig and check the SWR at several frequencies across the band. This will give you some idea of exactly where the quad is resonating. If any adjustment is needed, lengthen or shorten the loop to drop or raise the resonant frequency, respectively. Small adjustments can be made by applying tension to the 75 Ohm coax. If the SWR is 1.8:1 or below, you have no need to worry. The bandwidth of the quad is quite good and providing the SWR is below that, no adjustment is really necessary and will not result in any significant improvement. Trying to trim it down to 1.1:1 for the perfect match, is pointless.



It's good practice to secure the quad elements with a 'lockwire' where it passes through each spreader. Use a short length of heavy gauge wire.

With the matching adjustment completed, carefully seal the coax at the feedpoint to prevent moisture from getting into the matching section coax, which isn't good for it.

Reflector tuning

For those who want to optimise their quad for peak performance, the reflector can be tuned. This will improve its front-to-back ratio. The tuning can be done with a simple shorted 'stub' which is added by breaking the

Matching

The feedpoint impedance of the driven element of a cubical quad is reported to be generally around 80-100 Ohms. By far the most popular method used to match this to a 50 Ohm line is the quarter-wave transformer. This makes use of the impedance-transforming properties of a quarter wave transmission line, inserted between the antenna feedpoint and the feedline to the transceiver.

The input impedance of a quarter-wave line, Zin, connected to a resistive load, Zl, is given by:

$Zin = Zq^2/Zl$

where Zq is the impedance of the quarter-wave line. If we know the input impedance, Zin, and the load impedance, Zl, we can find the required impedance of the quarter-wave line by rearranging the equation, like so:

Zq = square root (Zin × Zl)

If our load impedance, that is, the quad's feedpoint impedance, is 100 Ohms, and we're matching this to a 50 Ohm feedline, the required impedance of the quarter-wave matching section is:

Zq = square root (50 × 100)

Thus, Zq = square root 5000

= 70.7

The nearest standard impedance cable is 75 Ohms. Only a small mismatch, giving a VSWR of about 1.1:1, will result, which is of little importance. Even if the quad's feedpoint impedance were down around 80 Ohms, requiring a quarter-wave line of 63 Ohms impedance, using 75 Ohm cable for the matching section will only result in a VSWR of 1.4:1, which is not significant and readily tolerated.

The general arrangement of a quarter-wave transformer of coaxial cable is shown here in the diagram. The velocity factor of the cable used must be taken into account when calculating its length (hence the λc^4). Use this formula:

Lq = (7620 × VF)/f in cm,

Where Lq is the length of the quarter wave line, VF is the velocity factor and f is the design frequency in MHz. The cable's velocity factor is obtainable from the manufacturer's literature. For solid dielectric type cables, such as RG59 or RG11, VF is generally 0.66. If our design frequency is 28.3 MHz, and RG59 is to be used:

Lq = (7620 × 0.66)/28.3

= 5029.2/28.3

= 176.5 cm

This calculation results in a length that is slightly longer than actually required, allowing the cable to be trimmed for the best match and taking into account

One completed quad element. Now for the next one, to complete the cubical quad.

reflector loop with an insulator, in the same way as is done for the driven element feedpoint. The method is illustrated here in Figure 4.

The stub is made of tinned copper wire, and is around half the length of one side of the reflector loop measured from the insulator to the end. A short is placed across it to tune the stub. You'll need a field strength meter placed some distance away, with the meter itself placed in some convenient position so you can see the effect of adjustments. Be warned, this is not an easy exercise with a relatively large quad.

The short can be made from two bulldog clips joined by a length of tinned copper wire just short enough to allow you to clip them across the stub.

The short is adjusted for best forward signal strength and front-to-back ratio. Obviously, you'll need some means of rotating the antenna to do this. When you've adjusted it to your satisfaction, check the SWR and adjust the matching too, if necessary.

Variations

The spreaders of your quad assembly may be made of aluminium tubing to within 300 mm of where the quad loop wire passes through. The tips of the spreaders must be of a non-conducting material. Wood dowel may be forced down the end of aluminium spreaders, which is simple, cheap and effective. However, it should be treated as previously discussed to protect it from the effects of the weather.

Instead of using an egg insulator at the driven element's feedpoint, you could substitute a special T-shaped centre insulator made for use with wire dipoles. These are available from Emtronics in Sydney, Melbourne and Brisbane.

If you're considering the construction of a multi-element quad, it is best to get your hand in by first building a cubical quad, *then* graduating to a larger array.

Conversely, for a small, cheap and cheerful rotatable antenna having a modicum of gain, you could make a single quad loop, following the instructions for the driven element. It may be mounted using the method shown in Figure 5.

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The Quad Antenna Handbook, by William I. Orr W6SAI, published by Howard W. Sams & Co.

The ARRL Antenna Book, edited by Gerald L. Hall K1TD, published by the ARRL.

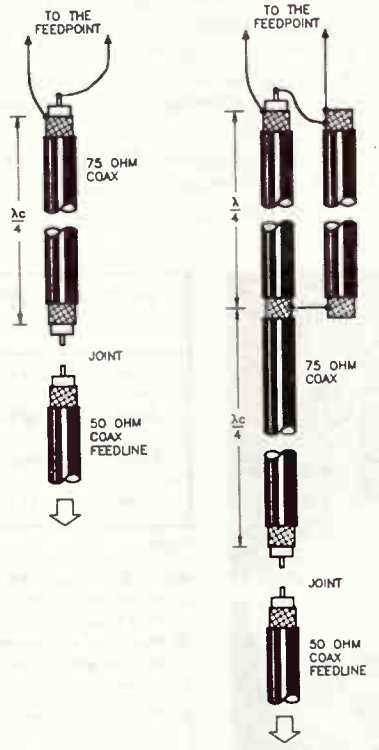
the few per cent tolerance variation in cables' velocity factors, measuring and cutting inaccuracies, etc.

The joint between the 75 Ohm quarter-wave transformer and the 50 Ohm feedline is made by terminating the two cables with suitable coax plugs and using a double-female connector to mate them. Alternatively, use a female line socket on one cable and a plug on the other.

All joints should be securely taped to prevent water getting in. Self-amalgamating tape, a 3M product obtainable through hardware suppliers, is ideal for this. Or, wrap the joint in plumber's Teflon tape and then insulation tape, or slip a length of heatshrink tube over it all and shrink it on.

While the feedpoint of a quad's driven element is actually a balanced load, and coax is unbalanced, connecting coax direct to the quad's feedpoint is, strictly speaking, not kosher. But many constructors seem to get away with it. If you are worried about this, the arrangement shown in the right side of the diagram can be used.

A quarter-wave stub balun is made from two lengths of coax separated by a small gap (halves of plastic clothes pegs make ideal separators, taped at



intervals). Use the equation above to find Lq, but make the velocity factor 1. Then a quarter-wave transformer follows to provide a match to 50 Ohm line. All this may be made from 75 Ohm cable.

BUILD A 'SMART' 2400 BPS PC IN-MODEM

Part 2. Here's how to set up and install your modem, followed by data sheets on the modem chip and its controller.
By Roger Harrison.

Before socketing any ICs or attempting a first power-up, a few preliminary checks are in order. First, a thorough visual inspection is recommended. Take your time. Correct any obvious mistakes picked up here. With your multimeter, check the supply rails for shorts. Because the board is solder-masked, the likelihood of anything going wrong here is remote, but checking saves grief later. If you do find a fault, search it out and rectify it now. Any other faults will only show up with subsequent testing. To tackle such faults that may arise will require a modicum of common sense, some patience and a little experience with digital fault-finding.

Note that, because a number of CMOS devices are used on this card, you should take the usual precautions when handling the ICs during installation and handling the completed card.

Configuration

With the project passing preliminary checks, you can carefully install the socketed ICs. Then install the LIU cover with two plastic zip ties. The manual supplied with kits covers in detail the configuration and installation and the Hayes command set operational details.

The modem is installed into an empty slot inside your PC/compatible. First, however, you need to set the jumpers on the card to configure the I/O address and interrupt line to use.

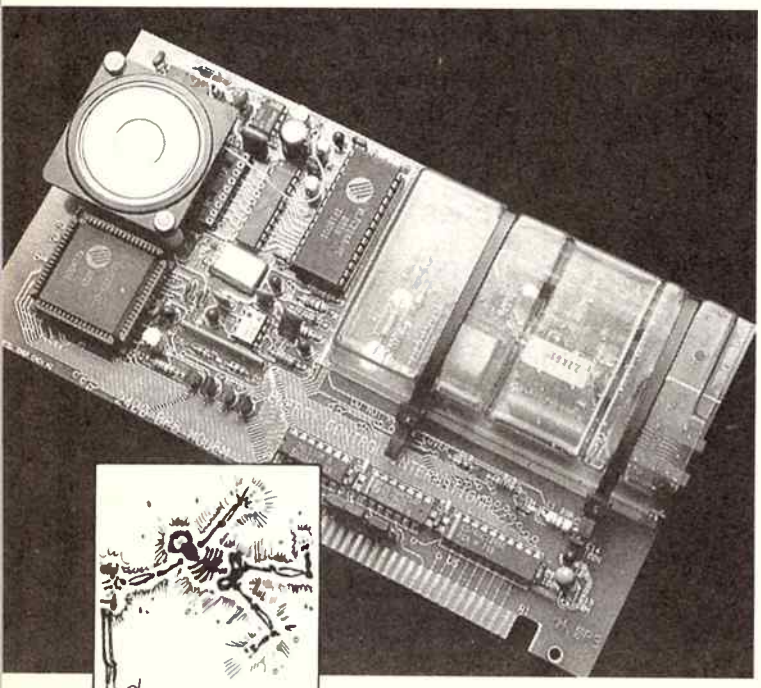
The modem must have a different interrupt line (IRQx) and different I/O address to everything else in your computer. If you currently have no serial ports installed in your computer, then set the jumpers for COM1 as shown in Table 1 here. If such is the case, you can proceed to the section headed "Installation".

If you have one serial port installed and configured for COM1, then set the jumpers on your modem card for COM2 as per Table 1; then proceed to "Installation". Conversely, if you have the one serial port installed and set for COM2, set your modem jumper for COM1.

To run correctly with most communications software, your modem should be installed for either COM1 or COM2. If you have both of these taken up, then you'll have to remove one of the peripherals to free up either COM1 or COM2. Some software allows the use of COM3 and COM4. You can configure your modem to use either of these, as per Table 1. Table 2 shows the meaning of the jumpers.

Installation

Once the modem card has been configured, you can then insert it into a slot in your computer. First, turn off the computer's power switch and disconnect the power plug. Open the case and remove the rear metal slot cover for the empty slot you intend using. Insert the card and screw it in place. The telephone line connection inserts into the RJ11 socket protruding through the rear metal slot cover. Restore the case, hook up everything and you can power up. The software instructions lead on from here. Happy communicating! eti



ELECTRONICS
E T I - 1 6 2 5

PORT	DEFINITION	JUMPERS (B2)					
		1	2	3	4	5	6
COM1	3F8-3FF IRQ4		X	X		X	
COM2	2F8-2FF IRQ3	X			X	X	
(COM3)	3E8-3EF IRQ?	?	?	X			X
(COM4)	2E8-2EF IRQ?	?	?		X		X

Table 1

NOTE: The three links should be placed so that the middle pin in each group of three connects to either its left or right neighbour (as indicated by the X).

Some software allows you to use COM3 or COM4. The modem can be configured for these port addresses if you only intend using it with such software. You'll need to find out which interrupt lines (IRQ?) are used and set the jumpers in 1 and 2 accordingly; that is why the ? are in those positions in the table.

1 2	Selects IRQ4 Selects IRQ3	left right
3 4	Selects 3x8 address Selects 2x8 address	left right
5 6	Selects xF8 address Selects xE8 address	left right

Table 2

ABBRIEVIATED DATA SHEET — 2400 BIT-PER-SECOND MODEM

FEATURES

- Complete 2400 bit-per-second modem conforming to V.22 bis specifications
- Compatible with CCITT V.22 bis, V.22, V.21 and BELL 212A and 103 standards
- Integrated DTMF/GUARD TONE GENERATOR, call progress monitor and contains an on-chip hybrid
- Analogue, digital and remote digital loopback.
- Programmable audio output port
- Three-micron CMOS technology
- DIP or PLCC package
- High-level of integration provides for economical 2400 bit-per-second modem solution
- Broadly adaptable to established worldwide standards at 2400, 1200 and 300 bit-per-second
- Minimises need for external components simplifying design of intelligent modems
- Testable signal path diagnostics
- Audio interface for phone line monitoring
- Low pawer consumption

DESCRIPTION

The VL7C224A is a complete 2400 bit-per-second modem IC containing all modem functions except the adaptive equaliser. It is used in conjunction with an external controller such as the VL7C235 (for parallel bus applications), the VL7C245 (for RS-232 applications) or a general purpose microcontroller such as 8096, to implement a 2400 bps full duplex modem, compatible with the CCITT V.22 bis recommendation. The controller performs all modem control and handshaking functions as well as the adaptive equalisation.
The VL7C224A operates in 2400 bps QPSK/QAM and 1200 bps PSK as well as 0 to 300 baud FSK modes, compatible with Bell 103 and 212A as well as CCITT V.21, V.22 and V.22 bis standards. When used with the VL7C225, VL7C235, or VVL7C245 controllers, the VL7C224A becomes an intelligent modem controlled by the industry standard "AT" command set. The interface between the VL7C224A modem and the controller (either the 8096 or the VL7C225/235/245) is a standard microcontroller interface that easily connects to an EEPROM for permanent storage of configuration settings and phone numbers.

FUNCTIONAL DESCRIPTION

- Full transmitter consisting of
  - Async to sync converter
  - Scrambler
  - Data encoder
  - 75% square root of raised cosine pulse shaper
  - Quadrature modulator
  - FSK (Bell 103 and CCITT V.21) modulator
  - Hybrid
- High-band and low-band filters
- High-band and low-band compromise equalisers
- V.22 Notch filter (selectable at 550 or 1800 Hz)
- Transmit smoothing filter
- Programmable attenuator for transmit level adjust
- DTMF, 550 Hz, 1800 Hz, 1300 Hz, and 2100 Hz tone generators
- Transmit clock circuit for synchronous operation (slave, external, and internal modes)
- Pattern generator for generating fixed digital patterns in handshaking mode
- Receive section consisting of
  - 64-step programmable gain controller (PGC)
  - Energy detector at the output of the PGC
  - Hilbert transformer
  - Quadrature demodulator (free running carrier) with low pass filters
  - Baud timing recovery circuit (sampling clock of 600 Hz)
  - FSK demodulator
  - Sync to Async converter
- 8-bit analogue to digital converter (ADC)
- Control and status register
- 8-bit microprocessor interface with interrupt and multiplexed address/data lines
- Audio output with level adjust

Transmitter

Since data terminals and computers may not have the timing accuracy required for 2400/1200 bps transmission (0.01%), timing correction on the incoming data stream must be made. The async/sync converter accepts asynchronous serial data clocked at a rate between 2400/1200 Hz±2.3%, – 2.5%. It outputs serial data at a fixed rate of 2400/1200 Hz±0.01% derived from the master clock oscillator. To compensate for the input and output rate differences, a stop bit is either deleted or inserted when necessary. If the input data rate is slower than the output rate, a stop bit is inserted. If the input data rate is faster than the output data rate, a stop is deleted. The output of the async/sync converter is applied to the scrambler.
The scrambler is a 17 bit shift register clocked at 2400/1200 Hz. Outputs from the 14th and 17th stages are exclusive OR'd and further exclusive OR'd with the

SIGNAL DESCRIPTIONS

Signal Name	Pin Number	Signal Description
SCR	1	Synchronous Clock Receive (Data set source) — A TTL output that is used only in bit synchronous mode. It's recovered by the receiver phase locked loop from the far end modem. Data on RX is valid at the rising edge of this clock.
AGND	2	Analogue Ground
SCT	3	Synchronous Clock Transmit (Data set source) — This TTL input is used only in bit synchronous mode and is generated internally by the VL7C224A clock generator. Rate = 1200 Hz±0.01% or 2400 Hz±0.01%.
SCTE	4	Synchronous Clock Transmit (DTE source) — TTL input used only in bit synchronous locked mode and data on TXD line is latched by the VL7C224A at the rising edge of this clock. Clock rate = 1200 Hz±0.01% or 2400 Hz±0.01%
SPKR	5	Speaker — The hybrid output is passed through a programmable attenuator and fed to this analogue pin. Four different levels can be attained by controlling bit 0 and bit 1 of the SPKR register as specified under SPKR register description.
EDC	6	Capacitor for Energy Detect — A.1.0μF capacitor should be connected between this pin and AGND.
DGND	7	Digital Ground
—CS	8	Chip Select — An active low TTL input.
—WR	9	Write — This TTL input is normally high. Data on ADO-AD7 is written into the VL7C224A registers at the rising edge of this pulse.
—RD	10	Read — A normally high TTL input. Data on ADO-AD7 is read from the VL7C224A registers at the rising edge of this pulse.
A/D1-A/D4	12,13,17,18	Multiplexed Address/Data Bus (8-bits) — These four TTL I/O bits are used for multiplexed addressing and data I/O of internal registers.
VSS	14	Negative Power Supply - — 5V.
RXA	15	Receive Analogue — Input.
TXA	16	Transmit Analogue — Output.
DO,D5-D7	11,19-21	Data Bus Bits O,5,6 and 7 — They are don't cares as far as the address is concerned.
CLKIN	22	Clock Input — 9.8304 MHz or 12.288 MHz clock input from the VL7C225/235/245, or external controller.
GS	23	Gain Select — To compensate for loss in line coupling transformer. When left open or tied to VSS, the compensation is 0 dB. Connected to ground, +2 dB compensation is provided, and when tied to VDD, the compensation is +3 dB.
ALE	24	Address Latch Enable — The address on A/D4-A/D1 is latched into the VL7C224A address decoder at the falling edge of a positive pulse on this normally low TTL input.
INT	25	Interrupt — A normally low TTL output. A short (13μs typical) positive pulse is generated after all A to D conversions are completed.
RXD	26	Received Data — A TTL output.
TXD	27	Transmit Data — A TTL input.
VCC	28	Positive Power Supply - +5V

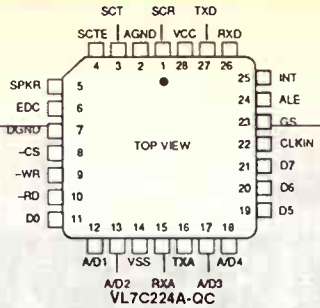
input data. The resultant data is applied to the D input of the shift register. Outputs from the first four/two stages of the shift register form the quad/dibit that is applied to the QAM/QPSK modulator. The purpose of the scrambler is to randomise data so that the energy of the modulated carrier is spread over the band of interest – either the high-band, centered at 2400 Hz or the low-band, centered at 1200 Hz. In the 2400 bps mode, the modem actually sends four bits at a time, called a quadbit; quadbits are sent at 600 baud, the actual rate of transmission; 600 baud is the optimum rate that can be transmitted over the general switched telephone network for a dull duplex FDM (frequency division multiplexing) modem because band limit filters in the central office cut off at about 3000 Hz.
In the 2400 bps data rate, the data to be transmitted is divided into groups of four consecutive bits (quadbits). The first two bits of the quadbits is encoded as a phase quadrant change relative to the quadrant occupied by the preceding signal element. The last two bits define one of the four signaling elements associated with the new quadrant.
In the 1200 bps data rate, the data stream is divided into groups of two consecutive bits (dibits), the dibits are used to determine the phase quadrant change relative to the quadrant occupied by the preceding signal element. The resulting signaling elements from the inphase (I) and quadrature (Q) channels are passed through base-band filters with a square root of raised-cosine shape. The filtered signals subsequently modulate sine and cosine carriers and add to form the QAM/QPSK signal. The wave shaped signal is then passed through either the low-band or high-band filter depending upon originate or answer mode selection.
For low speed operation the FSK modulator is used. It produces one of four precision frequencies depending on originate or answer mode and the 1 (mark) or 0 (space) level of the transmit data. Different frequencies are used for V.21 and 103 modes. The frequencies are produced from the master clock oscillator using programmable dividers. The dividers respond quickly to data changes, introducing negligible bit jitter while maintaining phase coherence. The output of the FSK modulator is applied to the appropriate filter when the low speed mode of the operation is selected.
The filter section consists of low-band (1200Hz) and high-band (2400 Hz) filters, half-channel compromise amplitude and group delay equalisers for both bands, smoothing filters for both bands and multiplexers for routing through the appropriate band filters. For CCITT V.22 bis applications, a notch filter is included that can be programmed for either 550 Hz or 1800 Hz. In the call progress monitor mode, the low-band filter is scaled down by a factor of 2.5 to centre it over a frequency range of 300 to 660 Hz. Thus, during call establishment in the originate mode, call progress tones can be monitored through the scaled low-band filter and the modem answer tone or voice can be monitored through the unscaled high-band filter.
The low-band filter is a tenth order switched-capacitor band-pass filter with a centre frequency of 1200 Hz. In the originate mode, this filter is used in the transmit direction; in the answer mode it is used in the receive direction. When analogue loopback is used in the originate mode, this filter, together with the low-band delay equaliser, is in the test loop. In the call progress monitoring mode, the filter response is scaled down by 2.5, moving the centre frequency to 480 Hz. The low-band delay equaliser is a tenth order switched-capacitor all-pass filter that compensates for the group delay variation of the low-band filter and half of the compromise line characteristics, producing a flat delay response within the pass-band.
The high-band filter is a tenth order switched-capacitor band-pass filter with centre frequency of 2400 Hz. In the answer mode, this filter is used in the transmit direction; in the originate mode, it is used in the receive direction. When analogue loopback is used in the answer mode, this filter, together with the high-band delay equaliser, will be in the test loop.
The high-band delay equaliser is a tenth order switched-capacitor all-pass filter that compensates for the group delay variation of the high-band filter and half of the compromise line characteristics, producing a flat delay response within the pass-band. The transmit smoothing filter is a second order low-pass switched-capacitor filter that adds the modem transmit signal to the DTMF or V.22 guard tones. It also provides a 2 dB per step programmable gain function to set the output level.

Receiver

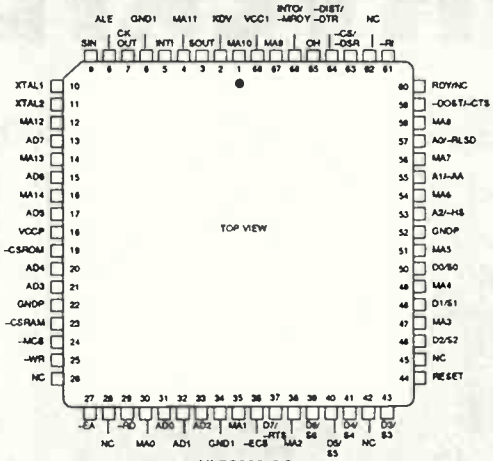
The receiver section consists of an energy detector, programmable gain control (PGC), part of the QAM/QPSK demodulator, FSK demodulator, 8-bit ADC and sync/async converter.
The received signal is routed through the appropriate band-pass filter and applied to the energy detector and PGC circuit. The energy detector provides a detection within 17 to 24 msec. It is set to turn on when the signal exceeds -43 dBm and turn off when the signal falls below -48 dBm measured at the chip. A 2dB minimum hysteresis is provided between the turn on and turn off levels. In call progress mode the energy detector is connected to the output of PGC to allow detection level adjustment.
The output of the filter is applied to the programmable gain control (PGC). This circuit has a wide overall range of 47.25 dB and provides 64 steps of 0.75 dB/step. The PGC gain is controlled by the external processor. It also includes autozeroing to minimise the output DC offset voltage.
The QAM/QPSK demodulator uses a coherent demodulation technique. Output of the programmable gain control (PGC) is applied to a hilbert transformer that produces an in-phase and 90° out of phase component. These components are then demodulated to base-band in a mixer stage where individual components are multiplied by a free running carrier. The base-band components are low-pass filtered to produce I and Q channel outputs. (In phase and quadrature.) The I and Q channel outputs are both filtered by 300 Hz band-pass filters. Then they are rectified, summed and passed through a band-pass filter giving a 600 Hz signal. This signal is applied to a digital phase lock loop (DPLL) to produce a baud rate clock. Using the recovered clock signal, the I and Q channels are sampled and digitised into 8-bit samples by the ADC. Each channel (I and Q) is sampled twice during a baud period, once at the middle and once at the end of the baud period allowing T/2 or T sampling operation. The external processor is interrrupted once every baud period (1.667 msec). The processor should read I and Q samples (within 100µ sec from the time interrupt is issued), and perform adaptive equalisation carrier phase tracking, data decoding, and data descrambling. One quad/dibit is then transferred to the VL7C224A during each baud period.
In the asynchronous mode, data received from the external processor is applied to the sync/async converter to reconstruct the originally transmitted asynchronous data. For data which had stop bits deleted at the transmitter (overspeed data), these stop bits are reinserted. Underspeed data is passed essentially unchanged. The sync/async convertor has two modes of operation. In the basic signaling mode the buffer can accept an overspeed which corresponds to one missing stop bit in eight characters. The length of the start and data bits will be the same and the stop bit will be reduced by 12.5%. In the extended signaling range, the buffer can accept one missing stop bit in four characters and stop bits will be reduced by 25% to allow for over-speed in the transmitting terminal. Output of the sync/async converter along with the output of the FSK demodulator is applied to a multiplexer. The multiplexer selects the appropriate output, depending on the operating speed, and outputs received data on the RXD pin.
For low speed operation, the FSK demodulator is used. The output of the PGC amplifier is passed through a zero crossing detector and applied to a counter that is reset on zero crossings. The counter is designed to cycle at a rate four times faster than the carrier signal. The counter output is low-pass filtered and hard limited to generate FSK data.
To improve performance of receiver at low signal levels, while maintaining a wide amplitude range, a 1-bit AGC circuit is placed prior to band-pass filter. The decision thresholds of this AGC are controlled by AGCVT bit when AGCVT = 1, the thresholds will 6dB farther apart than when AGCVT = 0, so that probability of gain change will be reduced. The status of the AGC gain is available through AGCO bit. AGC will have 8 dB more gain when AGCO = 1. Status of AGCO should be monitored every baud timing and when it makes a transition (causing gain-hit). PGC's gain should be modified to prevent divergence of the adaptive equalisation.

Hybrid

The signal on the phone line is the sum of the transmit and receive signals. The hybrid subtracts the transmitted signal from the signal on the line to form the received signal. It is important to match the hybrid impedance as closely as possible to the telephone line to produce only the received signal. When the internal hybrid is used, by setting the "HYBRID" bit in the control register, this matching is provided by an external resistor connected between the TXA and RXA



VL7C224A-QC



VL7C225-QC

pins on the VL7C224A. The filter section provides sufficient attenuation of the out of band signals to eliminate leftover transmit signals from the received signal. The hybrid also acts as a first order low-pass antialiasing filter. The hybrid can be deactivated by the external controller.

The VL7C224A internal hybrid is intended to simplify the phone line interface. The internal hybrid can compensate for the loss in the line coupling transformer used in the DAA. Depending upon the transformer selected, the loss can be as little as 1 dB or as high as 3 dB. Internal hybrid can make up for this loss from 0 to 3 dB, using the GS pin.

Tone generator

The tone generator section consists of a DTMF generator, V.22 guard tone, 1300 and 2100 Hz tone generator. The DTMF generator produces all of the tones corresponding to digits zero through 9 and A,B,C,D,*, and # keys. The v.22 guard tone generator produces either 550 Hz or 1800 Hz tone. Selection of either tone will cascade the corresponding notch filter with the low-band filter. The tones are selected by applying appropriate codes through the Data I/O pin. Before a tone can be generated, tone mode must be selected. Facility is also provided to generate single tones corresponding to 1300 and 2100 Hz and the individual rows or columns of the DTMF signal.

Audio output stage

A programmable attenuator that can drive a load impedance of 50k ohms is provided to allow monitoring of the received line signal through an external speaker. The attenuator is connected to the output of the hybrid. Four levels of attenuation – no attenuation, 6 dB attentuation, 12 dB attenuation, and squelch are provided through the ALC1, ALC0 audio output level control codes. Output of the attenuator is available on the audio output pin where an external audio amplifier (LM386 type) can be connected to drive a low impedance speaker. The output can directly drive a high impedance transducer, but the volume level will be low.

FUNCTIONAL DESCRIPTION OF THE VL7C225, VL7C235, AND VL7C245

The VL7C235 modem controller, implemented in VLSI's two-micron CMOS process, was designed specifically to handle all of the modem control functions, as well as the interface to a system bus. Besides including a 16-bit mircoprocessor, 8K by 8 bytes of ROM and 304 by 8 bytes of RAM, it also contains the functionality of an 8250B UART, greatly simplifying the interface to a parallel system bus, such as the one used in IBM's PC. In fact, a complete Hayes-type compatible modem for the PC consists of the VL7C235 controller, the VL7C224A modem and the DAA. All of the popular communications software written for the PC will work with the VL7C224A/VL7C225 set.

Another version of the controller, the VL7C245, is intended for RS-232 applications. It contains the same processor, memory and UART as the VL7C224A and has the same interface to the modem chip. The difference is that the UART is turned around so that serial data from the RS-232 port is converted to parallel data handled by the internal processor. Pins are provided for connecting the familiar switches and indicator lamps found on most stand-alone modems, although the switches and lamps are not needed for operation – all of the switch settings can be done through software. A third version, the VL7C225, uses external EPROM memory instead of internal ROM for full customisation to specific applications. The internal UART can be software configured (for either parallel bus or serial RS-232 data applications).

The controller receives 8-bit signal sample from VL7C224A and performs adaptive equalisation, carrier phase recovery, data decode, and descrambling. VL7C225, VL7C235,and VL7C245 have identical hardware. Each controller is designed by using a 16 bit 2900 processor to perform the digital signal processing and the control functions. Its instruction set is a subset of the Intel 8096 instruction set but operates faster than the 8096.

The VL7C245 provides a standard five volt logic level interface. RS-232 drivers are required to interface to the serial port. Like the VL7C235, the VL7C245 comes preprogrammed with the Hayes "AT" command set, and when used with the VL7C224A modem, emulates a Hayes-type stand-alone modem. The VL7C235 and VL7C224A emulate a Hayes-type IBM PC plug-in card modem.

But the chip set is by no means limited to implementing a Hayes-type smart modem. VLSI is in the custom IC business and both chips were designed with this in mind. And since the controller is ROM programmable, any command set, not just the Hayes "AT" set, can be implemented.

Both the VL7C235 and VL7C245 are available in two different pinout options. They are 44-pin and 40-pin. The VL7C225 is available in a 68-pin package. (The 68-pin package allows the controller to access external ROM for up to 32K bytes and external RAM for up to 16K bytes. This allows users to customise their own software. And provides a means for software development.) The 44-pin and 40-pin packaged VL7C235 and VL7C245 do not provide external ROM access. All three pinouts allow the controller to talk to both the VL7C224A and a SC22102-1 (EEPROM).

The interface to the VL7C224A is via an 8-bit address/data bus and the control lines for read and write. The same interface is used for access to an electrical erasable random access memory (SC22102-1). They operate on six clock multiplexed address/data bus cycles. For the 44-pin option an I/O ready signal is provided for interface to high speed PC/AT type bus cycle. For the VL7C225 there are 15 extra address lines and chip selects for external ROM and external RAM interfaces.

Besides the interface for the VL7C224A modem, the VL7C235 controller has an 8-bit data port, three address lines, a chip select input, an interrupt line, and the DOST and DIST control lines found in the 8250B UART. It also has control lines for ring indication, the off-hook relay and a data/voice relay; these lines connect to the DAA.

In the VL7C245, the 8-bit port becomes the switch input lines and the address chip select, INTO, DIST, and DOST lines become the lines for the RS-232 interface, and modem status. These lines are also used to drive the LEDs. Internally, all of these lines are treated as programmable I/O ports under software control – so the main difference between the VL7C235 and VI7C245 is the ROM code. It also contains the same modem and DAA interface lines as the VL7C225A.

The VL7C235 and VL7C245 are designed to control a modem or other peripheral that operates at a moderately slow data rate up to 2400 bits per second. The VL7C235 allows a slow peripheral, such as the modem, to interface to a high speed bus, without making the main processor slow down.

This is done through the UART interface and the on-chip registers which look somewhat like dual port registers. The main processor can write to and read from them at will, while the on-chip controller can do the same. The controller was designed this way because most communications software has to have unrestrained access to UART registers. To make the VL7C235 compatible with this software, these registers were included.

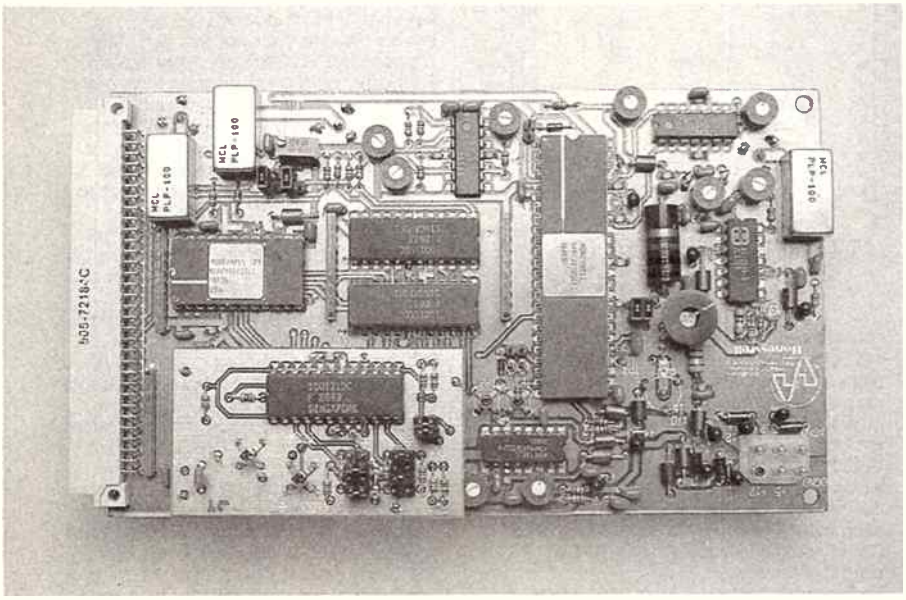
The actual processor contains a 16-bit data path and can execute 54 instructions with three different addressing modes: direct, indirect, immediate. There is 8K by 8 of ROM on-chip for program storage.

To the system bus, the VL7C235 looks and acts just like an 8250B UART. Communications software written for the UART will work with the VL7C235 and VL7C245. The VLSI chip set is a completely compatible Hayes-type modem in two chips.

In operation, the VL7C235 or VL7C245 monitor the registers to determine the mode of operation – command mode or data mode; at power-up it is automatically put in the command mode and it looks for instructions. Once carrier is detected, it goes into the data mode, and stays there until an escape sequence is entered, just like in a Hayes-type modem. The escape sequence is three + signs (+ + +) in the default mode, but it can be changed in software.

8-BIT FLASH A-D/ D-A CONVERTER

This is a technology demonstration project that shows the capability of leading edge solid-state technology in this field. By Tom DeLurio.



View of the completed flash converter. A combination of digital and analogue-RF technologies is employed in its design.

This project provides hands-on experience with some leading edge devices from Honeywell Inc's Signal Processing Technologies: the HADC77200A/B flash A-D converter and the HDAC10181A/B or HDAC51400 Ultra High Speed D-A converters. The board provides for either the ADC or DAC to be used together or separately. Included on the unit are two 100K ECL multiplexers for data routing between the A-D and D-A or on and off the board as shown in the block diagram here (Figure 1).

The HADC77200A/B is a monolithic flash A-D converter capable of digitising a 2 V analogue input signal with full scale frequency components to 70 MHz into 8-bit digital words at a minimum 150 MSPS update rate. For most applications, no external sample-and-hold is required for accurate conversion due to the device's wide bandwidth.

The HDAC51400 and HDAC10181A/B are monolithic 8-bit D-A converters capable of converting data at rates of 400, 275, and

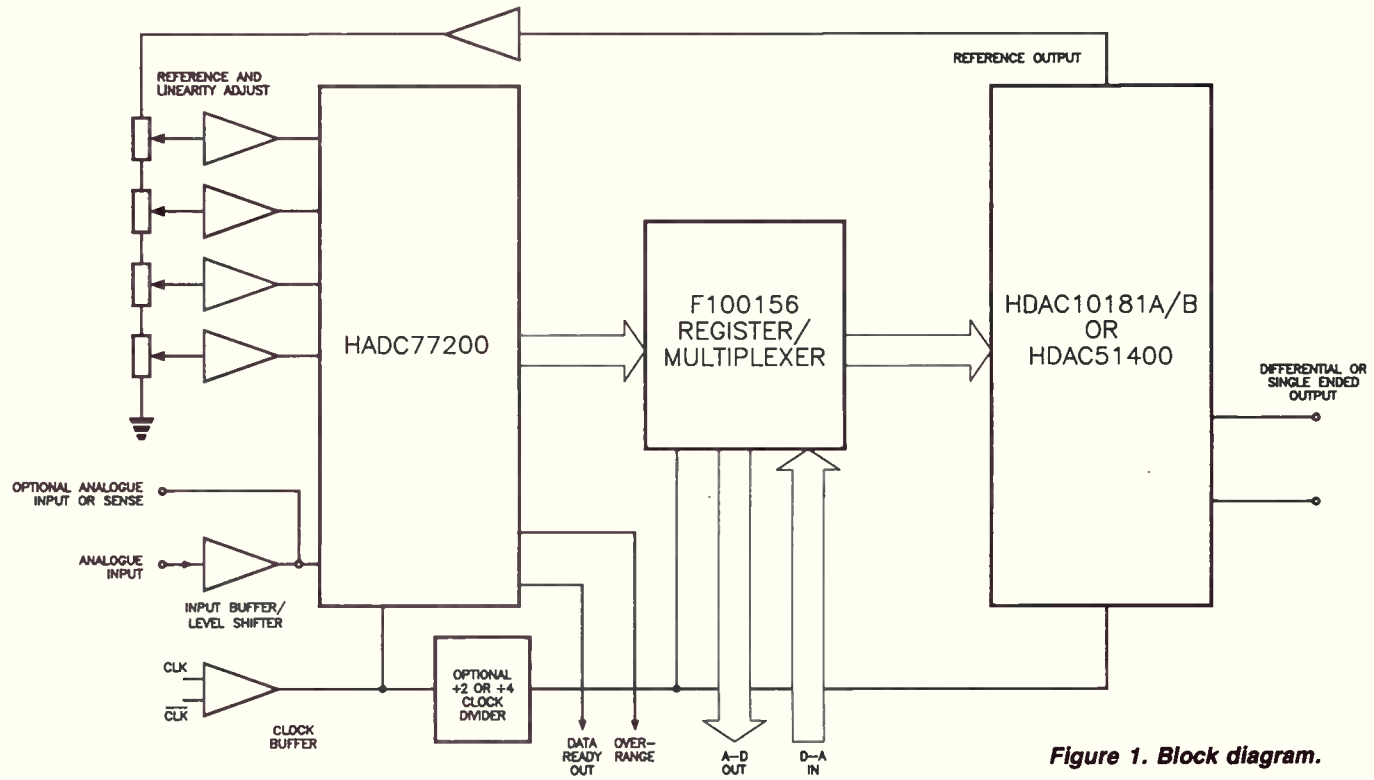


Figure 1. Block diagram.

WORKSTATION

ETI'S COMPUTING SUPPLEMENT

SPECIAL SURVEY:

- 1989's PERIPHERAL STARS
- ICELOCK REVIEWED

THAT WAS THE YEAR THAT WAS

COMPUTING

NetComm's innovative CellModem.

Kester Cranswick is a very experienced journalist specialising in the fields of computers, information technology, communications and photography. He was formerly editor of Computing Australia.

Kester Cranswick picks out the peripheral highlights of 1989. He ventures that it has been quite a year.

It has been quite a year in the world of peripherals. Technologies in printers, storage and communications have all taken important steps forward.

In the printer field, perhaps the most notable announcement was a new laser printer engine. Embodied in the **Hewlett-Packard LaserJet IIP printer**, (see Workstation cover) it was (unusual in an industry noted for ever faster devices) slower than the normal laser printer, with an output rate of just four pages per minute, compared to the average six or eight.

But it was small enough to fit on any desktop, cost less than $3000 and had some clever features such as self cleaning coronas and clicky control switches. HP is promising a cartridge to give the new Laserjet PostScript compatibility – that should give the budget laser printer makers something to think about. Next year will probably see a clutch of rival laser printers using the new Canon engine.

Canon came out of its shell during the year, with its own LBJ III laser printer, billing it the third generation of laser printing. The LBJ-III range is not PostScript compatible, but it does have nine internal, scalable, rotatable fonts with sizes from 4 to 254 points. There are also 64 built in font ornament patterns. The printers output at 300 dpi resolution, eight pages per minute and are priced to compete with non-PostScript printers.

Canon also introduced a tiny new font cartridge with four times the capacity of previous font cartridges.

In the world of storage, the biggest news of the year was when Digital Audio Tape

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READER INFO No. 50

The Laserjet 11P from Hewlett-Packard.

(DAT) storage for computers finally became a reality. **Apricot Computers** had the headlines mid year, launching a 1.2Gbyte DAT storage device.

The DAT standard has been developed jointly by Hewlett Packard and Sony. It uses video recorder technology to store massive amounts of data on a cassette filled with 4mm tape. The data density is 61,000 bits per inch and the emerging standard for data exchange is called Digital Data Storage or DDS.

Data is transferred at 6Mbyte per second, giving a backup time of two hours per gigabyte. Average time is 20 seconds and the drive has a 64 Kbyte cache. The media has a high level of integrity too, with a claimed corrected error rate of less than one in ten to the power of 15. There was also a DAT standard tape system launched late in the year by **Emerald Systems**.

Another major storage development was the affordable read/write optical disk. **Ski Peripherals** released an erasable magneto-optical disk storage product for 80286 pca, priced at less than $14,000.

Other distributors also announced erasable optical disks, but Ski had the distinction of being the first local company to supply the working products.

The **Discus Rewritable DR-650RE** is an external device from New York-based AGA and is built around a mechanism from **Olympus** in Japan. It stores 650Mbyte of data on a removable 5.25in, double sided disk, costing $900. The disk cartridge is from **3M** and will be usable in optical drives from other manufacturers. Average data access time is 61 milliseconds and the data transfer rate is 1.2mbytes/second, with a 4Mbyte/sec burst rate.

Writing is slower, as two passes are needed. The first uses a high intensity laser to wipe data, followed by a low intensity laser to write the new data.

Completing the drive is a 16-bit SCSI controller and software, running on any 80286 AT-compatible or PS/2 micro under MS-DOS 3.0 or OS/2.

There were plenty of new developments among communications peripherals too.

Perhaps the most innovative was Australia's first cellular modem, from local manufacturer, **NetComm**. Called the **CellModem**, it is designed to work with the **Oki** range of cellular and mobile phones. Formerly sold under the **Racal** brand name, it is compatible with any computer sporting a serial interface.

The CellModem sends and receives data at 300, 1200 and 1200/75bps rates. It also supports US 300 and 1200bps protocols, so should be usable anywhere.

Like most modems, it has a Hayes-compatible command set and non-volatile memory to store configurations. It draws power from the phone and has an auto disconnect feature to save running costs. The product costs $599 and, like all NetComm modems, comes with a copy of the popular Gateway V3 communications program.

Another company getting in on the portable modem act was **Dataplex**, which released a portable facsimile and data modem <**197**>, the first in Australia.

The **WorldPort 2496 Fax/Data Modem** comes from **Touchbase Systems** in the USA. Costing $1200, it has its own power source and is designed to add facsimile functions to a laptop. The fax/modem measures 35 x 122 x 70mm, weighs 213g and comes with its own facsimile and electronic mail software. Facsimiles can be sent and received in the background, stored for sending at a pre-set time or printed to any Epson or Hewlett-Packard-compatible printer.

In non-fax mode, the 2496 works at speeds up to 2400 bps and comes with a cable for an acoustic cups adaptor. It has full Telecom approval.

One of the most innovative new products to hit the desktop this year was the first economically priced colour scanner, from **Sharp**. Two models were launched, the $6750 **JX-300** and the $12,450 **JX-450**.

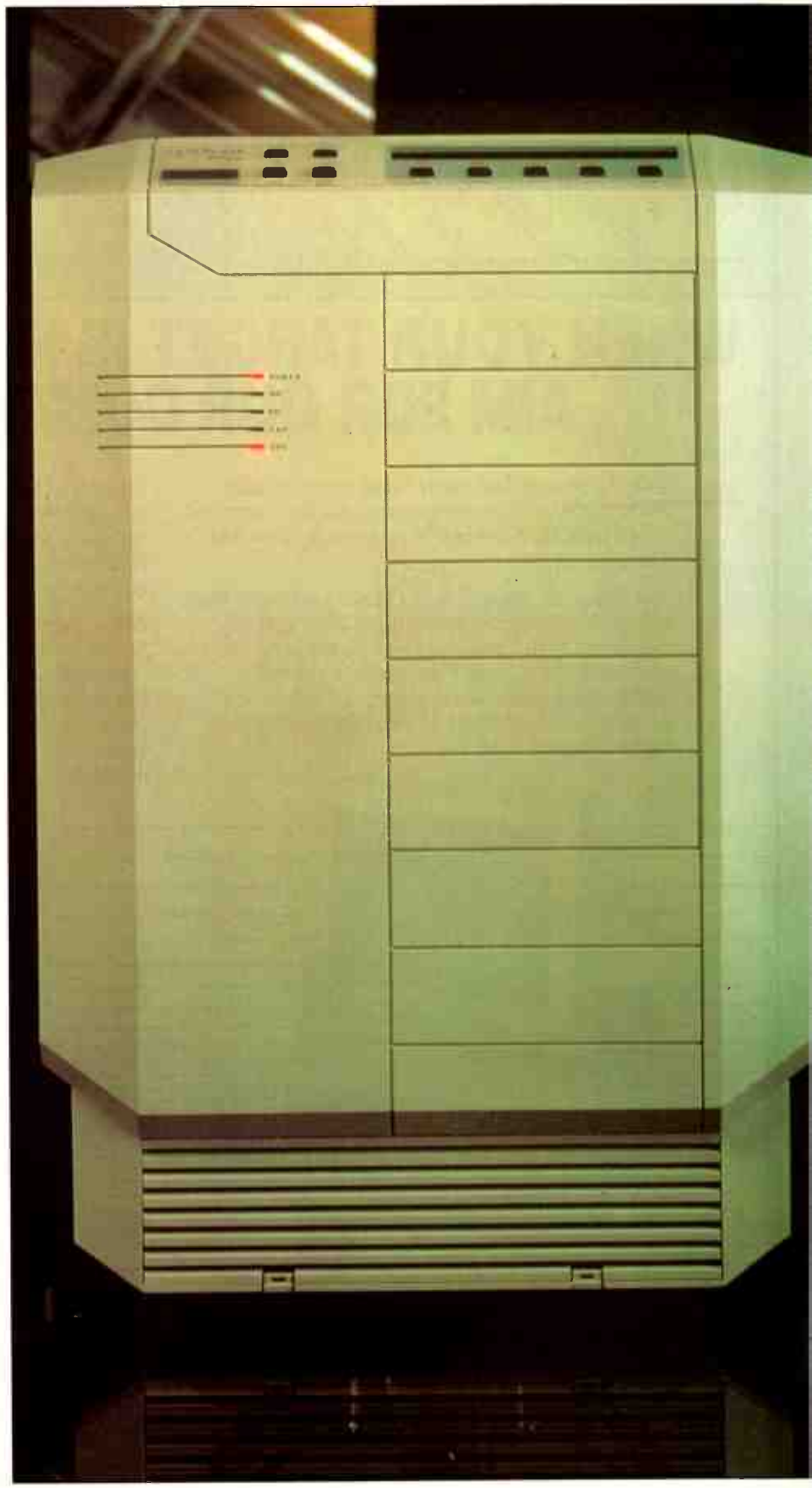
Both can scan colour images and digitise the picture for subsequent manipulation by a computer. The artwork is placed face-down on a glass plate and scanned in three passes, at a resolution of up to 300 dots per inch.

On the cheaper model, the maximum scan area is letter size. The larger model will scan half a sheet of newspaper, 35mm and overhead transparencies and provides selectable resolution, from 300 to 30 dpi.

While the JX-300 can separate some 256 separate colours, with an eight-bit RGB output, the JX-450 can scan 260,000 different tones, thanks to 64-bit output. Both scanners come with the appropriate software and can be used on Macintosh or MS-DOS platforms.

These peripheral developments will ensure that those of us who already own a computer will still want something from Santa this year! eti

Kester will complete this survey in January, ETI.



Apricot Computers' VX FTserver.

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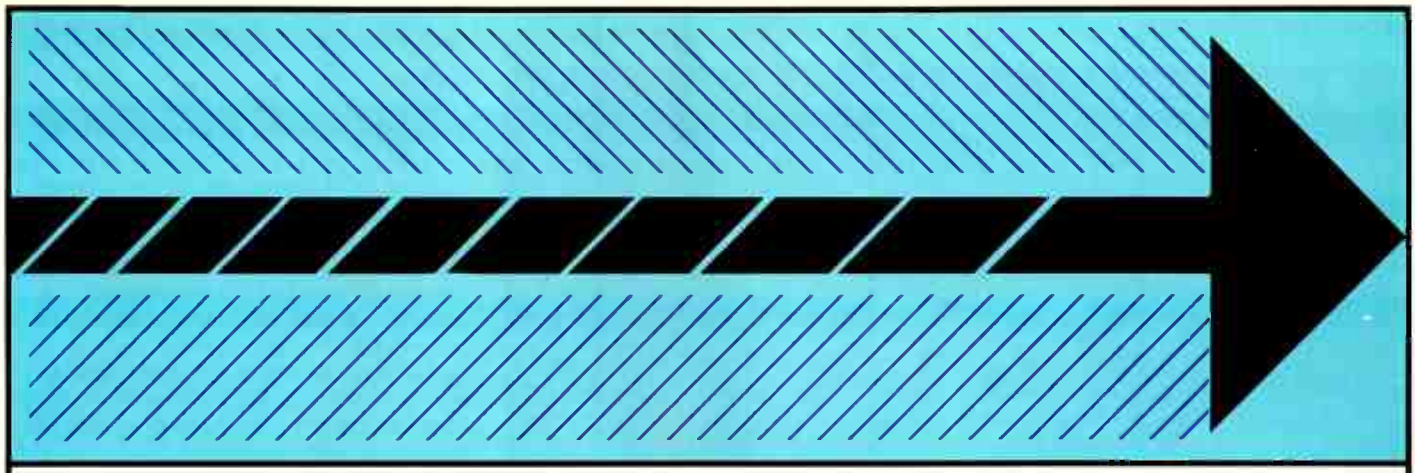

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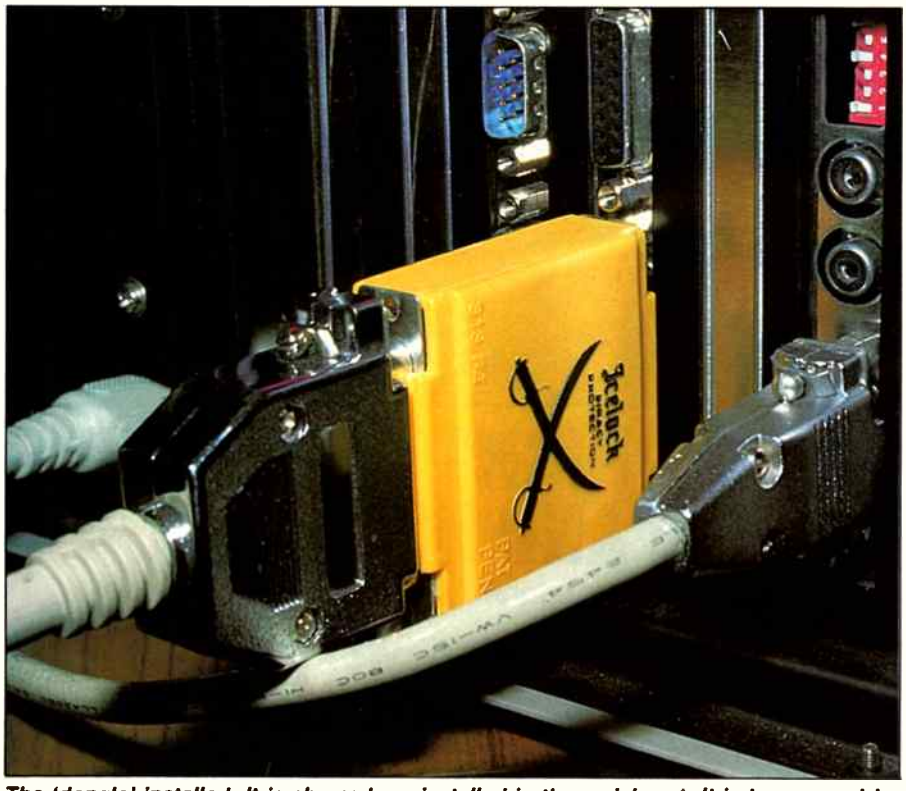


The 'dongle' installed. It is shown here installed in the serial port. It is transparent to devices connected to your serial port, which just plug into the dongle's rear connector. Cunningly, by turning the dongle around, it can be installed in your parallel port.

ICELOCK — ADVANTAGE OR DISADVANTAGE?

Jamye Harrison reviews this locally developed and produced software protection product.

Icelock was fully described in the September issue, pages 74-75, so it won't be necessary to repeat the description here. Suffice to say that Icelock involves the installation of some software that works in conjunction with a hardware dongle plugged into your computer's serial or parallel port. It works in any DOS environment and encrypts existing programs, preventing their disassembly while at the same time allowing backup copies to be made.

I won't go into the various aspects and methods of software protection in this article. Nor will I provide an explanation of the semantics of software piracy. I will, however, attempt to explore the advantages and/or disadvantages of the Icelock method of software protection.

Appearance

For software developers, or dealers, who wish to protect software, or for that matter anyone not wanting the fruits of their labour to be easily ripped off, for $60 Microway will provide you with an Icelock 'master kit' which includes a 5 1/4" disk of software and the aforementioned dongle. It appears that part of the Icelock's design is that it needs no manual.

By executing the file SHOWTIME.BAT on the master disk, a snazzy demo program goes through the main hardware and software features of the package. Its companion, MANUAL.BAT, provides a more in-depth presentation of how to use and implement the product. The display is informative and interesting while being non-technical. This approach allows Icelock to be implemented by schools and corporations wishing to protect their commercially sourced software from would-be pilferers. A more technical or semantic explanation I think would tend to alienate potential users.

The dongle itself is of robust design, being encased in a hard plastic shell pumped full of a buff coloured epoxy resin. Any investigation is simply likely to destroy the unit, frustrating any attempt to crack its secrets.

Useful?

Okay, let's pretend you're the head of an Australian Software Development company of modest size; perhaps you employ thirty people. Assuming you've already decided to protect your new product, why choose Icelock?

Well, the first feature which struck me as being innovative during the demonstration run was that the hardware lock can be connected to either the serial or parallel port, just by turning the device around! Useful indeed. This provides certain flexibility from the user's point of view; the hardware lock isn't 'locked in' to one type of port or another (pardon the pun).

Secondly, many methods of protection which require the detection of a device in, or connected to, the computer need extra code to be written into the source. Not only is this awkward but it is often inconvenient in today's software environment. For instance, much of the software appearing in Australia is sourced from the United States and is imported and distributed here through a dealer network. Now, when we're talking about large volumes of product, importing the software, manual and a similar hardware lock is going to be more expensive than just importing the product itself. Using the Icelock method, an Australian distributor could import an American product and protect it here with a minimum of fuss.

COMPUTING

A feature incorporated into the design of the product, and emphasised in the demonstration, is the fact that multiple Icelocks are able to be connected to the one system, if the user has a few programs using the Icelock method of protection. Well that's fine. However it does conjure up images of a computer laden with dongles. There is even mention of an extender board which enables up to four dongles to be connected to one port. Heavens above!

In addition, Icelocks can be reused and reassigned to a new version or program. Good idea, considering the cost. Buying extra Icelocks is expensive. To purchase one to ten sets you back sixty bucks a piece – not including sales tax. This may be quite a cheap method of protection for a five or six hundred dollar, or costlier, program but it doesn't go a long way to promote keenly-priced Australian developed software, for instance of the calibre and price of products from the prolific FBN Software in Canberra. Maybe their low prices are protection enough.

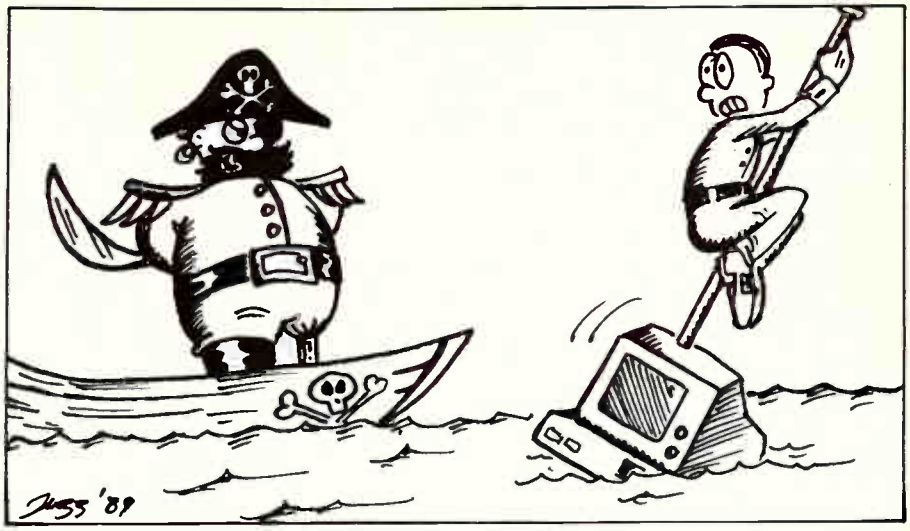
In quantity, however, the price of Icelock drops substantially, making it worthwhile for software manufacturers and distributors to add it on where quantity sales are involved.

Conclusion

I think three main features are necessary for a method of software protection to be great. Obviously it needs to be reasonably effective, although no method of software protection exists which cannot be broken with enough determination and a lot of time. Icelock, and hardware locks in general, appear to be reasonably effective, so full marks in this respect.

Apart from being effective it must be cheap. From a software developer's or distributor's point of view, Icelock, in my opinion, doesn't succeed in this area. However, it does provide a relatively cheap alternative for schools and companies.

The protection method must also be easy to implement from the developer's end of things – top marks here! It must be easy to use and preferably almost inconspicuous from the user's end – yes, Icelock passes in this area too. Lastly, flexibility – i.e: No special equipment is required in order to use the device. Well, everyone must agree it succeeds here too – most people have at least one serial and/or one parallel port on their IBM-PC or compatible these days. eti



Throw me a dongle — somebody!

Icelock is sold by Microway, 292 Chesterville Rd, Moorrabbin Vic. 3189. ☎ (03)555-4544.

JIM TUCKER

TACKLING SYSTEM FILES WITHOUT FEARS OR TEARS

Most PC users know that system files exist. But few know what they do. You won't find a proper explanation in your DOS user manual! So here goes. Jim Tucker gently switches on his PC and describes what happens.

Click. It's on! Most of the noise comes from the fan, which is starting to whirr, and buzzing disk drives.

But, straight down to software. During startup the operating system looks for two files of user supplied commands, which allow you to customise your system in various ways.

These two files must be named CONFIG.SYS and AUTOEXEC.BAT and should reside in the root directory of your boot diskette or your hard disk.

When you turn on your computer, the CPU (the 8088, V20 or whatever) boots a program in ROM (Read Only Memory) that all IBM compatible machines have. This ROM is in addition to the working RAM (Random Access Memory).

When you buy a machine with 640K memory, that figure refers to the RAM. There is an additional 16K or 32K of ROM. RAM is cleared whenever you turn off your machine or reboot. ROM is permanent and doesn't change (we hope).

There may also be RAM on other bits and pieces such as the screen board, which is not counted in the total. And hard disk controller boards include ROM, which you usually don't need to worry about.

Booting up

The program that is automatically run from ROM usually begins with a brief test of various components.

If you have an XT or AT the most noticeable part is the memory (RAM) test, accompanied by counting up the memory on your screen as the test progresses. On the original IBMs this was awfully slow but most PCs now do it in a few seconds.

This test is usually skipped when you do a warm reboot by hitting Ctrl-Alt-Del. You may also notice your drives and printer growling as they are tested.

After this test, the computer searches for various ROM extensions – additional ROM that can come with a hard disk or EGA card, for example. The program then searches drive A then a hard disk for a program to transfer control to.

It transfers control to the very first sector on the disk. This is called the boot sector.

When you format a diskette, a little program is placed in the boot sector which will display the message "Non system disk, replace and hit any key".

When you transfer the operating system to the disk with the SYS command or via FORMAT/S, this boot sector program is changed to transfer control to a program which must immediately follow the boot sector.

If the disk has the system on it, control is transferred successively to two hidden files which load the BIOS (Basic Input/Output System part of which is in ROM) and the DOS (Disk Operating System).

When most users think of DOS they think of the familiar prompt and copy commands. These parts of DOS are only loaded later – the part in the hidden file involves services provided by DOS to programmers rather than directly to users.

The two hidden files are called IBMBIOS.COM and IBMDOS.COM in PC-DOS and may have different names on other systems. For instance, on DR-DOS they are not even hidden, unless you choose to hide them.

In any case, there isn't really much hidden about hidden files.

As you may know, the DIRectory you are used to display gets its information from a special file also called the directory. This file is essentially a little database with information about each file, including the filename, extension, date and time of creation.

One byte in the record for each file is called the attribute byte and contains eight "switches" to keep track of things – like whether the file is a volume label, read only, and so on. One of these switches (a single bit) is whether the file is "hidden".

To anyone with any programming experience, or with any of a large number of public domain or commercial programs, these files are not in any sense hidden. The basic DOS services like DIR and COPY are specially set up to ignore hidden files and that is the only sense in which these files are hidden.

The two system files are hidden because their location is critical for a successful boot-up. You unhide them and do a directory sort at your own risk.

After the second hidden file is mainly loaded, it looks for a special file called CONFIG.SYS and processes the commands in it. Then control is passed to the third file in the operating system, COMMAND.COM.

As the final step in booting up, COMMAND.COM looks for a file named AUTOEXEC.BAT and, if found, it loads it and runs it. If not found COMMAND.COM exits, with the DATE and TIME commands.

Except for its special status as a bootup file, the AUTOEXEC.BAT file is an ordinary BATch file with the usual rules.

The CONFIG.SYS file has a special syntax with a limited number of allowed commands.

Both must be pure ASCII files, that is without any special formatting codes that some word processors add. Many word processors which have special codes have a "non-document" mode for preparing ASCII files.

If you have any doubts about whether the file is pure ASCII you can use the TYPE command to display it on the screen and see if it just has ordinary letters and numbers.

The root directory

When a subdirectory fills up, it adds another cluster of disk space to increase its size, but the size of the root directory is fixed at the time the diskette or disk is formatted.

It is not merely because of the size restriction that I recommend you keep your root directory

small. Since the files in the root are likely to be of diverse type, it will be difficult to keep track of things if you put too much there.

But personally, I find directories within directories confusing and there is really no need for them, even on a 30 meg hard disk. Frankly, unless you run a tree program to show where everything lives, you're likely to forget they exist.

For writing, I have a separate directory for Wordstar (only the program), and one for letters and stories. I use the filename extension for other sorting. For instance, .ETI means a story for this publication, .AUS means The Australian and .SMH means The Singapore Monthly Herald.

Generally, I reckon there are only three files you need in the root directory: COMMAND.COM, CONFIG.SYS and AUTOEXEC.BAT. You could put AUTOEXEC.BAT elsewhere and even COMMAND.COM but that's carrying things a bit too far.

I won't tell you how to structure your hard disk except to say think about it and practice good housekeeping. Subdirectories on a floppy disk are a waste of time.

There is no help for some software which forces you to have certain files in the root directory. A plague on their house.

Device drivers

There is a group of programs which are made permanently resident and which are loaded as part of CONFIG.SYS. Virtually any resident program can be produced in this format, but certain ones must be of this form.

Typically, console drivers and any program which controls "a device" must be loaded now. Most virtual disks and print spoolers also are loaded as device drivers. While device drivers are programs, they need not have the extension "com" or "exe". In fact, so far as I have been told their extension can be anything that you like. But nearly all commercial device drivers have the extension "sys". Some mouse drivers are available with the extension "dev". The syntax for loading a device driver in your CONFIG.SYS is

device = path name parameters

so if you have a device foo.sys in the directory \devices on drive C: and it will take a numeric parameter to set the size of some buffer, you might load it with

device = C:\bin\devices\foo.sys 128

The drive letter C: is not required but it can't hurt.

The question of which parameters a given device driver allows, or whether it allows any at all, depends on the driver and should be dealt with in its documentation.

Setting up

The hidden file IBMDOS sets up several devices, even if you have no CONFIG.SYS. These are: con, prn, aux, lpt1, lpt2, lpt3, com1 and com2.

Con, short for console, is a combined keyboard/monitor device, prn for printer is by default a name for lpt1 and aux a name for com1.

The DOS mode command allows reassignment of these devices. LPTn and COMn are names for the parallel and serial ports on the computer. These device names are assigned even if you don't have the full complement of ports.

The most common device driver to install is a console driver which replaces the default console driver.

Some of these replacements attempt to address the notoriously slow display speed of the monitors and/or the annoying flicker on the colour graphics display.

Also, some of the escape sequences of the 1977 console standard of the American National Standards Institute (ANSI) are implemented. These sequences include ways of controlling colours, cursor position and some DOS level keyboard macros. One console driver of this type, called ANSI.SYS is supplied with DOS and takes about 2K of memory.

It does not address the speed of display issue but it does implement several ANSI escape sequences. There are hundreds of programs which assume the ANSI.SYS is installed to operate properly (as well as a few that don't work properly if ANSI.SYS is installed!) so it is wise to install ANSI or an equivalent driver even if you do not want to use its features yourself.

Actually, it is not hard to use the driver at the DOS level to set colours, set up a fancy prompt or redefine keys.

RAM disk

DOS 3.x comes with a program VDISK.SYS to set up a RAM disk. This disk can operate in conventional or AT extended memory. It will not set up a RAM disk in EMS memory but most EMS boards come with device drivers to set up RAM disks in EMS.

In addition, Microsoft WINDOWS comes with a RAM disk device driver (which can be run independently of WINDOWS) and which can be set up in conventional AT extended or EMS memory. Given Microsoft's experience and the care they have lavished on WINDOWS, I'd recommend using the WINDOWS RAM disk driver if you have it in preference to alternatives and, in particular to VDISK which also comes from Microsoft.

However, having said that, some experts suggest that if you are loading other programs that use AT extended memory, you may want to stick with VDISK because the specification that IBM uses to access AT extended memory is published while that of Microsoft is not and so other programs may clobber the Window's RAM DISK driver.

If you want to set up more than one RAM disk, you can include more than one line loading a RAM disk driver in your CONFIG.SYS file.

You can normally load the same driver twice or use different drivers if you prefer. Be warned that there is typically a few K overhead in conventional memory to load a RAM disk and you will pay this overhead more than once if you load more than one RAM disk.

Print spoolers set aside some memory to receive printer output and then send that output to your printer as a background process. I regard them as a tremendous productivity tool. While there exist print spoolers loading as com files, many are loaded as device drivers.

A mouse requires software in memory so your system will recognise the rodent. The Microsoft mouse comes with two versions: MOUSE.SYS which is loaded as a device driver in your CONFIG.SYS and MOUSE.COM which is loaded later, typically in AUTOEXEC.BAT.

I do not know if there is any particular reason to prefer one over the other. Microsoft recommends using the device driver.

As you may know you can place remarks in your BATch files and in particular in your AUTOEXEC.BAT. This is useful if you want to temporarily run your system without some resident program that is usually loaded in your AUTOEXEC.BAT file.

You need only "remark it out" – insert the word "REM" at the beginning of a line. Technically, remarks are not allowed in CONFIG.SYS files (which is naughty, because all files should allow remarks or comments). However, if you insert the word "REM" at the start of a line in your CONFIG.SYS file you will get a message like:

Unrecognised command in CONFIG.SYS

But, since the rest of the line is not acted on, this procedure will have the desired effect of "commenting" the line in question so you should not hesitate to use it.

ECHO also doesn't work in CONFIG.SYS so there is no direct way of placing messages on the screen when it loads.

NEW PRODUCTS

Arrow — straight to the point

ALLDATA Australia Pty. Ltd. has added two new models to Arrow's range of PCs. All Arrow Computers are fully built, assembled and tested in Dandenong, Victoria, at Alldata. Australia's new national headquarters.

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Arrow's 386 machines are priced at under $5,000 RRP. Alldata also has available the new SUPER XT with more than twice the processing speed of any other on the market, the company claims. Alldata's Super XT is set to change the standards in motherboard architecture, by introducing AT processors onto the XT motherboard. The implications are far reaching, particularly in the area of low-cost, super fast diskless workstations in networking environments. This computer uses the same high quality componentry as the other Arrow ATs and 386 machines, and has the same case, with 200 watts power supply. Super XT will be available for under $2,000 tax inclusive.

Other machines available in the Arrow Product Group include a stock standard 4.77/10MHz XT, an Arrow AT 12MHz Zero Wait State, and of course the 16MHz Arrow AT with 21MHz Landmark Speed.

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For more information regarding the Australian built Arrow computers, contact Sales Hotline on ☎ (03) 794 5099.

READER INFO No. 254

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IF November ETI's Computer Animation feature was of interest, G2 Systems' products (distributed in Australia by Neriki Enterprises) may make you very animated indeed.

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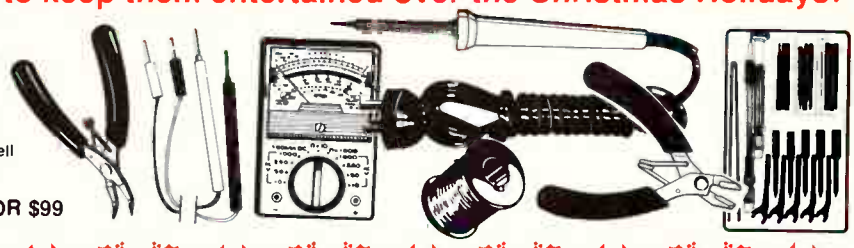

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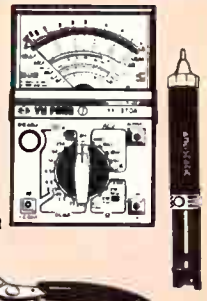

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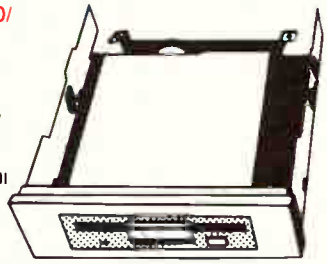

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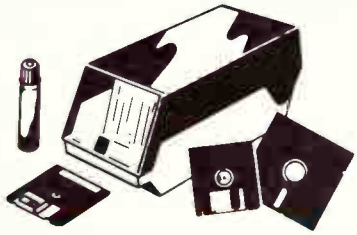

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CONTENTS

MANAGING CHANGE — A SPECIAL CHALLENGE

Managing change has been a preoccupation with management gurus for decades. Not surprisingly, managing technological change has its own special challenges and implications, particularly on the people side. If people are not aligned and motivated, no amount of technology will help. Final year management students from Blacktown TAFE recently surveyed 300 of the top 500 companies to determine the impact of technological change on organisations, their people and structure.

Across the range of industries surveyed, employee retraining, resistance to change and conflict through changes in policy were consistently cited. Seventy-five per cent recognised that too little attention had been paid to pre-planning.

Warren Parry, a change management consultant, has been addressing the vital human factor in technology change for some time. He believes it is no longer possible to work with people or technology in isolation and the challenge now is to bring the two together.

Rounding out our new Management section, David Feeney, Fellow in Information Management at Oxford University, has a quick glance at how a good strategy, supported by information technology, can magnify performance.

Another regular to debut this month is our Database section. Kicking it off, we debunk a few of the myths in this fast growing sector; and Katie Blake from Enterprise Information Management guides the uninitiated through the first steps of going on-line.

Finally, HUB is going through a major change itself right now. With this issue we go monthly and, through our new partnership with leading electronics technology magazine ETI, we gain a mass circulation through newsagency distribution. HUB's editorial team and direction will be the same. Welcome to the second generation.

Shelley Spriggs,
Editor.

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Submissions to the investigation into common interest arrangements in private networks being conducted by Austel, the Australian Telecommunications Authority, are in and Austel is due to report by year end. Judi Stack, managing director of Bond Communications, runs through the issues and the implications for the development of enhanced services in Australia.

SHARED INTEREST IN PRIVATE NETWORKS

BY JUDI STACK

Managing Director
Bond Communications

Under the Telecommunications Act, private networks are permitted as an exception to Telecom's monopoly in the provision of reserved services; indeed, private networks have been permitted by Telecom for decades. Essentially, organisations want to establish private networks where services aren't readily available from Telecom at a price reasonable to them; where the organisation itself wants to have some sort of specific control over its telecommunications services, perhaps to isolate them from industrial action or to have switching control or redundancy; or where Telecom is unable to provide a service — such as in remote Queensland (Bond Communications provides the Q-Net service for the Queensland government to service remote areas).

Private networks are, theoretically, permitted for a single company with a single business, or a group of companies or organisations with a single business (trade associations or government instrumentalities); or for a group of users who are vertically integrated to one another (the airline and accommodation industries). They have grown to a reasonably high degree of sophistication in this country, simply because of the cost of long haul traffic and because of specific applications (the carriage of television coverage) that Telecom doesn't market as a service to the entire community.

Before the establishment of Austel, Telecom, as the regulator and service provider, approved the establishment of private networks for common interest groups on a seemingly ad hoc basis. Decisions were apparently based on the extent the private network might interfere with Telecom's ability to gain revenue on the national network, and therefore its ability to meet its community service obligations (thus the cross-subsidy of CSOs is an issue here); or on whether permitting certain private

Judi Stack

networks might move traffic off the public switched telephone network (PSTN) and therefore have a negative impact on the further development of the PSTN.

Although that seems straightforward, the actual process of permission doesn't appear to have any underlying consistency or logic. For example, in Queensland, Bond Communications operates private networks on behalf of the Queensland government — one each for the Water Resources and Electricity instrumentalities and one for other State government departments. Telecom decided that rather than having one common interest group and therefore one private network, there should be three; and that, rather than them being able to speak to one another as arms of government, they should pay interconnect fees. There is a kind of irony in this, because essentially the network is supplying a service to areas to which Telecom is obliged to provide CSO: it becomes a reverse subsidy when a private network has to pay an interconnect fee in order to allow Telecom to extend its network into unprofitable areas .

So while Telecom uses, as a rationale, the extent to which private networks divert money from the CSOs, the actual cost of CSOs has never been quantified. Press reports put it as low as $80m which, in the context of Telecom's profits, is not a sizeable amount. And further, inherent in the premise that private networks will redirect traffic from the PSTN is the assumption that Telecom operates the network efficiently.

In the absence of hard data we analysed Telecom annual reports over the last 12 years to see if it could be established that Telecom had to be of a certain scale to pass economies of scale through to users. Normally, with any commercial business you get an economy of scale as production increases, lowering business average cost per unit. We found that between 1976 and 1988 as Telecom's network expanded Telecom actually experienced a negligible economy of scale — in other words, the average cost of services did not come down but, rather, increased at only 0.6 per cent less than the cost of inflation. From 1981-1988 the size of the Telecom infrastructure increased by 42 per cent and the average cost rose by 1.2 per cent over the rate of inflation — a trend which is opposite to an efficiently run organisation.

There are significant advantages in the liberalisation of private networks. Firstly, they create a situation where the telecommunications infrastructure of a company is under its control — the switching equipment and value-added services are controlled by the network operator who can then choose the appropriate enhancements for the particular application. For example, the type of services the ANZ bank requires are quite specific to the banking arena. If Telecom tried to introduce those services on the basis of equity of access, subscribers would be paying for the gilding of the network without getting the benefits of the gilt.

We found that between 1976 and 1988 as Telecom's network expanded Telecom actually experienced a negligible economy of scale.

Unless a company's network is under its control, the sort of proprietary systems that exist for electronic mail and EDI (which a company introduces to gain a competitive edge) are difficult to implement throughout their entire organisation.

Further, private networks have a role themselves in the delivery of CSOs as illustrated in the Queensland case. Similarly, Bond Communications recently put to Telecom a proposal to extend Q-Net to remote communities in the Northern Territory.

But the most important point as far as Bond Communications is concerned is the opportunity network management affords this country in building a base of expertise in telecommunications. We have obviously taken initiatives in that area in Queensland and in our bid for the NSW government network, but we see the operation of large, sophisticated private networks in this country as giving us a base from which we can operate similar networks internationally.

What we would like to see come out of this inquiry is a definition of shared private networks integrated into the Act. That needs to be a wide definition that allows for 'common interest' being

i) groups that operate in the same market

ii) groups or companies that are related to each other (for example, there is no guarantee that Bond Group and Bond Media could share a private network)

iii) companies that are vertically integrated (ie) a manufacturer, wholesaler and retailer

iv) groups of people that are located in geographic areas where, by forming a private network, they can fulfil a CSO, and

v) anyone within the same exchange area because the rationale for *not* allowing private networks is that users can't by-pass the STD part of the network.

In effect, the market should be able to control whether there is a common interest or not. To rent a leased line you need to have a significant amount of traffic since the cost of the leased line is directly related to the amount of traffic you put on it. If there is no actual common interest there won't be enough traffic to justify the private network in economic terms.

The liberalisation of private networks will result in better allocation of resources in terms of the telecommunications infrastructure in Australia; a more rapid take-up of enhanced services; more control for the operators of those services; and a better positioning of the Australian industry as a whole in terms of being able to export telecommunications expertise. ■

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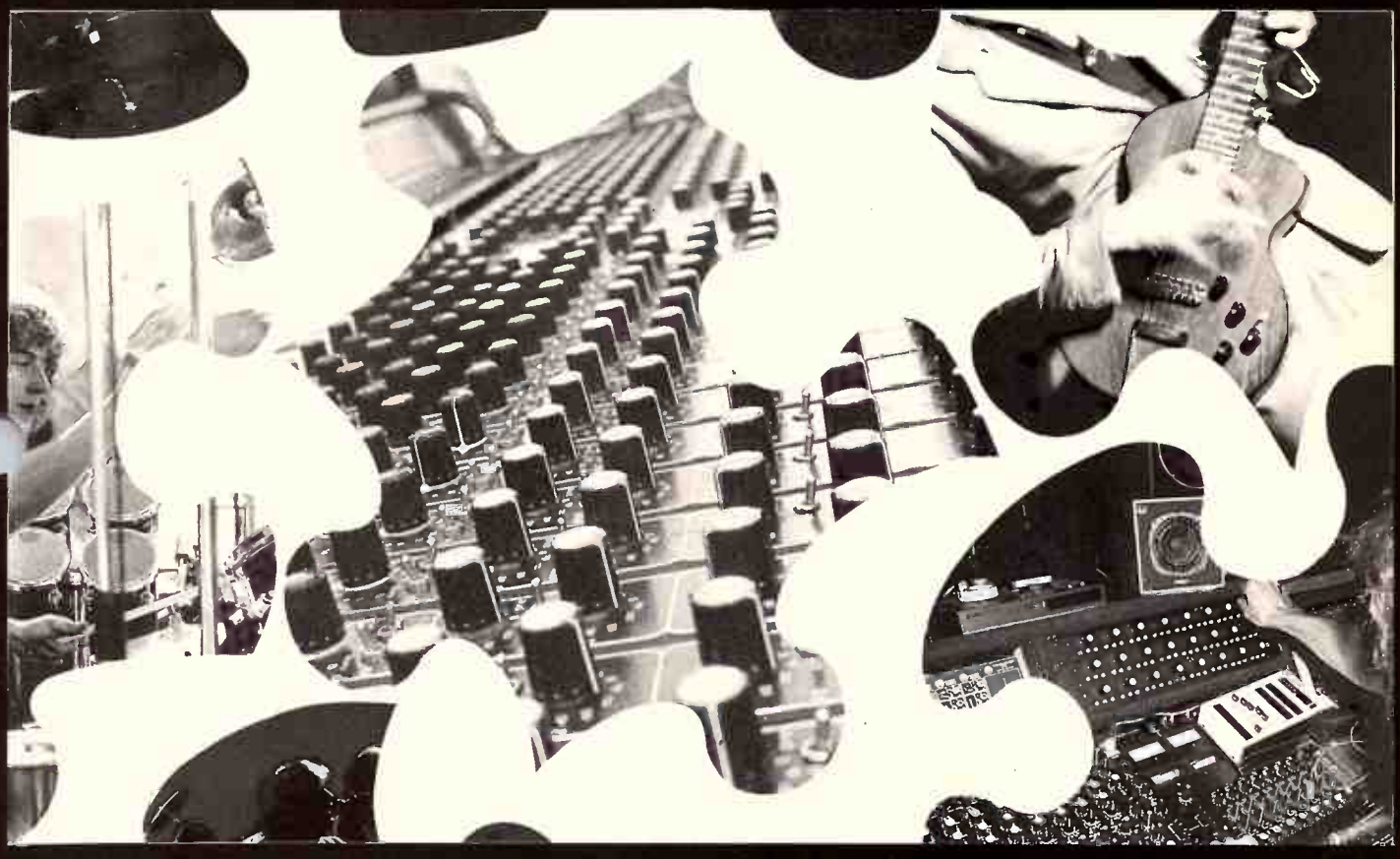

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The Radio Communication Bill, the third, final and most dramatic legislative change in the NZ Government's restructuring of broadcasting, gives virtually open access to radio and television airwaves to anyone with the money to become a broadcaster.

AIRWAVES GO TO AUCTION

BY JANE McSWEENEY

The New Zealand Government has embarked on a radical auction of the airwaves which could see it pocket more than $50m over the next two years.

The Government has introduced to Parliament the Radio Communication Bill to manage a market-driven radio frequency spectrum.

The bill gives virtually open access to the radio and television airwaves to anyone with the money to become a broadcaster.

It does not include rights to VHF channels, the type used by TVNZ and TV3; these frequencies will be tendered in several years time.

The Radio Communication Bill is the third, final and most dramatic legislative change in the Government's restructuring of broadcasting.

The first was the Broadcasting Restructuring Act. It scrapped the Broadcasting Corporation and replaced it with the Radio New Zealand and Television New Zealand state-owned enterprises last year.

The second, the Broadcasting Act 1989, abolished the Broadcasting Tribunal. It set up two QUANGOs to police standards, allocate money for minority interest programming and set new rules for advertising. It became effective in July.

The bill is based on a report by British consultants, National Economic Research Associates (NERA). NERA proposed frequency bands for mobile telephones, land mobile telecommunications, radio paging, and ultra-high frequency and sound broadcasting channels to be sold off progressively over the next three years.

The Government has given top priority to UHF television and then cellular mobile telephones.

Companies will bid for a 20-year tradeable share. The successful tenderer will have the freedom to sublease, aggregate and police its own share. It will pay an annual fee to cover Government administration.

The system allows potential users to put a value on the spectrum. This should save public servants from assessing the merits of each case. It will also raise more revenue.

Now, fees under the Radio Regulations 1987 Act raise $10m annually of which 40 per cent comes from Telecom, 20 per cent from radio and television, 10 per cent from Government users such as the Ministry of Transport and 30 per cent from the like of amateur operators. Most fees for non-profit making users are about $39.

While the Government has stressed the frequencies go up for tender only when there is excess demand, the second highest price will generally be accepted.

While the Government has stressed the frequencies go up for tender only when there is excess demand, the second highest price will generally be accepted. This is designed to prevent unrealistically high values in the heat of the auction. Where there is no competition the only interested user will get it by paying a licence fee.

Those with existing frequencies who lose their portion will be given three years to make transitional arrangements and in some cases the opportunity to match and pay the highest bid. Most affected by the proposals are existing users facing competition. Telecom is the heaviest user of the spectrum with land mobile services and microwave links. Although Telecom does not hold all possible licences in one of the two mobile telephone subbands it will be treated as having the use of the whole band and will be subject to paying or matching the highest bid.

Telecom has said the price paid for the spectrum could be passed to the consumer. If it is substantial, Telecom would have to assess the future viability of the service.

The Government has repeatedly defended the auction of the airwaves as the fairest way to ensure a scarce resource is put to the most valued use. It says people making money from a community resource ought to pay for the value of the resource.

First in the queue for tendering are companies wanting to introduce a variety of television services using the UHF band.

So far, 44 broadcasting groups have tendered their interest. TVNZ wants to set up two more nationwide networks and TV3 is interested in one more.

Others include the TAB, which wants a national network to broadcast live horse racing; Motorola, nationwide coverage for land mobile services; and Christchurch-based Tait Electronics for nationwide coverage of fixed mobile services.

Technically, there is only room for eight nationwide networks and up to eight regional channels.

Tenders for UHF frequencies will probably close early next year. Tenders for FM, AM and VHF will be called in September next year. ■

Thirteen thousand New Zealanders have already paid anything from $500 to $6000 for two-way cellular phones. The next generation of cordless phones, dubbed in Britain "the poor person's mobile phone", will provide a low cost alternative in an already strong market. Now the race is on in New Zealand to install the network.

TALKING ON THE RUN — THE RACE IS ON

BY JANE McSWEENEY

The race is on in New Zealand to install a network for the next generation of cordless phones.

Plans made public by New Zealand Post, Cable and Wireless and GEC Plessey Telecommunications (GPT) suggest the network will be modelled on Britain's yet to be released Telepoint.

Dubbed in Britain "the poor person's mobile phone", the next generation of cordless phones could revolutionise talking on the run. Four licences have been issued by the British Government to set up Telepoints. The licensees predict three million users in five years and about 100,000 Telepoints.

British telecommunications observers see great potential for second generation cordless (CT2) phones and say they will offer a low cost alternative to the cellular phone and provide network operators with an alternative to the costly maintenance of public phone boxes.

The digital phones will be able to be used in the home or on the run and manufacturers have promised they will be cheaper than current cellular mobile phones.

In a surprising move, New Zealand Post has beaten Telecom to the gun and announced a partnership with multinational Cable and Wireless.

Telecom is looking at the technology and is understood to have been approached by several manufacturers, GPT among them.

Both Cable and Wireless and New Zealand Post would not confirm the extent of their arrangement. At the time of writing, NZ Post's managing director, Harvey Parker, said they were having discussions and it was too early to talk of joint ventures.

Sole Cable Wireless representative in New Zealand, Noel Newton, has been ensconced in NZ Post headquarters in his own office for over a year, supposedly seeking out business opportunities.

The company was expected to have gone public with a deal with Telecom or some plan to directly compete as a network operator on a mega scale. Industry commentators are surprised by the tie-up with NZ Post.

NZ Post plans to retail the phones through its postal outlets. The outlets would also provide a nationwide backbone for base stations needed to route calls from the phones to Telecom's public switched network.

Three systems are being considered. One, for the domestic user, would receive and transmit calls. Users on the move, but within the range of a base station, would be able to send calls only with the second. The third would be used in business premises as two-way phones attached to private exchanges.

NZ Post begins test trials before Christmas, either in Auckland or Wellington. The trials will coincide with similar ones GPT has planned, with about 50 users.

Director and general manager of GPT's Telecom division, Wayne Singleton, says CT2 phones could take as much as 30 per cent of the cordless phone market.

GPT plans to target the business community first. When demand grows GPT will look to the domestic market and then later to the public market.

Earlier this year, GPT's mobile systems director in Britain, Tim Lowry, visited New Zealand to talk to Telecom and potential customers.

He expected initial investment in a Telepoint type system would be about $3m, with each base costing about $5000.

Meanwhile, Telecom is waiting for gear to arrive in the country. Telecom's business development manager, Laurence Zwimpfer, was tightlipped, saying it was too early to talk of concrete plans.

Zwimpfer predicted the market for CT2 phones would be strong. The cordless phone is very popular, despite its high costs. Thirteen thousand New Zealanders are already paying anything from $500 to $6000 for two way cellular phones. ■

VERBATIM

Voice logging comes to finance industry

Philips has developed a voice logger capable of recording 64 simultaneous conversations on to a special 'Certified Logging Cassette' that is simple to handle and load.

Voice logging — the recording of vital incoming and outgoing phone or radio communications — is well established throughout Australia's police and emergency service control centres and, more recently, the finance industry, to verify details of important business conducted by telephone. The traditional voice loggers, in large cabinets with king-size magnetic tape spools, need expert operators, however, and the retrieval of recorded messages can be tedious.

The Philips 64-channel recorder, model CLS8000, has a footprint of only a quarter of a square metre and its special cassette is about the size of an average paper back novel.

To aid retrieval of information the time and date are electronically and automatically imprinted on to each cassette, which will hold 24 hours of continuous recording in the 64 channel mode.

Development of the new 64 channel cassette method of voice logging was made possible by Philips' production of a ceramic recording head using thin film technology, better known in the company's integrated circuit activities.

Small business systems

Alcatel STC has manufactured a new Small Business Systems (SBS) range, to be marketed by Telecom and called the Commander E series. The new one- and two-line systems were developed in association with Telecom Technologies and were launched in September.

Alcatel STC has been supplying Commander systems to Telecom Australia and to its own overseas customers for several years producing a series that ran from three exchange lines and eight extensions, up to 24 exchange lines and 64 extensions.

With the new one-line, five-extension, and two-line, eight-extension systems, Alcatel can now provide domestic users, small businesses, and overseas customers new benefits from the Commander SBS range.

When the planes are grounded

The pilots' dispute prompted Telecom Australia to bring forward the introduction of a new national telephone conference system called Conferlink.

Conferlink can be likened to holding a conference on the phone with, ultimately, the facility to connect dozens of people from around Australia and the world.

Before now, a maximum of only ten people could take part in audio conferencing.

Because Conferlink is connected by an operator, individual conference participants can be contacted with private messages without disrupting the conference.

The system is completely secure and, if necessary, enables selected conference delegates to carry out a private discussion within the larger meeting.

Low-end telephoning

Voca Communications has entered the low end of the telephone handset market with the release of the Voca ATX10.

The ATX10 features on-hook dialling, a 20-number memory (10 one-touch and 10 abbreviated), and battery back-up for the memory storage.

The ATX10 is PABX compatible with an earth/flash selection. Standard features also include tone/pulse, pause, and last number redial. The ATX10 will provide users with an alternative telephone, offering enhanced features which may be purchased instead of rented, thus providing substantial savings over a period of time.

The unit comes with a 12 month warranty and retails for $109.

The Voca telephone handset range begins with the ATX10, and continues upwards with the ADX17, ADX27 and ADX37.

Maximum security Novell NetWare

LAN distributor ComTech Communications has announced LANtrail, a complete network auditing tool for Novell NetWare that provides the network manager with the ability to monitor LAN activity, generate detailed usage reports, and enable supervisor control access at all levels.

Security protected, LANtrail eliminates the possibility of unauthorised users from viewing, altering, or processing the information generated and allows the supervisor to access data and generate reports from any fileserver.

Reports available within LANtrail include: access report; bindery changer report; programs executed report; rename, create, delete report: file access report; directory usage report; system error log; server summary report; security report and survey reports.

Each report provides a comprehensive description of specific network activity, detailing users' identification, time of day, affected fileserver and physical node address.

LANtrail requires Novell Advanced NetWare 2.0 or greater, IBM PC or compatible, DOS 2.1 or greater and 3K Resident RAM at each workstation.

Everyone knows that effective access to good information is critical to good business management. But information is not the same as data.

NAVIGATING THE OCEAN OF INFORMATION

BY KATIE BLAKE

Director, Enterprise Information Management

There is more data around today, and in more forms, than ever before. There is a sea of printed materials, an ocean of electronic data. Almost every organisation, whatever its size, has its own databases. There are thousands of publicly available databases easily accessible from anywhere in the world. We should be better informed than ever before. But it is easy to drown in all that data, even easier just to ignore it altogether.

Everyone knows that effective access to good information is critical to good business management, good marketing, effective research. But information is not the same thing as data. The important equation is this:

Data + Management = Information.

The mass of available data, public and private, internal and external, must be managed if it is to inform. Managing data means making decisions — decisions as to what sort of information is required, whether it will be stored in-house and for how long, and in what form; who has access to it, and when; whether to use external databases, and which ones; how much you are willing to pay for information; what hardware and software to use.

It is easy to drown in all that data, even easier to ignore it altogether.

The sort of information required will vary, of course, with every organisation, but some broad categories can be outlined:

- Information on competitors and/or customers. This might include such material as marketing strategies, product offerings, financial information (share prices, credit ratings, balance sheet figures etc.), key people, organisation charts, credit information.
- General industry information, such as the number of players within specific industries, who the major players are, the economic wellbeing of the industry, forecasts and market research.
- Financial and economic information, including currency exchange rates, share price movements, futures information, credit information and general economic indicators.
- Information on people.
- Information on technological developments, including reports of research and development, patent information, technical data.

- Legal information, including acts and statutes, regulations, case law, intellectual property etc.

Some will be generated in-house, and may be stored in your own databases. But much information is already in public electronic databases which can be used when required rather than stored pemanently on your computers. There are thousands of databases, but most of them can be categorised into the following groups:

- News and current affairs databases
- Advertising and market research databases
- Demographic databases
- Company information and management databases
- Financial services databases
- Computer and electronic databases
- Science and technology databases
- Energy and environment databases
- Patent and trademark databases
- Public affairs databases
- Social sciences and humanities databases
- Biological and medical databases
- Telecommunications databases

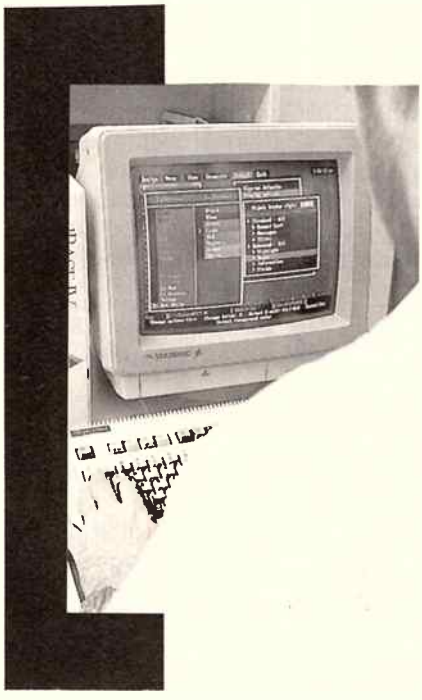
All that is necessary to get at these databases is a PC and modem, some telecommunications software and a bit of knowledge about where and how to look for it.

Capturing data

It is very easy to capture data from online systems and keep it forever in your own computer. This is called downloading. In practice it is not always useful to do so. What is more useful is to add value to data from an external system and store that.

Once material is downloaded from an external source into your own system it becomes available to be processed and managed using a variety of computer applications, such as spreadsheet, word processing or database management. It usually comes in ASCII format (American Standard Code for the Identification of Information), and many online systems provide you with output already designed to be loaded into a spreadsheet or a database.

One of the most common ways of handling information from external databases is to use word processing software to enhance it — to add comments and notes, to tidy it for printing, to delete extraneous matter, to incorporate it into reports.



Documents kept as word processing files can usually be searched for words or phrases using a locate/replace function. Some systems also provide you with rudimentary cross-file searching through the provision of 'history' screens. However, the documents are essentially separate, and you have no quick and easy way of searching on specific terms or relationships between terms across a number of documents. This is where a package like Isys, or AskSam, or Zyindex comes in handy. These packages index the contents of each word processing document, allowing you to search across many of those documents at once. They provide powerful searching capabilities — Boolean operations and proximity searching. Their primary purpose is retrieval. Let the word processor do the job of presenting the document nicely on paper — the text retrieval application can help you to manage all those discrete documents on the disk.

Powerful functions

However, neither word processing nor text retrieval software can provide you with the powerful sorting and reporting functions of text management or database management software. These are different again. While there are some differences between these applications, they both divide information into logical groups — documents or records. They create searchable and sortable databases of things like mailing lists, customer records, library catalogue records and so forth. Each document within a database is divided into specific fields, or sections of the record. These sections might include data elements such as surname, first name, book title, address, document type, postcode, location, description, key terms, notes, price, date and so on. Text management or database management software allows you to sort and print, in a format you design yourself, in any one of these fields. So I can produce an alphabetical list of all the people living in postcodes between 2000 and 2500. Or a list of book titles about whales or dolphins. Or those customers spending more than $3,000 in a year.

Managing information means choosing the right external sources to take advantage of the world's published information, importing only that which is useful to you, enhancing it with your own data, and controlling it with the right software. It means integrating your own data with that already available. Choosing the right external database sources and the right software is up to you. It isn't nearly as hard as you might think.■

Huge investments in increasingly sophisticated software resulted in a product so complicated it scared people. Now, moves towards a more practical application of on-line information are creating a market of sufficient size to sustain the investment which has been made to date.

LESS FRIGHTENING, MORE PRACTICAL

There would be few industries as myth-bound as the information industry — the paperless office, instant access, user friendly, secure, even time-saving. When you most want instant access, or to save time, your PC working to rule or the mainframe knocking off for a long weekend due to overwork is a dead cert; how many times have you not taken a hard copy only to find the original has been corrupted or wiped to free up space? And it seems a hacker with some determination can break into almost any system.

In the on-line information sector there appears to be a sixth myth — cost effectiveness. Information retrieval from databases was to be the answer to every busy and information dependent person's plea, delivering accurate, up-to-date information instantly.

In anticipation, small companies set up everywhere, librarians skilled at retrieval, entrepreneurs gathering an eclectic range of information and putting together databases, and publishers looking to add value to the printed word. Few survive and fewer make profits. Systems are based on software which is expensive to develop making investments hard to recoup in a market that refuses to grow as predicted.

Veteran on-line information specialist, James Harker-Mortlock, believes this sector has never fulfilled its promise — from either the users' or suppliers' side. "The problem has been a wrong definition," he claims.

"With its current technical orientation, suppliers have become mesmerised with competing with the latest software development, where, basically, competition should be about decent information for people to use and access simply.

The beauty of on-line systems is meant to be the timeliness of data — the ability to get to data which you would normally find difficult to obtain; and a limited amount of ability to search the data to go direct to an article which you would otherwise have to read a whole magazine to track down.

You don't need complicated software systems for many of the things people want to do.

According to Harker-Mortlock, huge investments in increasingly sophisticated software has resulted in a product so complicated it frightens people: a product which, in the end, has so much technical development it can only recoup its cost through charging exorbitant amounts of money. "In the end you create an image of a product which is beyond the reach of most people.

"Until recently, most of the marketing activity was aimed at satisfying the requirements of information professionals because the information itself has been more R&D, longer term strategic planning and general research rather than basic information activity. Most people don't have the same requirements as an information professional.

"But," says Harker-Mortlock, "the orientation is changing. Activity is being spurred by people coming to on-line information for very different reasons. Perhaps their primary reason for connection is to facilitate some day-to-day transactional activity through the use of an electronic service. That may be a messaging service such as E-mail, telex or fax from terminals, or filling out forms for an EDI system.

"People using these services are small to medium sized business. They can be introduced to the wider application of value added information services for little additional overheads. You don't need complicated software systems for many of the things people want to do.

In anticipation, small companies set up everywhere. Few survive and fewer make profits.

"Most transactional services provide some sort of communications program so users often have all the hardware and software they need. As a bonus, they can approach one entity to support them with using both the transactional

(Continued on page 18)

THESE GUYS CAN MAKE 500 DEALS AN HOUR ON WALL STREET.

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For them seconds mean the difference between making a killing, or a dead loss. But, whatever way the deal goes, they rush on the next gentleman's agreement.

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Now that networks are becoming involved in the value-added service area they are able to offer the advantages to the user of a kind of supermarket of on-line applications, blending the transactional activity with a messaging requirement and an information requirement all from the one entry point.

Built around this concept is the Harkers Database Network. Residing on OTC Dialcom and accessible from any point in Australia via Austpac, Harkers has been designed around menus for users to read and respond to quickly and simply.

From one entry point a user can choose from a number of functions including messaging, database access, noticeboards, diary, housekeeping and specialist applications such as inter-library loans and electronic data interchange (EDI). Apart from locally loaded databases, Harkers provides a gateway to external information services provided by other networks. This means that someone connected to Harkers can, from the one entry, go all the way through to another network — say OTC Intelnet — which allows users to search a wide range of databases using menus, without having to know the command language of the system connected to.

On the other hand, if you are an information professional, you can use Harkers to connect to a service and use all the high powered software that service may offer. Obligingly, if required, Harkers will do the local billing (or you can choose to have a separate account for the service) and will even load your password into the system so you don't need to remember it or re-enter it each time.

Although you can get from Harkers to major networks in the world, most of the databases actually loaded on Harkers will be Australian or regionally generated information, including new business data being compiled in conjunction with the Australian Graduate School of Management.

Connection costs $20 per month and $300 per annum, with a base rate of $30 per hour applied to moving around the menu, filling out forms and reading before you connect to something which has information and value added to it. Once you move into Harkers locally loaded databases, the charge for searching is around $150 per hour.

For offshore information you pay the telecommunications charge plus the charge levied by the information provider.

When connecting to another network, arrangements differ, to protect against double charging. For instance, if a user already subscribes to another system and accesses Harkers he will not be charged again.

Harkers is a new approach to the business of providing on-line information. Says James Harker-Mortlock, principal of Harkers: "It is a different way of applying the software".

(Continued from page 15)

service and the external information services.

"For the information provider the advantage is a much clearer definition of the market and a product that is generally much simpler, and therefore much cheaper, in terms of software development. Users of one particular network or transactional service generally form a niche market and are much easier to target. Rather than having to scatter across a range of broad industry sectors and different interests (as is necessary when targetting all corporate librarians, for instance), it is possible to say we are dealing with people in the trade industry, or people in the automotive industry.

"And, further," claims Harker-Mortlock, "instead of dealing with a multitude of accounts in distant geographic locations (because the reality is most database hosts are located overseas at this stage) they are able to deal with a major network. The network handles all the local billing. The customer pays the network in local currency and the network pays the information provider in foreign currency.

"This move towards a more practical application of on-line information through transactional services is finally creating a market that is of sufficient size to sustain the investment which has been made to date." ■

OMNITRACS: TRUCKING ALONG IN THE USA

BY STUART CORNER

The operations controller of a large trucking fleet sits down at a personal computer. On its screen he can call up maps — either showing the whole of Australia, or just a single city. On those maps are dots showing the location of each vehicle in his fleet. He can type messages at the keyboard which can be instantly relayed to any one of those vehicles, appearing on a display unit in the cab of the vehicle. The same vehicle-mounted unit is fitted with a keyboard on which the driver can type a message back to his head office, and which can be displayed on the screen of the PC.

This is not a scenario for the future. This system is already operating in the USA where it was launched early this year, and several major trucking companies are in the process of fitting out their fleets, totalling several thousand vehicles, with equipment to use the service. In the USA, the in-vehicle unit costs about $US4000, the PC software about the same and usage costs are about $US50 per month.

The company which developed the technology, and which operates the service, known as Omnitracs, is Qualcomm Inc of San Diego, California. It already has trials underway in Europe with several PTTS and, as this article went to press, was planning to start trials in Australia using the Aussat satellite. In the USA, the users' PCs are connected by terrestrial lines to a satellite earth station at Qualcomm's San Diego control centre which provides the links to the satellite.

Omnitracs uses a spread spectrum technology operating in the satellite KU band. The signal is transmitted at very low level across a wide range of frequencies; the receiving unit knows where to look among these frequencies for this low level transmitted signal, and so is able to discriminate it from the background noise. This highly sophisticated signal processing technology allows Omnitracs to operate with small non-steerable antennae mounted on vehicle roofs.

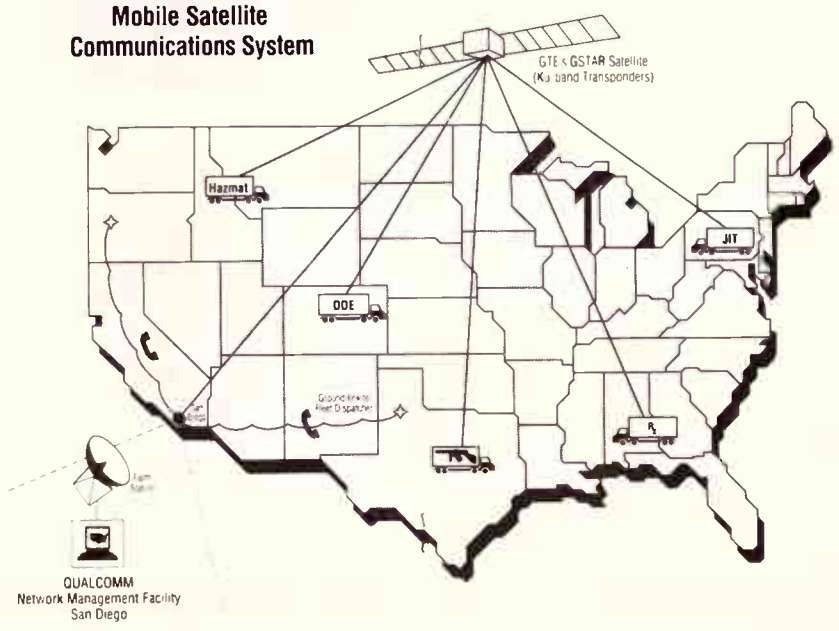
Other companies are developing competing two-way communications technologies for satellites, but Qualcomm claims to be the only one in full commercial operation. Aussat is developing KU band mobile two-way communications systems for use on its second generation of satellites. Until they are launched, it is using C band capacity on the satellites of Inmarsat, the international maritime satellite organisation. The only manufacturer so far licenced by Inmarsat to produce the mobile units is Thrane and Thrane of Denmark.

Whether the Omnitracs service can be viable in Australia is another matter. Because it uses a spread spectrum technology, it requires almost a full 12 watt transponder for outbound signals and another for inbound signals. These can support many thousands of mobile terminals, but make for high start-up costs until user numbers build up.

Also, the trucking industry in Australia may not have the same demand for instant communications as its US counterpart.

In the USA, Omnitracs is being used to track hazardous and other high risk cargoes, such as those which are prime targets for highjackers. The Department of Energy, for example, has installed Omnitracs units on vehicles carrying radioactive waste. ■

OmniTRACS™ Two-Way Mobile Satellite Communications System



BOOSTING BHP's SIGNALS

BY STUART CORNER

When BHP built its Iron Duke Mine 60 kilometres from Whyalla in South Australia, it needed communications services for the project, but the site wasn't served by the public telephone network. For the operational telephone needs of the completed mine, BHP was granted the right to install a private microwave link back to its main Whyalla office. During the construction phase it became the first user of a cell extender for Telecom's Mobilenet cellular mobile telephone service. By boosting signals from mobile phones at the mine site, this effectively brought the site into the main Mobilenet network in Whyalla.

These remote cell site technologies aren't restricted only to temporary applications such as remote construction sites. They can also be used to extend mobile coverage to small pockets of population and ribbon development such as major highways and to boost signals where reception is poor.

The X-Cell-100 Remote Cell Enhancer from US company Astronet, a subsidiary of Mitsubishi, is one such product. It is distributed in Australia by Mitsubishi Electric Australia, which also supplies Telecom with the Walkabout handheld telephone.

The X-Cell-100 is a signal booster which receives the mobile telephone signal from the main host transmitter, amplifies it and retransmits it to the mobile unit which would otherwise be out of range of the main cell site transmitter or which is in an area of poor reception. The signal from the mobile telephone is similarly amplified and retransmitted back to the main host cell site.

The systems can be used in a number of configurations depending on the population distribution around the main cell site. For example, the channels of the main cell site could be re-used at a remote location, or a portion of the total channel capacity of the central cell site could be dedicated to one or more remote locations by being relayed to those locations through the Astronet X-Cell-100. These units can be located up to 20 kilometres from the main host cell site.

Astronet has also packaged its technology into a trailer. The company claims that this can be set up and used to provide cellular telephone services within 24 hours. It suggests applications for this system in military and emergency situations.

Mitsubishi Electric Australia sold cell enhancers (model X-Cell-100) to both Telecom Australia and Telecom Corporation of New Zealand for use in their respective cellular networks during 1989. Both of these organisations have recognised the need for this type of product in providing solutions to the problems of poor reception areas and the expansion of capacity into areas of low population density.

MOBILEBITS

Cellular contracts

Motorola has won two cellular contracts from Telefonica in Spain to form a joint venture with local company Amper SA to make radio-telephone systems. The contracts, said to be worth $US100m are for a 900 MHz TACS (analogue) cellular system giving nationwide coverage, and for a GSM (pan-European digital cellular) system.

Telepoint

West Germany is expected to announce details of a licence to operate Telepoint services in competition with the Deutsche Bundespost's own service. The Bundespost is planning to launch its own Telepoint services early next year with three trial systems; one based on the UK's CT2, another based on its own cordless phone standard and a third integrating them both on one site.

New business

Ericsson of Sweden and General Electric of the USA have joined forces to attack the mobile telephone market. Ericsson will hold 60 per cent of the new company, GE 40 per cent.

Ericsson will be combining about half its mobile communications interests with all GE's activities to create a new business expected to have worldwide revenues of $US1b next year. The main focus will be on capturing a large share of the market for cellular handsets, growing at 30 per cent p.a.

Doings in the East

First Pacific, the Hong Kong-based investment group controlled by the Lien family of Indonesia, is buying a 50 per cent stake in the Pacific Link cellular telephone operating company, formerly known as Chinatel, from the Peking-backed China Resources.

Cordless alliance

GPT and two leading French electronics companies — Electronique Serge Dassault and Electronique Mecelec — have formed an alliance in the area of cordless telephone technology in the expectation that France Telecom will soon set up a public cordless telephone (CT2) system using common air interface technology.

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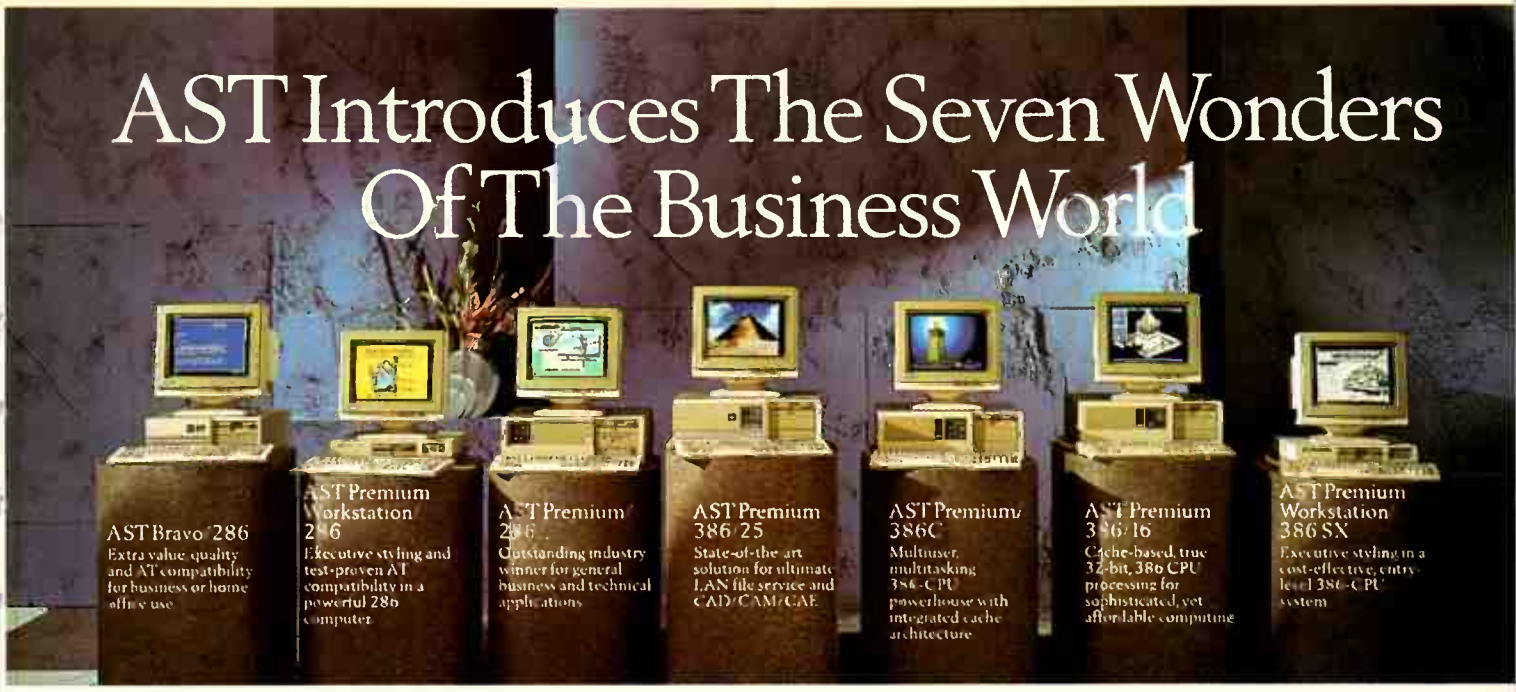

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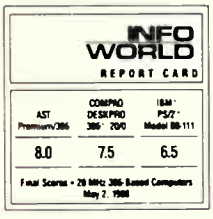

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MANAGING TECHNOLOGICAL CHANGE

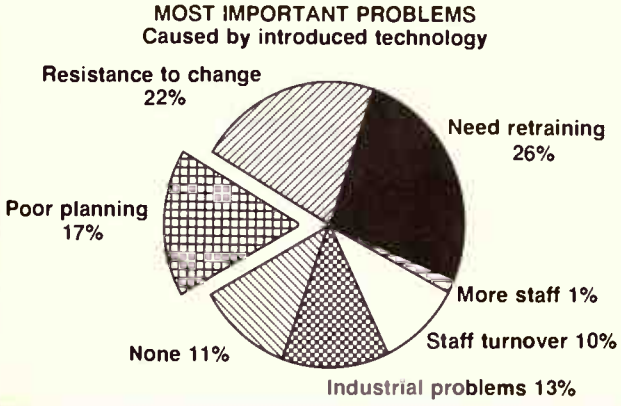
Students completing their three-year intensive Management course at the Blacktown TAFE have undertaken research on Managing Technological Change, and the impact of such change on organisations, structure, people and business environment. Some of their more significant findings are reported here.

The Business Research Team '89 used a three-phased approach; telephone interviews, major questionnaires targetted at 300 companies selected from the Top 500 and face-to-face interviews with CEOs of a random sample of companies.

Response rate to the primary questionnaire was 53% from a cross section of industries: manufacturing 32%; public service 30%; finance 12%; transport 9%; mining and construction 9%; telecommunications 4%; wholesale 3%; rural 1%.

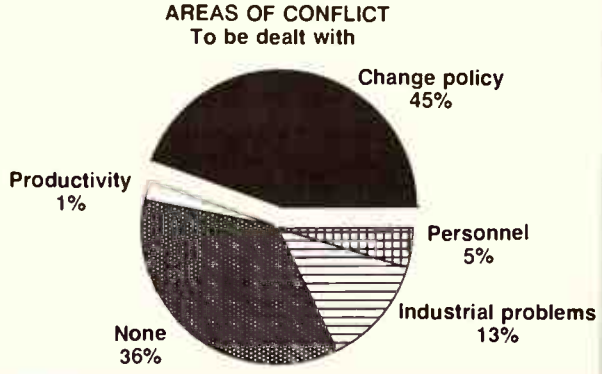
Most important problems

A total of 75 per cent of respondents stated that, in hindsight, they would have introduced their new technology by paying more attention to planning.



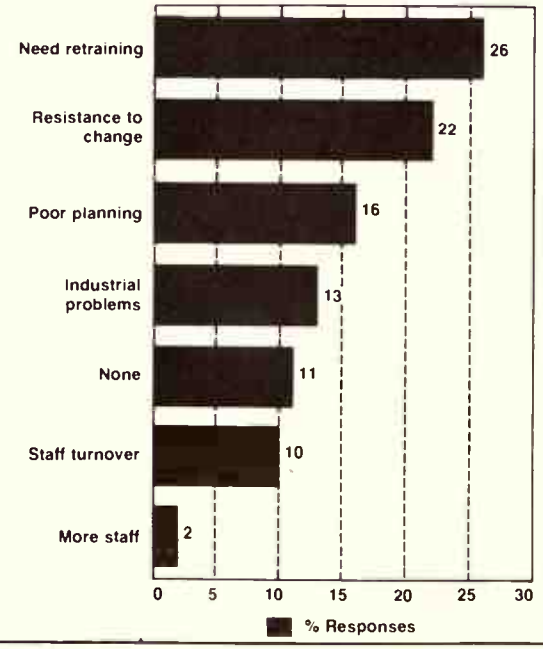
Areas of conflict

In 45 per cent of replies 'changes in policy' created conflict, again highlighting reluctance to adopt change and thus the necessity for extensive training programs.



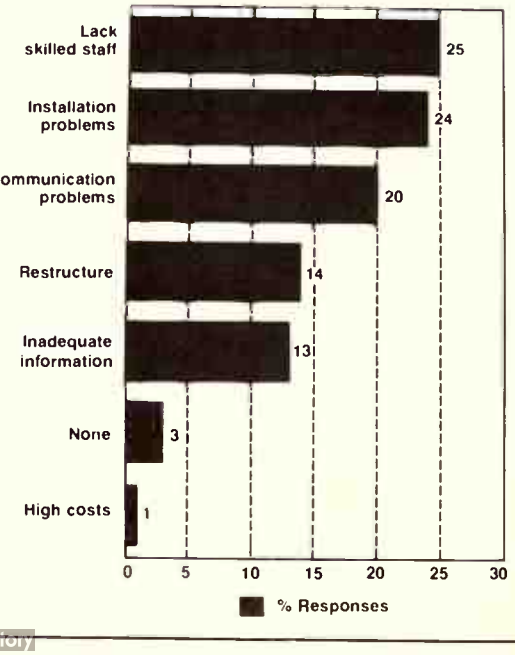
Most important problems

Training was further emphasised with the 'need to retrain' being cited as a major problem. A high 22 per cent believed the introduction of new technology and subsequently new systems met with resistance from employees.



Management problems

Lack of skilled staff was most commonly cited as the critical issue. Respondents indicated it was essential that sufficient training be provided including both broadbased and technology-specific, and enhanced managerial skills.



Technology integration into an organisation cannot ignore the basic human responses to change. If 'ruffled' the wrong way, otherwise well-developed software can become shelfware overnight. Technology systems not negotiated into the political and social networks of organisations run the risk of failure.

BY WARREN PARRY

Warren Parry is Director of Development Research Group; he works as a consultant with banks, insurance companies and Government organisations specialising in the 'people side' of technology integration.

It used to be thought that getting the technical solutions right was all that mattered. With this in place everything else would work, everybody would be happy and the 'new, beaut way' would take the organisation into the 21st century.

In many organisations, the potential of the computer-based system remains unfulfilled — not because of the lack of technical or design expertise, but because of the complexity of human factors in the work environment.

It is the rate of organisational and technical change in recent years that has highlighted the vital human factor in the change equation. It is now acknowledged that organisations can expect a major change once every four years and a minor one every year. There is a lot of mythology about change ('when we get through this change, things will be OK'), but the reality is that one change will merge with another.

What is unique about change management now is that the change manager is required to synthesise business knowledge, technical knowledge and human potential. All three of those have been well developed separately in the past, but bringing the three together is the particular challenge now. One of those factors neglected throws the others out of sync, and it is the human factor which is most often the stumbling block.

Introducing new technologically-based systems will also dramatically change the work culture to the extent that the organisation two years down the track may be vastly different from the organisation at present.

There are, therefore, two kinds of people necessary to an organisation before and during the change process: managers able to facilitate the process and people who can articulate the human vision behind the technology hardware.

Those faced with new technologically-based systems often move through four stages before they get used to it (if indeed they do). Initially, there is the shock stage. Then there is a reactive retreat — which I term the nostalgia stage — which often results in anger with the system for not doing this or that, and with the organisation for not being consulted or involved.

The third stage is reality acceptance — ('this is the reality of it, so let's get on') and finally, comes learning to cope and making it a challenge.

Some people move through these stages quickly (maybe 25 per cent), but it is the reactions of the remaining 75 per cent that are crucial to the ultimate adoption and success of the new system.

Most change management makes the assumption that either the first two stages don't exist or that people will move through

them by themselves. If change management comes in at the third stage, people hold on to the old system because it is not given any recognition.

It is up to the manager to facilitate a process: perhaps institute rituals at stage two to celebrate the old way and give recognition to it and individuals. As an illustration, a company in Melbourne introduced new technology which confounded people to the extent that they were on the verge of striking. Some people simply could not come to terms with it. The manager turned up one morning with bunches of flowers for the staff: it worked. The gesture conveyed: 'We are not insensitive to who you are or what is going on here', and gave recognition to the struggle some people were having.

Another company, in trying to move people from stage three to stage four, offered a small incentive each week to the person who could beat the new system. They made a game of it and turned it into a challenge, which spurred people into not just accepting the reality, but starting to be creative with it.

In a traditional office there are people recognised as knowledge sources — perhaps a supervisor who is sought after for advice as to how to do certain tasks. With the introduction of a computer system, information can simply be accessed through the computer, so that person's status and position is changed. From an efficiency point of view, this won't show up, but in terms of the social organisation of the branch, the person's sense of contributing goes down the tube.

The social structure is the maintenance structure of an organisation and if that breaks down you get increasing fragmentation and isolation, and hence suspicion.

If managers are insensitive to that dimension, and try to rationalise everything in terms of the task, they may stress the system by taking away the support structure.

The manager has to strike a balance between what is good for the organisation as a whole and what is good for the individual. It must be recognised that when a company puts in a new system all the various social, political, psychological and neurotic stuff gets attached. The rationalising force in spending millions of dollars on the new system is to develop organisational integration, but in a lot of cases the organisation is not healthy enough to withstand that level of integration.

Often, the old system grew up covering lots of inadequacies, and when individuals are put into the new environment where they are required to be healthy, a lot of those inadequacies are uncovered. Simply sending out information will not foster an openness to change. If a person has negative feelings towards the system and he keeps being given new information he will simply not remember it.

In any branch of an organisation there is a series of levels operating — task, social, political and psychological. If you only manage the task dimensions then all sorts of problems arise in the other ones.

I work on the assumption that what is not managed potentially works against you. It basically comes down to managing the resource.

There is a percentage of people who will work through the four stages on their own; there is a similar percentage who won't change no matter what is done; but there is a large group in the middle who, with support and assistance, will shift; that is the percentage not managed.

It is an interesting phenomenon that technologists are designing systems that, when implemented, often alter the concept of the organisation. What people are not realising is that if you develop an integrated technology system it will change the concept of the organisation. It won't just improve the old system, it will actually change and affect the way people work.

An organisation therefore needs people who can look at the situation, and the implications of technology adoption and say: 'Do you realise that by implementing this system, this is the kind of organisation you are going to end up with in two to three years? This is the way people will work, the way they will think, the kind of things that will emerge. Is that the vision you are spending millions of dollars to buy?'

In Aboriginal society, stone axes were made by the elders and were used in initiation rites. When metal axes were freely handed out — even to women! — whole social form was eradicated overnight; people who had the axe-making skills lost their status and the initiation to manhood was radically altered. No-one foresaw the impact on the culture; there was no-one to interpret the vision.

I don't think you ever get painless or resistance-free change implementation, because that is the nature of the beast. All change involves some degree of difficulty, some letting-go of the old ways and some inadequacy in mastering something new. If you accept that as reality, then you can alter the acceptance; and the degree to which you can alter it depends on the degree to which you can see the culture and the nature of relationships in the work place.

The illusions on which people implement new technology systems are that they are a clean, efficient cure-all — an intellectual idea about change which is out of line with the reality of human nature. ■

From the point of view of the businessperson, technology introduces the potential for competitive instability, providing an opportunity for some competitor to create a dynamic advantage: **Roehrich 1984**

THE AGENT OF CHANGE

BY DAVID FEENY

• David Feeney is a fellow in Information Management at the Oxford Institute of Information Management, Oxford University. His role is to research issues with which general business managers ought to be concerned in relation to information technologies — how to recognise opportunities, to generate strategies for exploiting information technology and how to organise resources. Much of his time is spent teaching management teams for businesses.

Information technology (IT) is a magnifier of business management performance. If you know what you are doing in your industry and you deploy IT in support of a good strategy then results will be better — sometimes dramatically better. It is the strategy that is paramount, not the technology.

For the past quarter of a century we have experienced the phenomenon of 'technology push', the idea that the answer to business success is somehow in technology. Business people have been promised that technology holds the key to improved performance — but expectations raised by the IT industry have been beyond the level of achievement.

That realisation led to a shifting of focus: a bottom-up approach, where emphasis was placed on determining the scope of the equipment and then searching the business for an application (having the solution, then looking for a problem). This approach does generate a return on investment but leads to a collection of bottom-up or ad-hoc investments, which I label *useful* applications of IT, because most of them represent potential improvements in efficiency.

The really crucial developments over the next 10-15 years, however, will be in investments in IT which can properly be called *strategic*, in that they are integrated into the whole strategy of the business. They are far more likely to be aimed at the revenue line than the cost line; to be aimed at effectiveness in the marketplace rather than internal efficiency; to be concerned with doing the right things rather than doing things right.

Before any large IT investment it is important to analyse the business and the industry to try to understand what sort of strategy could achieve a superior performance. Deploying technology for competitive advantage will be a product of management thinking creatively about the business. The technology area supports them in identifying the appropriate technology to carry out the ideas.

The same business idea might be implemented in a number of different ways using different technology.

First bite of the cherry

One way in which businesses can achieve an advantage is by earning the gratitude of the customer and getting priority in terms of selection of product. Helping the consumer or the consumer's agent to choose the right product is what American Airlines did with Sabre and United Airlines did with Apollo — essentially they provided the travel agent with a tool that could take a consumer's need and translate it into a series of choices.

Becoming the preferred supplier by making it easier for the customer is the line Thompson Holidays in Britain capitalised on. They were the first to make it easy for travel agents to enquire about and book holidays on view data sets; they consequently doubled productivity in terms of the number of holidays sold per employee.

A major advantage comes from knowing when the customer is going to be in the market place. You may have a situation where your customers only buy once every year, or every two years. In the late 1970s, the managing director of the marine coatings division of the International Paint Company, a part of the Courtaulds Group, conceived the idea of building a database about his customer targets.

The database is built by capturing information every time a ship

The really crucial developments, however, will be investments in IT which can properly be called strategic.

dry-docks anywhere in the world — when it docks, which paint supplier is providing paint and, if it is International Paint itself, they record which product, how it is being supplied and what condition the hull is in.

As the database grew, it was used for a number of purposes: to get an idea of the performance of products (which can be fed back into R&D); to better access market

share in all parts of the world; and, when they knew the date of the previous dry dock, the sort of anti fouling agent that was used, and when a ship was due to dock again, to target sales effort at the appropriate time.

A data base can trigger the sales effort on a client basis, a regular basis or an ad-hoc basis. For instance, when one of International Paint's competitors went bankrupt, International Paint used its database to ensure that within 24 hours every affected fleet owner received a call from an International Paint salesperson.

The idea of using IT to trigger sales action can occur in a range of industries, but the trigger is a function of the industry not the technology.

Supporting the salesforce

Technology can be used in a variety of ways to improve the effectiveness of the salesforce when face-to-face with a consumer. An account manager can use it to get up-to-date information about the status of the relationship, ensuring the sales call doesn't get diverted with bad news about last week's invoice or yesterday's machine breakdown, of which he would otherwise be unaware.

It can also be used at point of sale to ensure every question the customer has can be answered without having to break the call and reschedule. In the pharmaceutical industry, for instance, there is an enormous amount of information relating to new drugs which the salesperson cannot possibly hold. He can use a lap top computer to refer to results of trials, the interaction between drugs, the side-effects of drugs and the way they work.

The experience in the insurance industry is that more and larger products are sold by salespeople who have the advantage of lap top computers to produce on the spot proposals that perfectly suit a client's needs.

Additionally, evidence in that sector indicates individuals are more likely to accept the pronouncement of the technology at the point of sale than they are to accept that of the sales representative. Presumably they see it as unbiased.

GANG-NAIL: BREAKING NEW GROUND

The use of computer technology in structural and engineering design is somewhat taken for granted in 1989. But as early as 1972, one company, Gang-Nail Australia Limited, broke new ground by introducing computer designed timber roof trusses into roof truss fabrication plants.

Since those early days, Gang-Nail has produced a whole suite of programs tailored to the needs of the truss industry, including updated versions of the original Trussfacts program — Datatruss I and II.

Called Lumberlock Datatruss II, this updated program is much more powerful and comprehensive than the earlier version and is designed to serve truss manufacturers' needs for a few years to come.

Input is by roof shape, which speeds up the operation and enables the roof to be overviewed to ensure uniformity of approach, timber size and fitting together. The shape and layout are graphically displayed and may be printed to provide the client with a roof layout. The program uses logical steps and displays instructions, minimising the use of manuals and specific training.

The program designs the trusses for the specific jobs with conditions of loading, overhangs, cantilever, girders and so on to give the most economical design and thus the lowest cost roof. Quotations can be easily stored for retrieval on winning the job.

Following designing of the roof, the program estimates all costs of manufacture and adds the margin to give a selling price. Timber connectors and production costs come from 'security' files, updated by the fabricator as necessary.

Other programs offered in the suite are equally as comprehensive and include Lumberlok Dataform for the design of wall frames; Lumberlok Databuild for whole house design; and an administrative program, Lumberlok Data Library.

The programs run on a micro computer and are rented to Gang-Nail licencees at a nominal rate to help support upgrading and new development.

Building differentiation

A particular challenge is to build differentiation of a product that cannot in itself be strongly differentiated from a competitor's. A classic illustration concerns Gang Nail Australia which produces gang nails used to join roof timbers (see panel). There would be few products harder to differentiate; Gang Nail used IT to provide a service to companies manufacturing roof trusses.

Building partnerships

Over the last few years, many industries have begun to follow the Japanese philosophy of supplier relationships, which is basically to have a small number of suppliers to whom they are loyal but demand a greater level of performance in terms of quality, particularly of delivery — so-called just-in-time — which is proven to be more effective.

Using IT to link trading partners directly generally means a reduction in the amount of suppliers. But there are two winners — the buying organisation wins by achieving economies involved in the situation and the remaining suppliers win by being part of a small group with larger market shares, and greater security of continuing supply. The more intricately linked the buyer and supplier become the more difficult it is for the buyer to move away or change suppliers.

In a case where companies have a concentrated customer set of five or six, the customers have tremendous bargaining power in the relationship. Some would say this cuts out opportunities to use IT to achieve a competitive edge, but that's not strictly true. The competitive edge comes about through recognising the realities of the relationship and devising different ways of using IT.

The role of technology is simply the agent of change. ■

THERE'S A WHOLE LOT OF HUSTLING GOING ON

The main benefits to the retailer of EDI are speed and precision — advantages not to be scoffed at when moving faster than the competition gives the all important edge.

Behind the stacks of jeans, racks of shirts and shelves of plastic and glassware in retail outlets there is a revolution going on: a revolution in information processing — getting all the information that is associated with the trading process and trapping it electronically as quickly as possible. The revolution is called Quick Response and, although it appears far removed from the process of shopping, in the long haul it means improved customer service.

The bottom line is that automated systems can tell retailers what is selling and what isn't, at a faster rate than before. Today, the greatest advantage lies in moving faster than the competition.

Management guru Peters (*In Search of Excellence*), in his book *Thriving on Chaos,* maintains that "given changing technology . . . and the moves of competitors we must:

- Achieve total customer responsiveness via bold new partnerships with suppliers/distributors/customers;
- Seek out and create new markets with our partners;
- Introduce 'hustle' as a key strategic concept — fast moves, fast adaption and tight linkages will become a way of life.

"Adversarial relationships with suppliers, distributors and ultimate end users must be quickly replaced with partnership relations. Major electronic / telecommunications linkages and other tactics to enhance speed/responsiveness must be quickly achieved."

Quick Response (QR) is a management initiative encompassing a range of programs including

bar coding, product marking, laser scanning at point-of-sale (POS) and thus POS inventory managment. Bringing those technologies together to create 'hustle' is electronic document interchange (EDI).

Dennis Crane, general manager of General Electric Information Services in Australia, believes it is a change of process and a change in thinking.

"Ideally the entire ordering, stocking/inventory and reordering cycle can be electronic from end to end," says Crane.

"The vendor or manufacturer allocates a product number to goods before distribution to retail customers; from the product number the retailer bar codes the goods; the goods are scanned at the point-of-sale and the data automatically captured; when the inventory level gets down somewhat the computer recognises the inventory need, prepares the order, transmits the order and updates the inventory with new receipts."

One EDI requirement that crops up early is the ability to track sales at the same level at which items are ordered. If you are ordering at the size and colour level, you need to track merchandise at the size and colour level — the UPC (uniform product code) level. The UPC bar code is used in the USA for this purpose; however, Australia and the rest of the world use the EAN code, administered here in Australia by the Australian Product Numbering Association (APNA).

In the USA, where large retailers began to implement QR in the early to mid 80s, they found the key to getting it right was uniformity. Every stage in the retail chain, from production to sales, must be able to link in to achieve the turnaround and productivity improvements sought. (A study done in the USA in 1987 by Kurt Salmon and Associates for the textile-apparel-retail chain showed a life cycle of 66 weeks. Only 11 weeks were work in progress, with 82 per cent of the time being non-productive.)

So, in 1986, the retail-general merchandise-apparel industry got together and formed VICS (the Voluntary Inter-industry Communications Standards Committee) with a mission to develop and ensure the implementation of standard merchandise identifiers, standard carton coding and standard EDI transactions.

This meant going from individual proprietory standards to a uniform system. VICS-EDI (using ANSI X12) brought in electronic orders and invoicing and paved the way for sell-through analysis reporting, electronic packing slips and point-of-sale inventory data.

Importantly, what VICS did for the US industry by standardising was to make the technology (once only practical for the big store addressing an equally big manufacturer) accessible to any manufacturer who wants to deal with a volume retailer.

"Beyond that", says Crane, "it gives the smaller retailer the opportunity to experiment a lot more. With fashion, for instance, retailers can order in smaller quantities, and expect to order more frequently from a large supplier who is willing to hold inventory and can do that more cost effectively. The supplier, in effect, becomes the warehouse.

The bottom line is that automated systems can tell retailers what is selling, and what isn't, at a faster rate than ever before.

The economic benefits are substantial because of the efficiency of staff — releasing them for direct sales work — and the rapid turnaround time. "So, a retailer might come away thinking: I can afford to experiment and, from US experience, afford to source more domestically.

"Sourcing domestically is an interesting development and stems from the fact that delivery can be within two to three days. What is foregone in margin for off-shore sources is captured in less inventory and recovered in better fashion response, resulting in fewer markdowns and fewer returns than is the case with an offshore supplier," explains Crane.

From the technical side, the biggest challenge is not the electronic hookup from the retailer to the vendor, which is a relatively simple matter, but the changes to their hardware and software to accommodate the improved flow of information. To get maximum benefit from EDI an order must flow right through a vendor's system, right to the distribution centre, without being re-entered or manipulated manually.

David Milton, from Levi Strauss, Australia, stresses there is no point in putting in EDI unless you have a good integrated internal system.

"In EDI, it is the small to medium sized specialty stores that could potentially gain the most, because cost of participation is less and the availability of integrated solutions is far higher," says Milton.

"When you are talking about EDI in major corporations, it actually changes their systems, changes their applications. In the case of a large organisation it can be a substantial development project that will change the way a company works. A small to medium company, however, doesn't have a great deal to change so they can move that way a lot faster."

Levi Strauss particularly lends itself to an EDI set-up because 85 per cent of what it makes is basic reorderable merchandise. In the United States, the company has taken a very active posture in EDI, to the point where some retailers dealing with them have already achieved near 100 per cent automation.

Levi has gone as far as to create its own package called LeviLink, using the VICS EDI standard. LeviLink is made up of a number of modules or options and the retailer buying regularly may opt for any number or combination of modules. It is 'designed for every stage of the merchandise life cycle — inventory replenishment, purchase order reconciliation, invoice processing and payment, point-of-sale capture and overall market analysis'.

Early on in the development of retail automation Levi adopted vendor marking. Products are sent

to retailers with a standard ticket which features the UPC bar code and identifies products to the stock keeping unit (SKU) level.

One US menswear store invested in a system where it got direct store delivery from Levi with everything marked. On receipt, staff merely scanned the bar code of the container and, having already had electronic notification of that shipment, including what colours and sizes were in the box, put the merchandise straight on to the floor.

Because of the speed of ordering and receiving goods, the store has done away with inventory that isn't on the floor, and they don't have to go through the receiving and checking processes before merchandise is put out for sale and released to the point of sale systems. Once in the point of sale system any sales are automatically debited against the total received.

There are less obvious benefits here for both the vendor and retailer. One of the bonuses of EDI partnerships, as in the case of vendor marking, is that some of the work the retailer normally does is shifted back to the vendor. Similarly, the speed of ordering and receiving merchandise allows retailers to reduce the amount of inventory and use the vendor as the warehouse.

On the flip side, EDI can help vendors anticipate the market. Right now there is an element of guesswork in production, but with POS data being transmitted directly to the vendor they begin to get the whole picture — they know much earlier how many garments to make in what sizes and colours.

Australia

In Australia, that level of automation is on the doorstep and Levi Strauss is one of the companies with its foot in the door. "We currently don't have any trading partners (there are none ready) but we have been establishing systems for the past year and a half," explains Milton. "There are indications others will be ready to play in the first half of 1990 and when that occurs we will be getting a substantial part of our business through EDI.

Levi has been involved in pushing the infrastructure and the technology from the outset, says Milton, initially, through its desire to be a leader in vendor marking. They therefore became heavily involved in APNA (Australian Product Numbering Association).

"Through APNA we became involved in a retail pilot (purchase orders only) on EDI which was between eight companies from the retail-general merchandise-apparel area. The pilot was split into four existing trading partners and Levi partnered Myers. The objective of the pilot was to establish whether or not the ANSI standards would meet the industry needs; and to establish the credentials of third party network providers. It ran over six months and, although the results were not terribly impressive, there was enough there to see it would work."

At the same time, Levi got involved in establishing the EDI Council (see story this section). From the outset there were a lot of organisations interested, but a lack of know how; so they drew on the experience of Levi Domestic (US operations) and on VICS, and found that those guidelines do work.

In Milton's view (and demonstrated by the VICS experience) there are two important facets to EDI in the retail industry. One is to identify the item via a common identifier — the SKU — which is covered by the APN number. Equally important is to be able to identify the person you are trading with in a non-ambiguous way. Standards do not exist in Australia for this identification at present, although Dunn and Bradstreet numbers are being used as an interim solution.

A necessary step now is to build the same sort of industry cooperation in Australia that exists in the USA through VICS. That is underway through the retail-general merchandise user group of EDICA (EDI Council of Australia) where standards issues are in the process of being sorted out. ■

Shelley Spriggs

QR SURVEY FINDINGS

A 1988-89 study carried out by Arthur Anderson & Co on behalf of the US Voluntary Interindustry Communications Standards (VICS) committee, found Quick Response (QR) amounted to annual savings of $US9.6b after initial investments of $3.6b.

The study found that "for the individual company, these numbers translated into an average annual saving equivalent to 5.0 per cent. Those savings were identified through six specific areas.

Sales Because the electronically captured sales information is broken down to size and colour level, products that are selling can be replenished faster, and slower selling lines can be discontinued. Further, because the information is shared with vendors and manufacturers replenishment throughout the retail chain is more accurate.

Markdowns The level of markdowns decreased by 30 per cent in basic/seasonal merchandise and 40 per cent in fashion items, simply because stores were able to forecast demand more accurately and thus stock more of what customers wanted, faster.

Merchandising expenses "Automatic replenishment systems and EDI reduce the amount of time required to create, communicate and track purchase orders by as much as 80 per cent," the survey found.

Distribution expenses Vendor pre-ticketing and shipping container marking has accelerated the passage of goods along the distribution chain by as much as 45 per cent.

Administrative expenses "EDI significantly reduces the amount of data entry for both the vendor and retailer, at the same time reducing the likelihood of errors . . . and cutting the retailer's clerical costs by as much as two-thirds."

Interest on inventory The whole process of Quick Response allows for more frequent deliveries from vendors and thus less inventory held (the vendor as warehouse concept). The study found that inventory turns could be increased by 25-30 per cent in basic/seasonal goods and 10-45 per cent in fashion items.

DON'T GET LEFT BEHIND, WARNS EDICA

The day is dawning when electronic exchange of business data is mandatory — if a company is not geared for it it will be non-competitive, warns Michael Baker, CEO of the EDI Council of Australia (EDICA).

In some industries in the United States and United Kingdom that day has already arrived: US Customs and several large companies are taking the stand: "Deal with us electronically or we will desource you". And the UK Customs Service has stated that unless companies use EDI they will not be assured a "satisfactory customs service". Indeed, Australian Customs has it wired from the export side through its EXIT service and, not too far down the track, it will be mandatory for importers to exchange documents electronically.

But exchanging data electronically is not a practice that can be adopted overnight. The minefield of compatible standards, trading partners and networks must be crossed. And it's not cheap. Says Baker: "To get EDI up and going you have to spend money — change some systems and throw some out altogether.

"A small company might have one or two people planning for a number of months, while a larger company with more complex systems will need substantially more people planning the new system."

EDICA exists to coordinate the efficient introduction of EDI in Australia and, as a by-product, to provide support and advice amongst members to ensure the transition is as painless as possible. The council was set up in 1986 driven by the motor and retailing industries which were beginning to plan for electronic trading. Specifically, the motor industry formed an EDI sub-committee in 1985, followed closely by the Australian Product Numbering Association (APNA).

Out of the APNA sub-committee came EDICA, with an interim board made up of people from large vendor organisations (Telecom, General Electric) and organisations already beginning to dabble, like Mitsubishi. That board decided the council should properly be driven by users rather than vendors and consequently ruled that vendors should not hold board positions.

EDICA exists to coordinate the efficient introduction of EDI in Australia and, as a by-product, to provide support and advice amongst members.

There are now two types of membership. User membership fees are based on the size of the company and range from $500 per year for a company with a turnover of under $10m; $1000 for those with a turnover between $10 and $100m; and $1500 for those over that. Vendors pay $2000 per year.

For the price of that membership, says Baker, a company can ensure that the way it conducts its business is the way EDI is developed in Australia. "That's why the big companies were members from the outset. But it is important to note that regardless of size, a member has only one vote — little companies have as much say.

"Membership can ensure that standards are developed to suit specific company or industry needs, that evolving legal issues are fully understood, that software and hardware needs are addressed. In short, membership creates an opportunity for advice and feedback that may otherwise cost thousands of dollars from consultants."

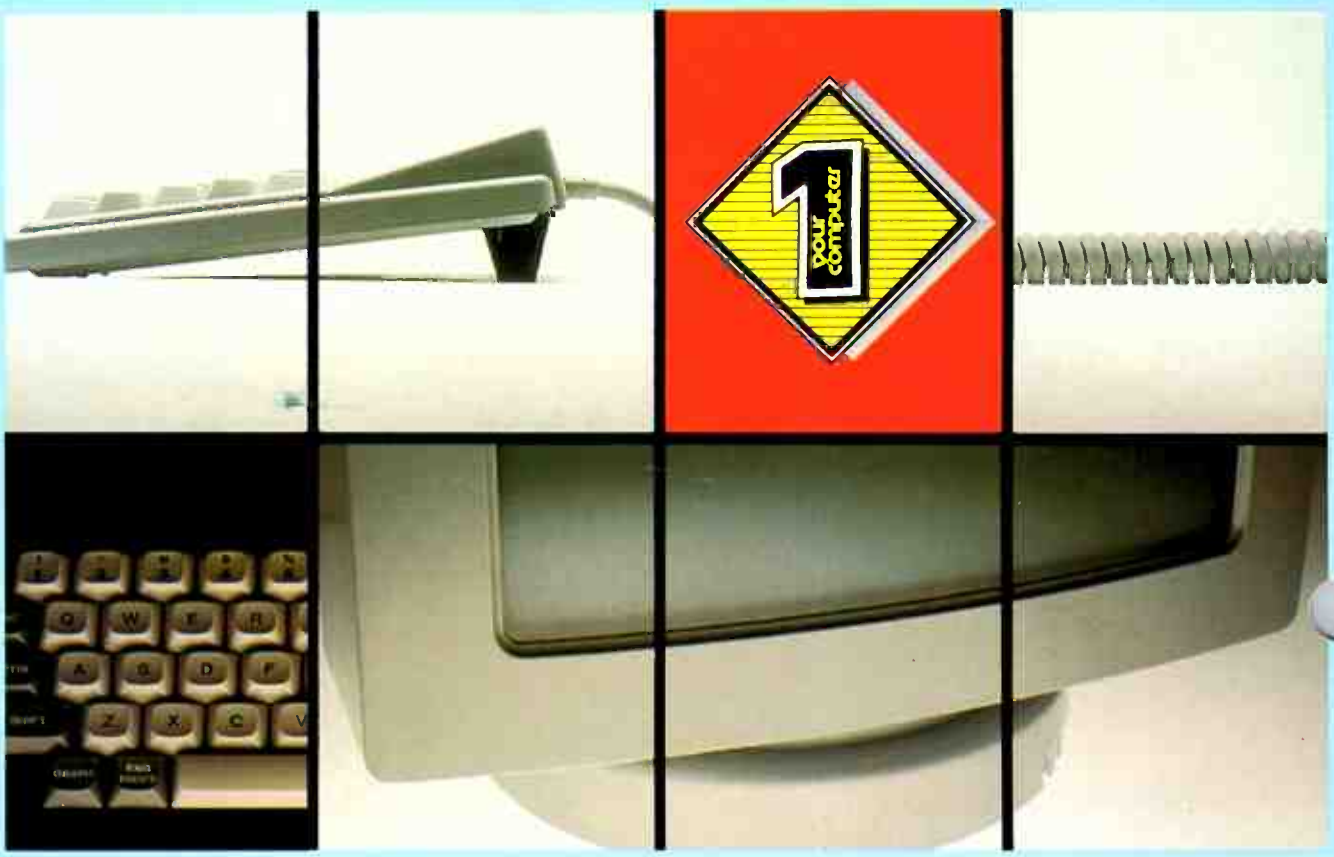
The business of the council is largely conducted through sub-committees and user groups. An Education and Training committee holds seminars, luncheons and breakfasts to inform about standards and implemention issues in general; a Standards committee takes input from several industry groups and formulates recommendations aimed at ensuring Australian requirements are incorporated in refining the international EDIFACT standard; a Legal and Audit committee tracks and examines issues in the auditing, authentication, contract and security areas; and the Vendor committee addresses issues raised by the members and other committees.

Importantly, the Council is plugged into the international scene, so developments in Australia remain in sync with our international trading partners. Recommendations travel a well-defined path stemming from industry groups, through EDICA to Standards Australia (national), on to the newly formed Australasian EDIFACT Board (regional) and finally to the United Nations EDIFACT body (global).

Since there are just three other regional boards — Western and Eastern Europe and Northern America, each with one rapporteur — the formation of the Australasian Board effectively gives Australia a 25 per cent say in global developments. Hence, claims Baker, anyone who is serious about EDI is in EDICA. ■

EDI

INTO COMPUTERS?



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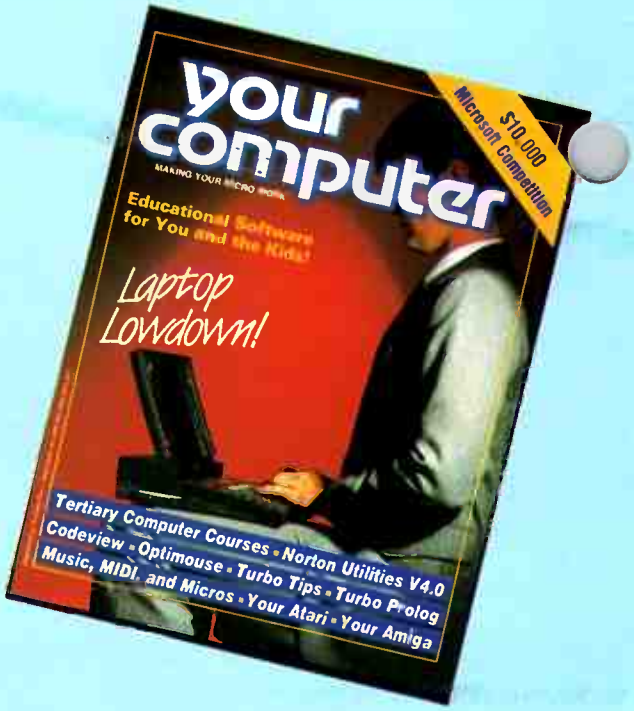


165 MWPS respectively. The parts have optional video controls and can directly drive doubly-terminated 50 or 75 Ohm loads to standard composite video levels. The DACs have an internal reference to supply themselves and the HADC77200 with a stable voltage reference and gain control for different output voltage swings.

The HCMP96870 is a high speed dual differential voltage comparator used to generate an ECL compatible clock signal from any type signal generator.

The board is in Eurocard format with a 64-pin dual height DIN connector for digital data. The analogue inputs, outputs and clock input are standard 50 Ohm BNC connectors. Tektronix high impedance probe jacks are provided to monitor the clock lines. Standard −5.2 V +5 V, and +/−12 to +/−15 Volt power supplies are required for operation of the board, with normal power dissipation of less than 11 Watts.

The ETI-1547 evaluation board consists of seven function sections that include an analogue input buffer, A-D converter, input/output multiplexer and data latches, D-A converter, reference voltage generator, ECL clock generator, and ECL clock divider. The analogue and digital grounds are separated on the board for better system grounding characteristics.

There are jumper options available to switch sections in or out of the system to suit individual needs. The clock divider circuitry is on a separate board that plugs into the main board to provide divide by 2 or 4 for the multiplexer and DAC. The jumper options will be discussed in more detail in the following sections. In addition, 90 MHz low pass input and output filters are on board.

Analogue input buffer

This section consists of a 90 MHz low pass filter, HA2539 high frequency op-amp, and a 2N5836 RF transistor. The input impedance is 50 Ohm and the gain is set at 2X so that a 1 Volt input can be applied. Compensation components are provided and can be adjusted for the desired frequency range needed. The compensation is adjusted for the desired frequency for 50 MHz bandwith operation. The bandwidth of the buffer amplifier can be increased by decreasing the gain to 1X by changing the 1.5k Ohm feedback resistor to 750 Ohm. The BNC connector shown in the schematics and layout near the output of the buffer can be used for monitoring the buffer output and input to the HADC77200. The BNC should be connected to a 50 Ohm terminated oscilloscope and will provide a 10X attenuated signal.

The positive input to the HA2539 is tied to an offset adjust to centre the input signal to the HADC77200 around −1 V, which is needed if a 2Vp-p input signal is applied. The input buffer can be bypassed by removing the 6.8 Ohm resistor at the emitter of the 2N5836 and the 450 Ohm resistor between

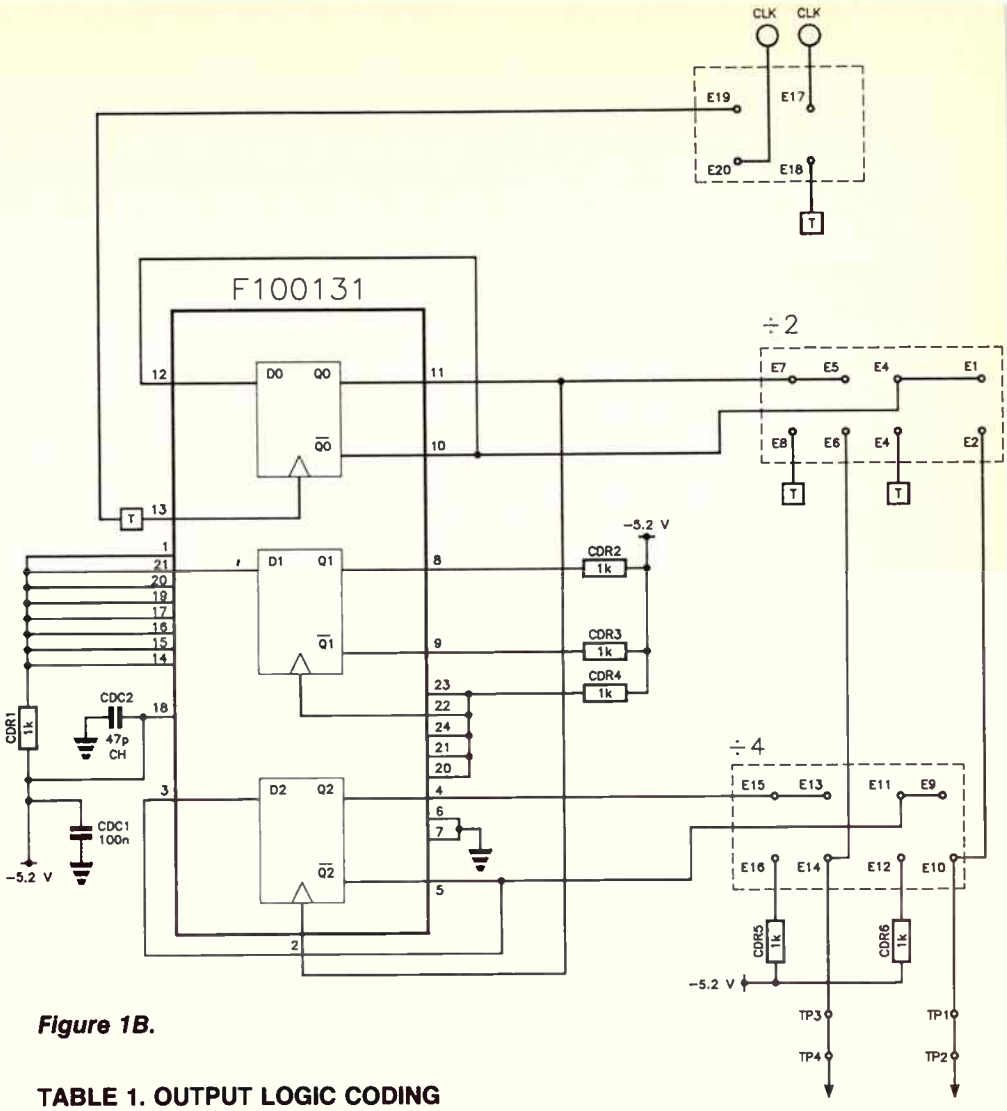


Figure 1B.

TABLE 1. OUTPUT LOGIC CODING

MINV LINV	0 0	0 1	1 0	1 1
OV	111...11	100...00	011...11	000...00
.	111...10	100...01	011...10	000...01
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
VIN .	100...00	111...11	000...00	011...11
.	011...11	000...00	111...11	100...00
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	000...01	011...10	100...01	111...10
−2V	000...00	011...11	100...00	111...11

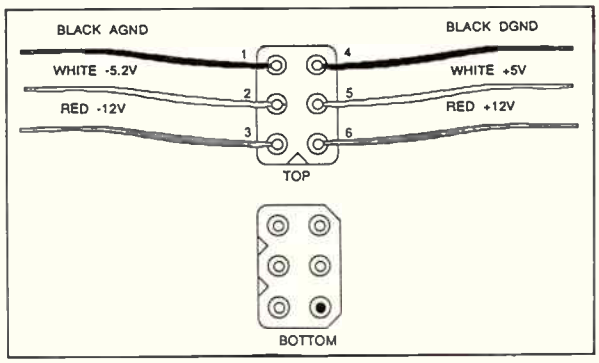


Figure 1C. Power supply harness configuration.

ELECTRONICS
ETI-1547

the BNC connector and the HADC77200. Bypass the 450 Ohm resistor with a jumper wire and the HADC77200 can now be driven directly. The input impedance is 4k Ohm in parallel with a 56pF distributed capacitance.

100K clock generation

The ECL clock section consists of an HCMP96870 dual comparator, duty cycle and hysteresis adjust, F100131 triple D flip-flop and several jumper options. Any type of high frequency signal generator can be connected to the BNC input to the comparators. Both inputs to the dual comparators are connected to the BNC. There are four outputs which generate differential 100k ECL clock signals. One set goes directly to the HADC77200 while the other two can go to the F100155 multiplexers and HDAC10181/51400 or to the clock divider circuitry.

The threshold input to the HCMP96870 comparators are connected together to a

Figure 2.

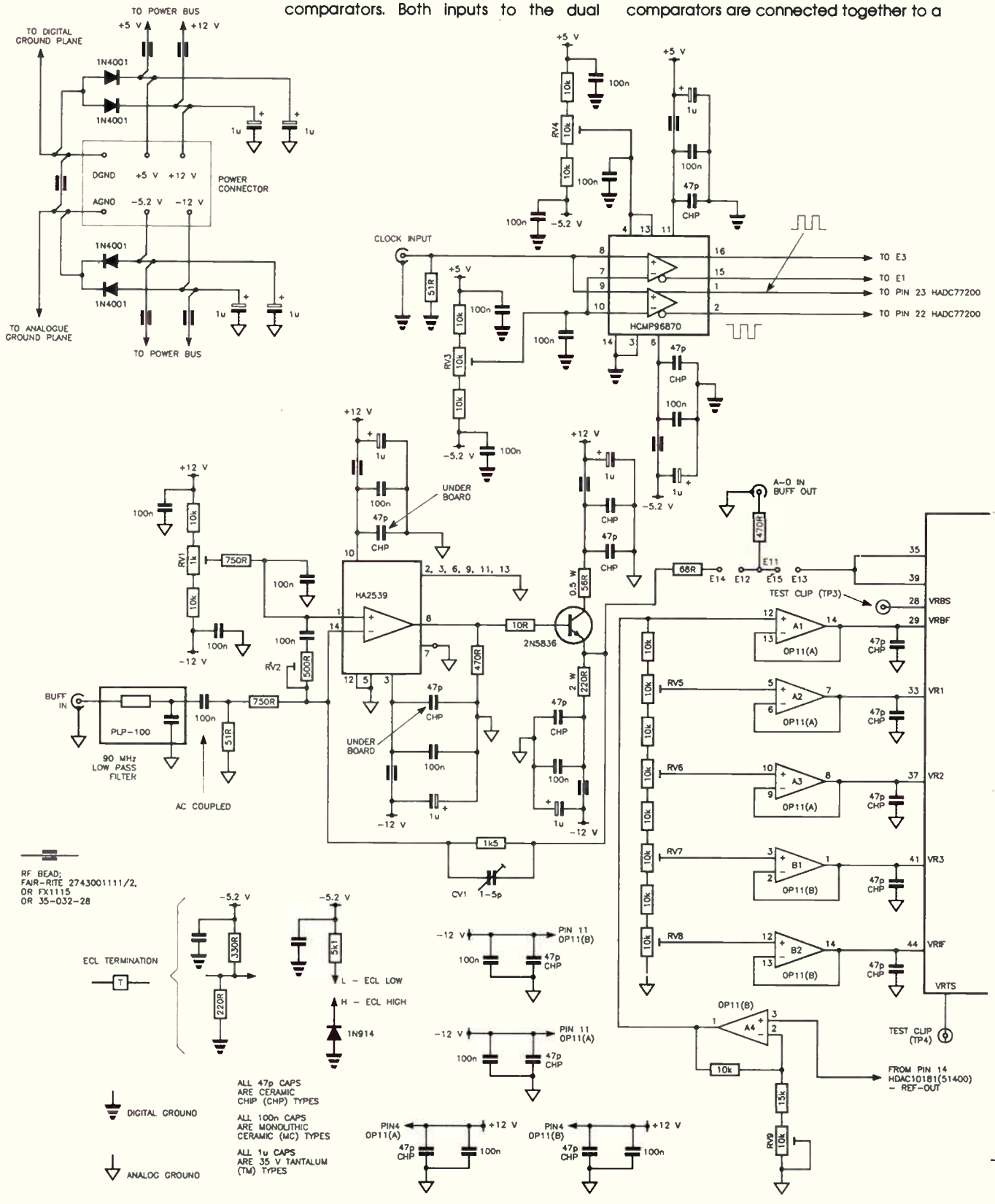


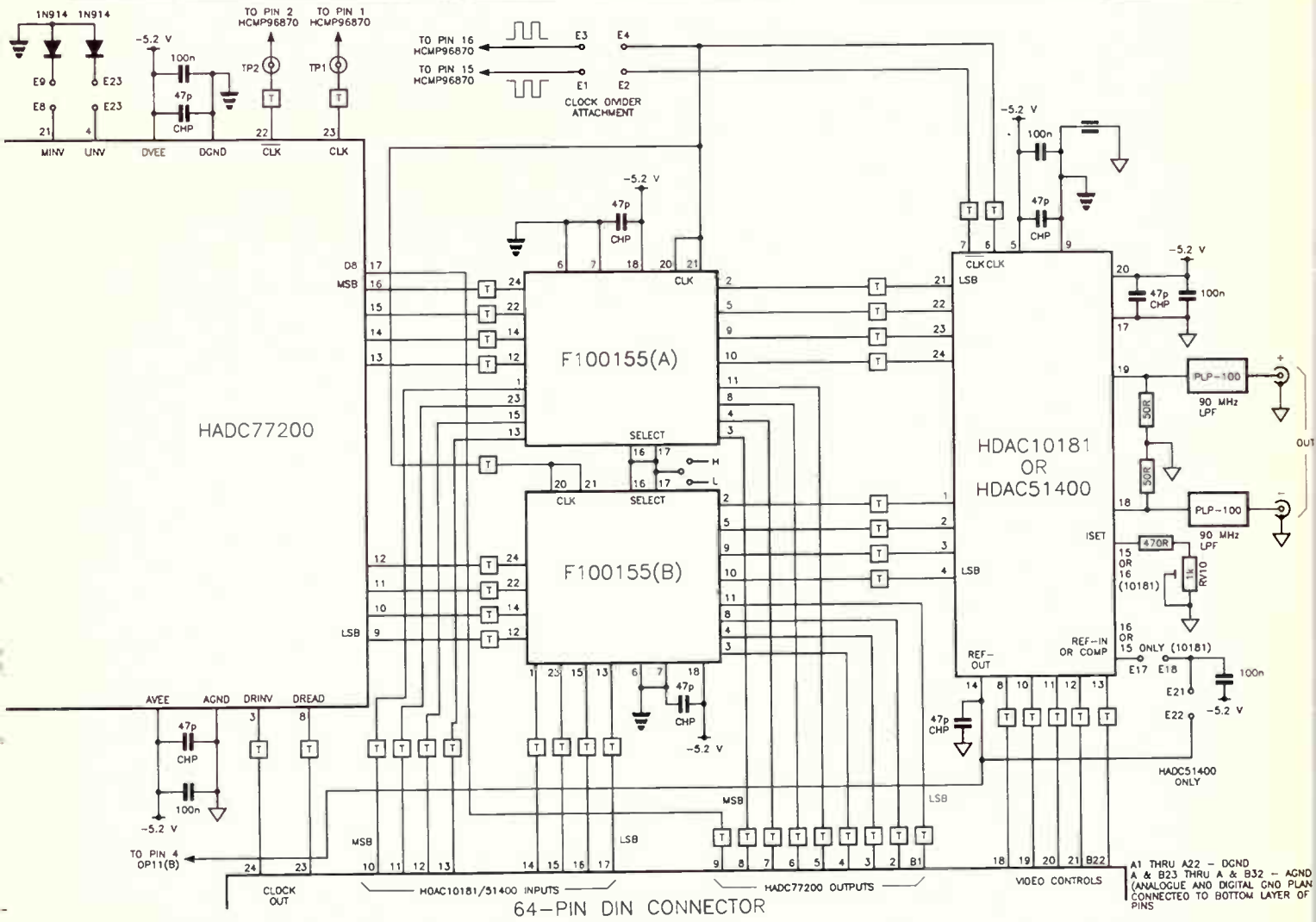
TABLE 2. POTENTIOMETER AND CAPACITOR ADJUSTMENTS	
No.	**FUNCTION**
RV9	Pot for adjusting gain to produce a 2V reference voltage for the VRB pin on the HADC77200 from the 1.2V reference voltage supplied by the HDAC10181/51400.
RV5 RV6, RV7	Pots for setting the linearity adjustments at the comparator reference ladder on the HADC77200.
RV8	Pot for setting the top point (VRT) on the reference voltage ladder. Nominally set at 50m V below AGND.
RV10	Pot for adjusting output current drive from the HDAC10181/51400 (see data sheets). Vout+=25.6 (digital code X Iset)/RL
RV3	Pot for setting the HCMP96870 comparator threshold voltage to adjust the ECL clock duty cycle.
RV4	Pot for adjusting comparator hysteresis.
RV1	Pot for adjusting up to a 2V offset voltage at the buffer output for driving the HADC77200.
RV2	Pot for adjusting compensation and bandwidth for the buffer circuitry. This has been set for maximum bandwidth by turning to the full counterclockwise range. The frequency range can be decreased by adjusting the potentiometer clockwise.
CV1	"Lead" Capacitor for changing the damping factor of the input buffer, used in conjunction with Pot RV2. This has been set for a flat response.

FEATURES

- 150 Megasample/second minimum conversion rate.
- 70 MHz full-scale input bandwith.
- 1/2 LSB integral linearity. (Adjustable with three reference ladder taps).
- Low clock duty cycle sensitivity. (Adjustable).
- ECL clock produced from any signal generator.
- Improved D/A output drive, doubly-terminated 50 Ohm.

APPLICATIONS

- Evaluation of HADC77200 A/D converter.
- Evaluation of HDAC10181/51400 D/A converter.
- High definition video.
- Digital oscilliscopes.
- Transient capture.
- Radar, EW.
- Direct RF down-conversion
- Medical electronics; ultrasound; CAT instrumentation



64–PIN DIN CONNECTOR

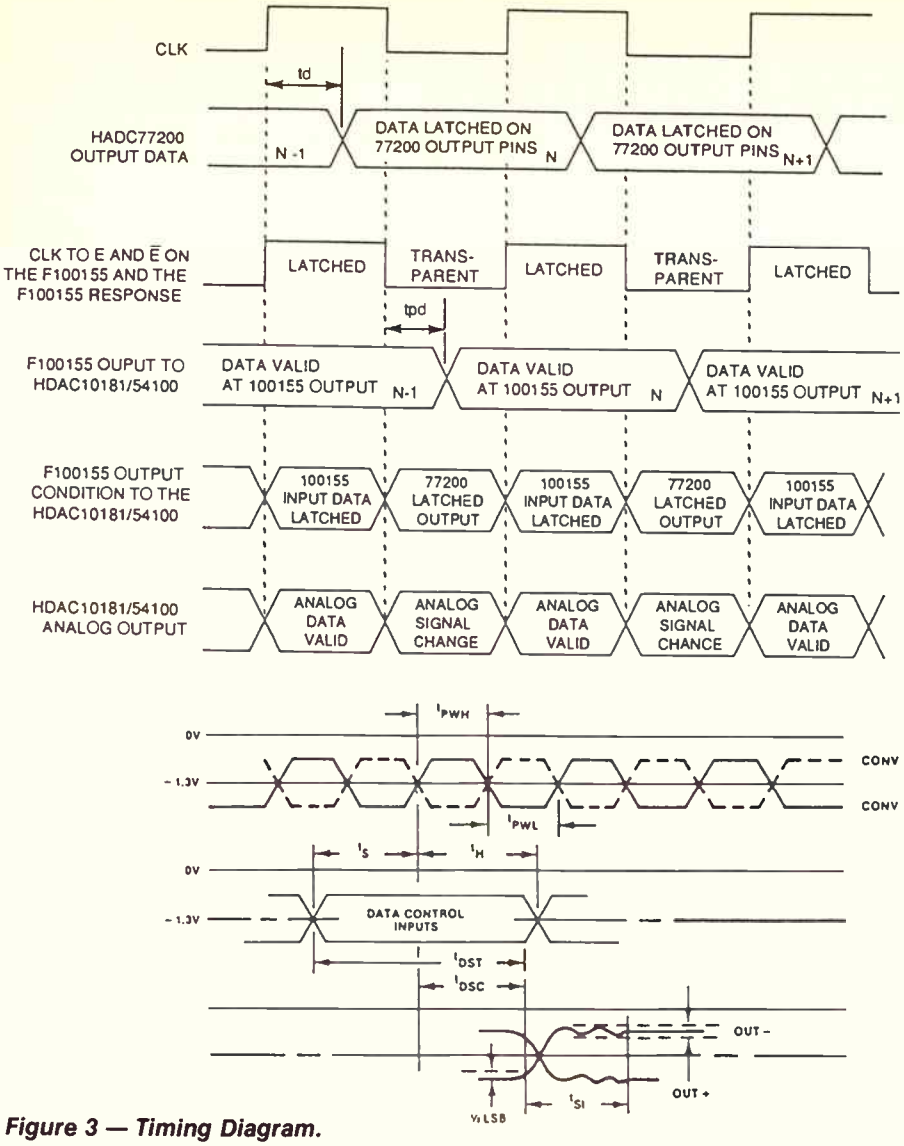


Figure 3 — Timing Diagram.

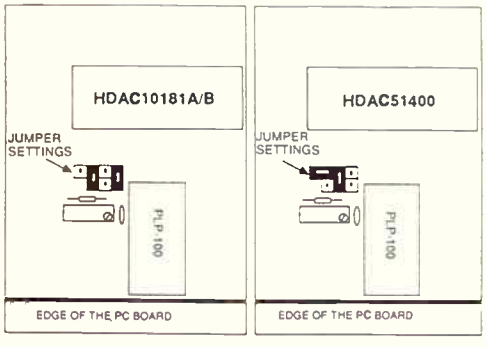


Figure 4. Jumper position and connections for either the HDAC10181 A/B or HDAC51400 (Not To Scale).

pot to adjust the duty cycle of the clock. The latch enable pins are also connected together to a pot to adjust hysteresis.

100K ECL clock divider

The clock divider section is shown in Figure 1B and consists of a triple D type flip-flop, which, if jumpered as shown, will provide divided down clock outputs. The clock divider can be bypassed to provide a full frequency clock. The divider is provided to make it easier to monitor the HADC77200 output with a low frequency logic analyser and to provide the DAC with a reduced sampling rate. When switching between divide by 2 or 4, the unused outputs "Q" and "Q\" must be terminated. The board is initially set in the divide by 4 mode. Furthermore, the jumpers on the clock lines to the multiplexer and DAC must be removed.

Reference voltage generator

The reference voltage for the HADC77200 and HDAC10181/51400 is internally generated by the D-A converter voltage reference of approximately 1.2 Volts. The A-D converter's 2 Volt reference, voltage midtaps and ground are controlled by two PMI quad op-amps (OP-11).

The magnitude of each setting is further adjusted with potentiometer RV5, RV9, RV8, RV6, and RV7 and shown in the detailed schematic and board layout.

Input/output register and multiplexer

The multiplexer section consists of two F100155 which select between external 8-bit digital data from the 64-pin DIN connector or data from the output of the HADC77200.

The choice is controlled by tying the SELECT pins to either an ECL high for external data or an ECL low for HADC77200 data. This data is then fed to the HDAC10181/51400 on the "Q" outputs of the F100155 and the "Q\" outputs are tied to the external connector.

A-D converter section

Both input pins to the HADC77200 are tied together to be either fed by the input buffer or by an external source. The MINV and LINV inputs are left open and tied internally to an ECL low. Diodes are provided to tie them high and change the output logic.

The connection choices for determining the output logic are in Table 1.

D-A converter section

The D-A converter section contains jumpers to use either the HDAC10181 or HDAC51400. The primary difference in the two parts is the reference voltage connections. These differences are shown in the detailed schematic in Figure 2. All jumpers will be connected for the HDAC10181A; if an HDAC51400 is used the board is changed. Figure 4A and 4B show the jumper settings.

The output current magnitude for the HDAC10181/51400 is controlled by a potentiometer (RV10) through the DAC's Iset control pin. In addition, two 90 MHz low pass filters are provided at both out – and out + output pins as well as 50 Ohm terminating resistors. The terminating resistors can be changed to 75 Ohm if desired. Keep in mind that the transmission line must be terminated at the receiving end with the same value resistor. The video and feedthrough controls are routed to the 64-pin DIN connector and are normally disabled.

Power supply connections

Power to the board is supplied through a six pin Molex type connector. The supply lines are colour coded as shown in Figure 1C. Connect the wire end of the power supply harness to power supplies as shown by Figure 1C and the silk screen near the mating connector on the pc board itself. The power harness is attached to the board with the

PARTS LIST ETI-1547
FLASH CONVERTER BOARD
SEMICONDUCTORS
1 x 2N5836 transistor
1 x Honeywell HDAC10181A/B or HDAC51400
1 x Honeywell HCMP96870
1 x Honeywell HADC77200A/B
1 x Harris HA2539
2 x Fairchild F100155
2 x PMI OP-11
4 x 1N4001 or 1N4002
3 x 1N914 or 1N4148
RESISTORS
1 x 220R, 2 W
1 x 56R, 1/2 W
1 x 68R, 1/8 W
11 x 10k, 1/8 W
5 x 220R/330R SIP-packs (ECL terminations)
4 x 220R, 1/8 W
4 x 330R, 1/8 W
2 x 750R, 1/8 W
3 x 50R, 1/8 W
3 x 470R, 1/8 W
1 x 10R, 1/8 W
1 x 15k, 1/8 W
1 x 5k1, 1/8 W
1 x 1k5, 1/8 W
1 x 500R circular pc-trimpot
1 x 1k circular pc-trimpot
1 x ik upright pc-trimpot
7 x 10k circular pc-trimpots
CAPACITORS
32 x 100n monolithic ceramics
16 x 47p ceramic chips
10 x 1u/35 V tantalums
1 x 1-5p min. pc-mount trimmer
MISCELLANEOUS
1 x pc board (EB101)
1 x 24-pin IC socket
1 x 64-pin DIN connector
18 x jumper pins
5 x pc-mount 50 Ohm BNC sockets
3 x 90 MHz low-pass filters
1 x Molex 6-pin keyed plug (pc-mount)
1 x Molex 6-pin plug to match
2 x Tektronix test points
Sundry test point terminations
CLOCK DIVIDER BOARD
1 x Fairchild F100131
1 x 100n monolithic ceramic cap
6 x 1k, 1/8 W resistors
4 x 220R, 1/8 W resistors
4 x 330R, 1/8 W resisitors
1 x 47p chip capacitor
2 x test point terminations
2 x Tektronix test points
9 x pin plugs
9 x pin sockets
pc board

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.

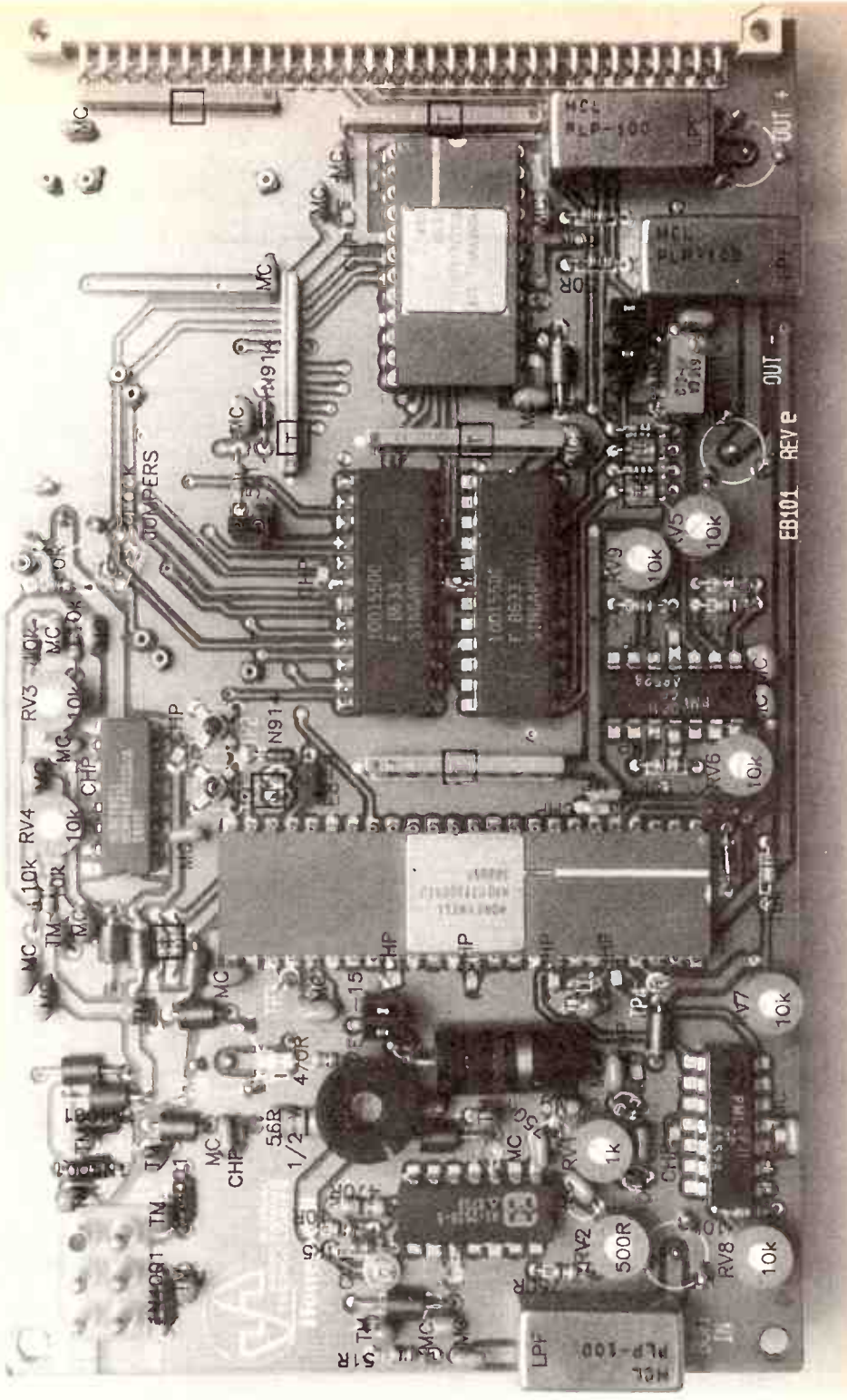


Figure 5. Component overlay of the main Flash Converter board, identifying the minor components, etc. Note that the output DAC is socketed so that either the HDAC10181 or HDAC51400 may be used. Assembly best proceeds in the following order: solder in the DAC socket, then all the other ICs, 2N5836 (note its heatsink) and diodes. Thread RF beads on short lengths of tinned copper wire and solder them (all 11!) in place next. Then solder the chip capacitors in place, not forgetting the two beneath the HA2539 (between pins 3-4 and 10-11). Follow by soldering all the small resistors (note those which stand on end) and capacitors in place, the five SIP-pack ECL terminations (note orientation), the jumper pins and the 220R/2W resistor last. Next, solder the BNC sockets in place, followed by the low-pass filters and test point terminations. All the trimpots and CV1 follow. If the external clock divider board is not to be used, solder the CLOCK JUMPERS in place now. Otherwise, solder the clock divider board's pin sockets in place. Last of all, solder in the 64-pin DIN socket and the power supply plug. Set up your jumpers as described in the text.

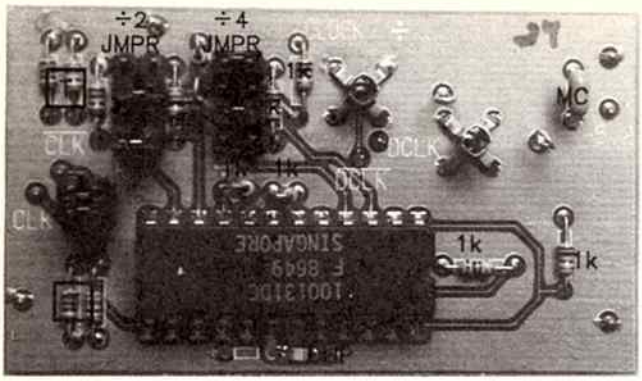
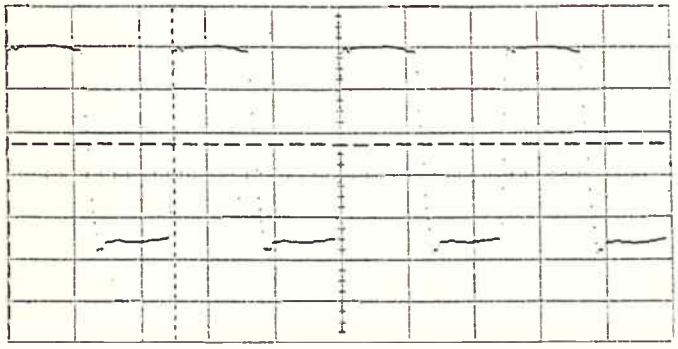


Figure 6. Component overlay for the Clock Divider board. Assembly is quite straightforward. Solder the resistors and capacitors in first, then the jumper pins go on the underside of the board. Solder the IC in last on this board. Set the jumpers as required.

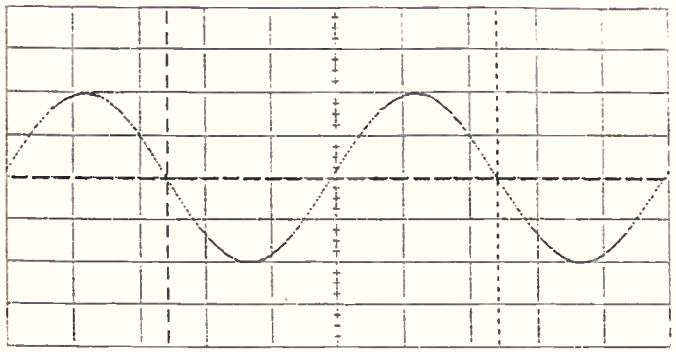


-100.000 nsec 0.00000 sec 100.000 nsec

Ch. 2	=	200.0 mvolts / div	Offset	=	-1.330 volts
Timebase	=	20.0 nsec / div	Delay	=	0.00000 sec
Ch. 2 Parameters			P-P Volts	=	968.7 mvolts
Rise Time	=	1.670 nsec	Fall Time	=	2.910 nsec
Freq.	=	20.1532 MHz	Period	=	49.620 nsec
+ Width	=	24.940 nsec	- Width	=	24.680 nsec
Overshoot	=	6.249 mvolts	Preshoot	=	43.75 mvolts

Trigger mode: Edge
On Pos. Edge on Chan2
Trigger Levels
Chan2 = -1.180 volts
Holdoff = 70.000 nsecs

Figure 7. Clock output at the Tektronix Probe Jacks.

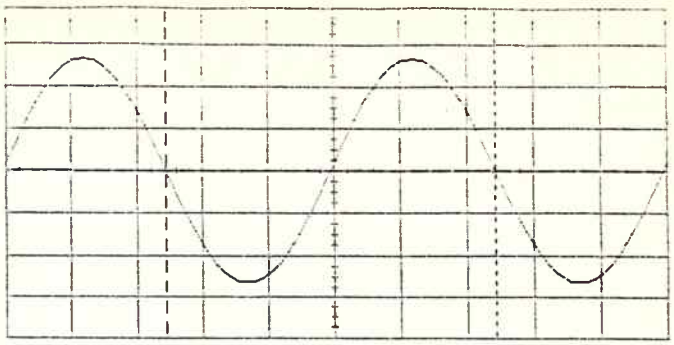


-1.00000 usec 0.00000 sec 1.00000 usec

Ch. 1	=	50.00 mvolts / div	Offset	=	-100.0 mvolts
Timebase	=	200 nsec / div	Delay	=	0.00000 sec
Ch. 1 Parameters			P-P Volts	=	200.0 mvolts
Rise Time	=	294.080 nsec	Fall Time	=	289.910 nsec
Freq.	=	997.904 KHz	Period	=	1.00210 usec
+ Width	=	499.810 nsec	- Width	=	502.290 nsec
Overshoot	=	1.562 mvolts	Preshoot	=	1.562 mvolts

Trigger mode: Edge
On Pos. Edge on Chan1
Trigger Levels
Chan1 = -100.0 mvolts
Holdoff = 70.000 nsecs

Figure 9. Output signal from the "buffer out" BNC connector. (50Ω impedance).

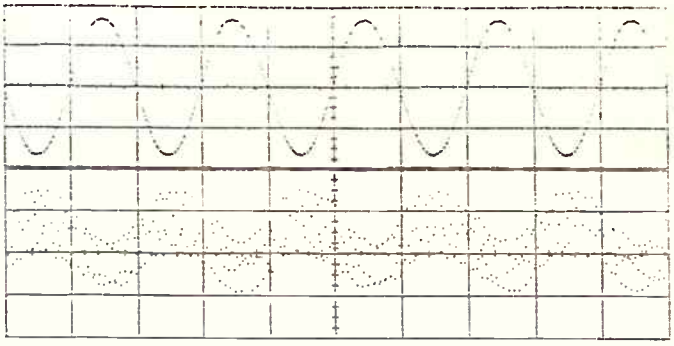


-1.00000 usec 0.00000 sec 1.00000 usec

Ch. 1	=	200.0 mvolts / div	Offset	=	0.000 volts
Timebase	=	200 nsec / div	Delay	=	0.00000 sec
Ch. 1 Parameters			P-P Volts	=	1.062 volts
Rise Time	=	289.640 nsec	Fall Time	=	289.320 nsec
Freq.	=	1.00014 MHz	Period	=	999.860 nsec
+ Width	=	497.520 nsec	- Width	=	502.340 nsec
Overshoot	=	6.249 mvolts	Preshoot	=	6.249 mvolts

Trigger mode: Edge
On Pos. Edge on Chan1
Trigger Levels
Chan1 = 0.000 volts
Holdoff = 70.000 nsecs

Figure 8. Input signal to the board (50Ω input impedance).

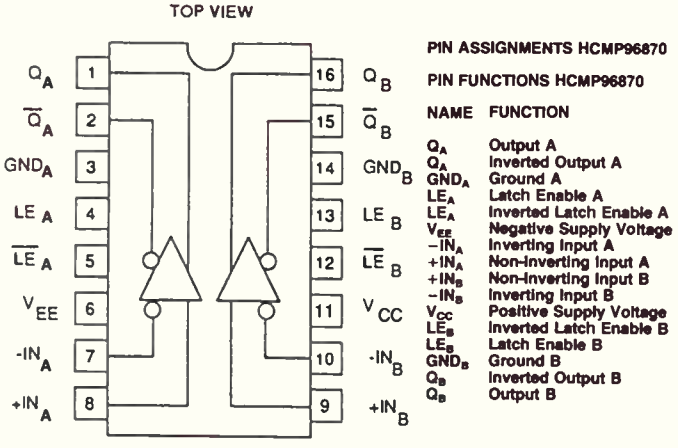


-2.50000 usec 0.00000 sec 2.50000 usec

Ch. 1	=	200.0 mvolts / div	Offset	=	0.000 volts
Ch. 2	=	40.00 mvolts / div	Offset	=	-102.0 mvolts
Timebase	=	500 nsec / div	Delay	=	0.00000 sec

Trigger mode: Edge
On Pos. Edge on Chan1
Trigger Levels
Chan1 = 0.000 volts
Holdoff = 70.000 nsecs

Figure 10. Oscillations are apparent and adjustment is necessary.



16 LEAD CERAMIC

PIN ASSIGNMENTS HCMP96870

PIN FUNCTIONS HCMP96870

NAME	FUNCTION
Q_A	Output A
$\overline{Q}_A$	Inverted Output A
GND_A	Ground A
LE_A	Latch Enable A
$\overline{LE}_A$	Inverted Latch Enable A
V_{EE}	Negative Supply Voltage
$-IN_A$	Inverting Input A
$+IN_A$	Non-Inverting Input A
$+IN_B$	Non-Inverting Input B
$-IN_B$	Inverting Input B
V_{CC}	Positive Supply Voltage
$\overline{LE}_B$	Inverted Latch Enable B
LE_B	Latch Enable B
GND_B	Ground B
$\overline{Q}_B$	Inverted Output B
Q_B	Output B

bevelled edges and hollow connector alligned to the mating connector.

The power requirements for the board at different supplies and with or without the clock divider board is shown in Table 3. When powering up the board, check to see if the current draw from each supply is equivalent to the numbers in the table. If there is a large difference, then recheck your connections. Supply protection diodes are on the board for any reverse polarity connection, but over-voltage protection is not provided.

DO NOT TURN ON THE POWER UNTIL ALL LEADS ARE CONNECTED TO THE SUPPLIES AND THE HARNESS IS ON THE BOARD!

Anti-aliasing & clock noise filters

The input to the buffer circuitry and the differential outputs from the D-A converter are provided with high frequency noise filters. The three filters are 90 MHz low pass and are intended to be used with the full analogue input frequency and full clock sampling rate of the HADC77200 A-D converter. If lower frequencies are used, the filters should be changed to filter clock noise and harmonics for a particular application.

Additional filtering can be achieved by decreasing the bandwidth of the input buffer by adjusting the 500 Ohm potentiometer (RV2 in Figure 3) clockwise. Also, adjustment of the clock duty cycle with potentiometer RV3 will lower the overall noise floor by controlling the setup and hold time of the digital data for the multiplexers (F100155) and DAC (HDAC10181).

Setup procedure

The board is accompanied with a literature package containing the "AN102 APPLICATION NOTE", the "HADC77200", "HDAC5140O", "HDAC10181", and "HCMP9687O" data sheets.

STEP 1. Connect the wire end of the power supply harness to power supplies as shown in Figure 1C. The power harness should be connected to the board with the bevelled edges and hollow connector alligned for correct operation.

DO NOT TURN ON THE POWER UNTIL ALL LEADS ARE CONNECTED TO THE SUPPLIES AND THE HARNESS IS ON THE BOARD!

Table 3 shows the power requirements for the board. Use the current meters on the power supply or a DMM in line with the power lines and set on current (I). These current values will vary somewhat until all the potentiometers are adjusted. When powering up the board, check to see if the current draw from each supply is equivalent to the numbers in the table. If there is a large difference, then recheck your connections. Supply protection diodes are on the board for any reverse polarity connection, but over-voltage protection is not provided.

STEP 2. Refer to Figures 2 and 5. Place a DMM probe (set to voltage selection) on the black jumpers at the input to the HADC77200 (E14). This should read −1 V and is adjusted by turning potentiometer RV1 (See Table 2).

STEP 3. Again, refer to Figures 2 and 4 and Table 4. Place a DMM probe (set to voltage selection) on pin 3 of the OP11-A and read approximately −1.2 V. If it does not, then check to see if the black jumpers for the HDAC10181/51400 are set up for the right part (see Figure 4).

Next, set the probe on pin 1 of the OP11-A. This should read −2 V and is adjusted by turning potentiometer RV9. Now set the probe on pin 7 of the OP11-A. This should read approximately −1.5 V and is adjusted by potentiometer RV5. Pin 8 of the OP11-A should read −1.0 V and is adjusted by potentiometer RV6.

On the other amplifier, OP11-B, potentiometer RV7 controls the output from pin 1 and should read −0.5 V. Finally, RV8 sets up the output from pin 14 on OP11-B and can be set between GROUND and −50 mV.

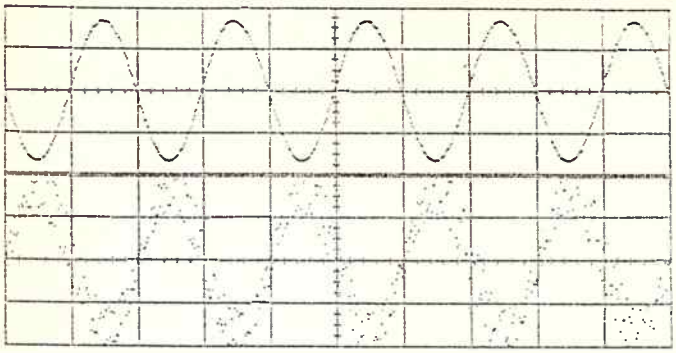
STEP 4. Refer to Figures 2 and 5. Attach a 50 Ohm BNC cable to the "CLK IN" BNC connector. Attach the other end to a sinewave or signal generator set at 20 MHz frequency and 1Vp-p amplitude (if 1Vp-p is not available, amplitudes down to 100mVp-p are acceptable). Put a Tektronix or H.P. high impedance probe in one or both of the probe jacks immediately below the HCMP96870 comparator.

Adjust potentiometer RV3 to achieve a 50% duty cycle squarewave (both "high" and "low" states are the same length). Adjust potentiometer RV4 if no waveform is present and/or to get rid of any jitter in the square wave (this is a hysteresis adjustment). The square wave amplitude should be approximately 900mVp-p and look like Figure 7.

STEP 5. Refer to Figure 2 and 5. Attach a 50 Ohm coax cable to the BNC connector marked "BUFFER IN". Use a second sinewave or signal generator set at 1 MHz frequency and 1Vp-p amplitude (See Figure 8). Attach another cable to the BNC connector "A-D IN/BUFFER OUT" and to an oscilliscope set at 50 Ohm input impedance. A 200mVp-p amplitude signal swinging around −100mVdc should appear at a 1 MHz frequency (See Figure 9).

If oscillation is evident (erratic signal amplitude or wrong frequency), Adjust potentiometer R22 to the full counterclockwise range. Now adjust capacitor C25 to stop the oscillation. See Figures 10, 11 and 12.

STEP 6. This measurement is done without the clock divider board connected and clock jumpers inserted as shown in Figure 5. Again referring to Figures 2 and 5, attach a 50 Ohm coax cable to the BNC connector marked "OUT −" and another cable to "OUT +".

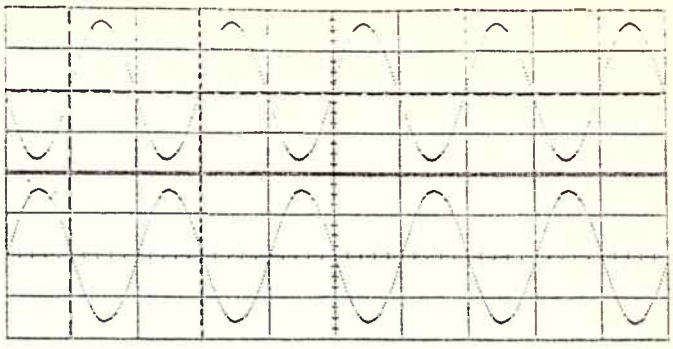


-2.50000 usec 0.00000 sec 2.50000 usec

Ch. 1	200.0 mvolts / div		Offset	0.000 volts
Ch. 2	40.00 mvolts / div		Offset	-102.0 mvolts
Timebase	500 nsec / div		Delay	0.00000 sec

Trigger mode: Edge
On Pos. Edge on Chan1
Trigger Levels
Chan1 = 0.000 volts
Holdoff = 70.000 nsecs

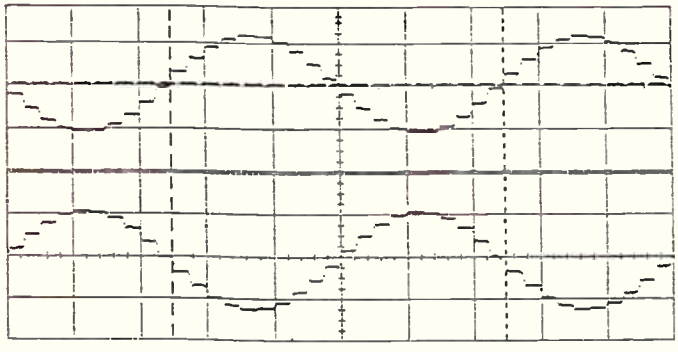
Figure 11. The oscillations are decreasing and the bottom waveform is starting to approach the same shape as the top waveform.



-2.50000 usec 0.00000 sec 2.50000 usec

Ch. 1	200.0 mvolts / div		Offset	0.000 volts
Ch. 2	40.00 mvolts / div		Offset	-102.0 mvolts
Timebase	500 nsec / div		Delay	0.00000 sec
Ch. 1 Parameters			P-P Volts	665.6 mvolts
Rise Time	290.790 nsec		Fall Time	291.830 nsec
Freq.	999.990 KHz		Period	1.00001 usec
+ Width	500.180 nsec		- Width	499.830 nsec
Overshoot	0.000 volts		Preshoot	0.000 volts

Figure 12. Oscillation has stopped and the bottom waveform is the same shape as the top waveform but is inverted.

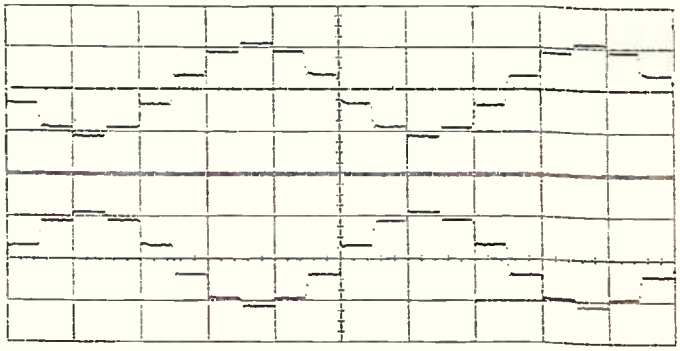


-1.00000 usec 0.00000 sec 1.00000 usec

Ch. 1	400.0 mvolts / div		Offset	-964.0 mvolts
Ch. 2	400.0 mvolts / div		Offset	-544.0 mvolts
Timebase	200 nsec / div		Delay	0.00000 sec
Ch. 1 Parameters			P-P Volts	912.5 mvolts
Rise Time	290.470 nsec		Fall Time	297.770 nsec
Freq.	1.00264 MHz		Period	997.370 nsec
+ Width	499.250 nsec		- Width	498.120 nsec
Overshoot	6.249 mvolts		Preshoot	6.249 mvolts

Trigger mode: Edge
On Neg. Edge on Chan1
Trigger Levels
Chan1 = -964.0 mvolts
Holdoff = 70.000 nsecs

Figure 13. Output waveforms from "out−" and "out +" without the clock divider board inserted and the clock jumpers connected as shown in Figure 4.



-1.00000 usec 0.00000 sec 1.00000 usec

Ch. 1	400.0 mvolts / div		Offset	-936.0 mvolts
Ch. 2	400.0 mvolts / div		Offset	-576.0 mvolts
Timebase	200 nsec / div		Delay	0.00000 sec
Ch. 1 Parameters			P-P Volts	912.5 mvolts
Rise Time	201.240 nsec		Fall Time	201.350 nsec
Freq.	1.00255 MHz		Period	997.460 nsec
+ Width	499.050 nsec		- Width	498.410 nsec
Overshoot	100.0 mvolts		Preshoot	100.0 mvolts

Trigger mode: Edge
On Neg. Edge on Chan1
Trigger Levels
Chan1 = -936.0 mvolts
Holdoff = 70.000 nsecs

Figure 14. "Out−" and "out+" with the clock divider board inserted and set at +2 mode.

Attach the other end to an oscilliscope set to 50 Ohm input impedance.

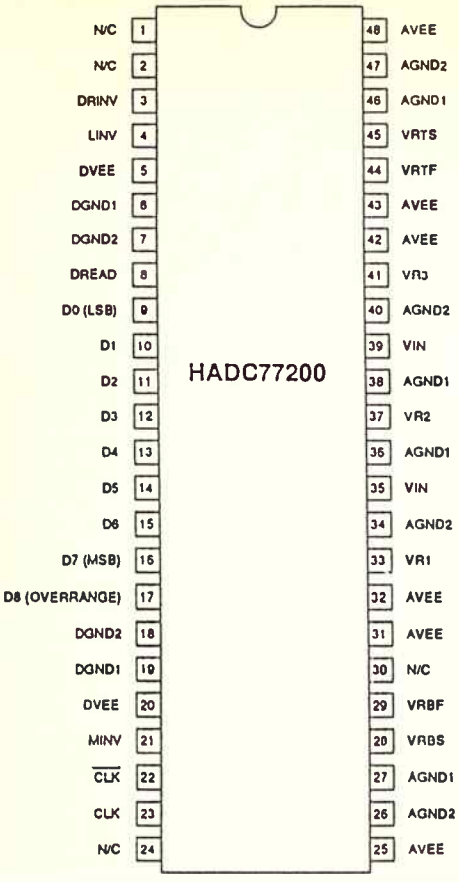
The outputs should be the opposite of each other and at approximately a 900mV amplitude. Adjust potentiometer RV10 to achieve this level. Do not adjust too far or the signal will start deteriorating. See Figure 13. After compieting step 6, remove one end of each clock jumper wire and leave the other end soldered to the board.

STEP 7. Insert the clock divider board and connect the shorting jumpers to the posts in the ÷2 configuration and compare to the waveform in Figure 14.

STEP 8. Insert the clock divider board and connect the shorting jumpers to the posts in the ÷4 configuration and compare to the waveform in Figure 15. eti

TABLE 3 — POWER DISSIPATION

EB100 with clock divider, ±15V			
Voltage	**Current**	**Power**	
+15V	.145A	2.175W	
−15V	.148A	2.220W	
+5V	.006A	0.030W	
−5.2V	1.65A	8.580W	
		13.005W	
EB100 W/O clock divider, ±12V			
Voltage	**Current**	**Power**	
+12V	.119A	1.428W	
−12V	.123A	1.476W	
+5V	.006A	0.030W	
−5.2V	1.49A	7.748W	
		10.682W	



48 LEAD CERAMIC SIDEBRAZED DIP

PIN FUNCTIONS HADC77200

NAME	FUNCTION
DRINV	Data Ready Inverse
LINV	D0 through D6 Output Inversion Control Pin
AVEE	Negative Analogue Supply Nominally-5.2V
DVEE	Digital Analogue Supply Nominally-5.2V
DGND1	Digital Ground 1
DGND2	Digital Ground 2
DREAD	Data Ready Output
DO	Digital Data Output Pin 1 (LSB)
D1-D6	Digital Data Output Pin 2 Through 6
D7	Digital Data Output Pin 7 (MSB) Overrange Output
D8	D7 Output Inversion Control Pin
MINV	Inverse ECL Clock Input Pin
CLK	ECL Clock Input Pin
CLK	Reference Voltage Bottom, Sense Nominally-2.0V
VRBS	Reference Voltage Bottom, Force Nominally-2.0V
VRBF	Reference Voltage Tap 1
VR1	Analogue Ground 1
AGND1	Analogue Input, can be connected to the Input signal or used as a Sense
VIN	Analogue Ground 2
AGND2	Reference Voltage Tap 2
VR2	Analogue Input, can be connected to the Input signal or used a a Sense
VIN	Reference Voltage Tap 3
VR3	Reference Voltage Top, Sense Nominally 0V
VRTS	Reference Voltage Top, Force
VRTF	Nominally 0V

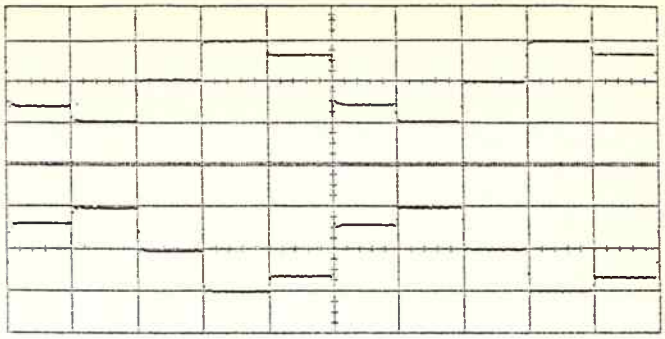
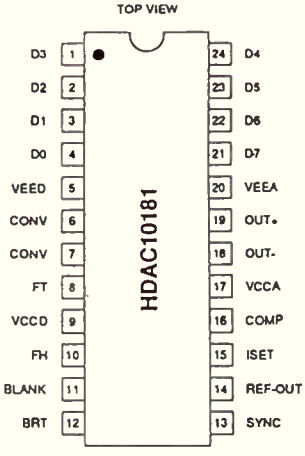


Figure 15. "Out−" and "out+" with +4 clock divider mode.

TABLE 4. EQUIPMENT LIST

- **2 Signal generators capable of producing 1MHz and 20MHz sinewaves at up to 1Vp-p output levels into 50Ω H.P.8656A or equivalent.**
- **1 Oscilloscope either H.P. Digitising Oscilloscope Model 54100D or equivalent or Tektronix Model 2465.**
- **1 Digital Multimeter(DMM), Keithley 197 or equivalent.**
- **4 Power supplies capable of producing the power listed in Table 1. 2 Lambda LPT-7202-FM or equivalent.**
- **5 50Ω coax cables (RG58) with BNC type connectors.**
- **1 High impedance probe (1MΩ) — Tektronix or H.P.**

TOP VIEW

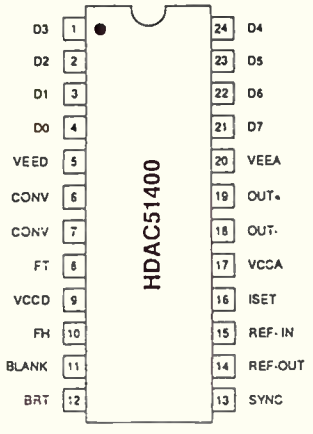


24 LEAD DIP

PIN FUNCTIONS HDAC10181

NAME	FUNCTION
D3	Data Bit 3
D2	Data Bit 2
D1	Data Bit 1
DO	Data Bit 0 (LSB)
VEED	Digital Negative Supply
CONV	Convert Clock Input
CONV	Convert Clock Input Complement
FT	Register Feedthrough Control
VCCD	Digital Positive Supply
FH	Data Force High Control
BLANK	Video Blank Input
BRT	Video Bright Input
SYNC	Video SYNC Input
REF-OUT	Reference Output
ISET	Reference Current + Input
COMP	Compensation Input
VCCA	Analogue Positive Supply
OUT−	Output Current Negative
OUT+	Output Current Positive
VEEA	Analogue Negative Supply
D7	Data Bit 7 (MSB)
D6	Data Bit 6
D5	Data Bit 5
D4	Data Bit 4

TOP VIEW



24 LEAD DIP

PIN FUNCTIONS HDAC51400

NAME	FUNCTION
D3	Data Bit 3
D2	Data Bit 2
D1	Data Bit 1
D0	Data Bit 0 (LSB)
VEED	Digital Negative Supply
CONV	Convert Clock Input
CONV	Convert Clock Input Complement
FT	Register Feedthrough Control
VCCD	Digital Positive Supply
FH	Data Force High Control
BLANK	Video Blank Input
BRT	Video Bright Input
SYNC	Video SYNC Input
REF-OUT	Reference Output
REF-IN	Reference Input
ISET	Reference Current
VCCA	Analogue Positive Supply
OUT−	Output Current Negative
OUT+	Output Current Positive
VEEA	Analogue Negative Supply
D7	Data Bit 7 (MSB)
D6	Data Bit 6
D5	Data Bit 5
D4	Data Bit 4

ELECTRONICS

ETI PROJECT BUYERS' GUIDE

Shoparound lets 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, along with useful snippets of news about products and services of interest to electronics enthusiasts.

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-782 Quad antenna

Another RF project in our series for radio amateurs, shortwave listening enthusiasts, etc. This is based on the locally designed and manufactured "Bandit" hub piece casting.

A single Bandit casting costs $30 tax paid, including postage anywhere in Australia. A pair, for a cubical quad, will cost you $60. Contact: Ashpoint Industries, 38 Birmingham St, Alexandria NSW 2015. Phone ☎ (02)693-1866, Fax ☎ (02)317-5629.

All the other mechanical components are obtainable from your local hardware store, the coax, wire and connectors etc, from many electronics retailers.

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, 26 Boron St, Sumner Park Qld 4074, Ph. ☎ (07) 376-2955, Fax ☎ (07) 376-3286. Cost is $289.

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

ETI-1547 150 MS/s A-D/D-A board

This is very much leading-edge technology and for experienced constructors only. Short form kits of components for this project will be available, containing all the ICs, the 2N5836, filters, pc boards etc through: Energy Control International, 26 Boron St, Sumner Park Qld 4074, Ph. ☎ (07) 376-2955, Fax ☎ (07) 376-3286. Cost is $399. Price for fully-built and tested units is available on request.

NEXT MONTH

D-A converter add-on for your computer

Here's a really simple digital-to-analogue (D-A) converter you can attach to your computer and program to generate all sorts of weird and wonderful signals in the audio range . . . maybe even, speech?

Wideband SWR bridge

While other magazines are still begging for RF and amateur radio projects, we just get on with presenting them for you! Here's a low-cost, accurate, simple to build SWR bridge. You can have the option of single or dual metering or drive the bargraph display from our '748 RF Monitor project.

Simple home intercom

A single IC, a handful of parts, run a little wiring between the kitchen and the garage — or wherever — and, in one Saturday afternoon, you've got an intercom! An ideal project for the newcomer to electronics.

Tips on measurement techniques

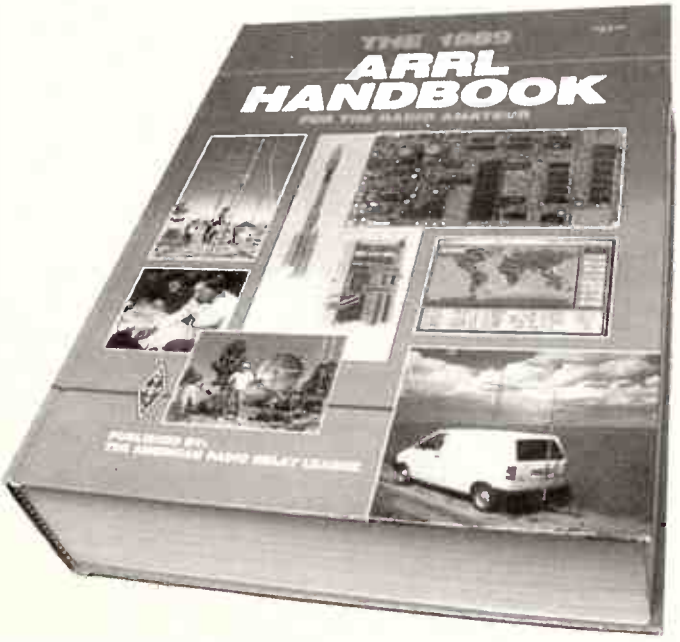
There is a law of quantum mechanics that translates loosely into "you can't measure anything without disturbing something". In electronics, this translates into the much more powerful Murphy's law: "No matter how carefully you measure something, you will get the wrong answer!" Jack Middlehurst gives practical tips on how to avoid the traps when using your multimeter.

BOOK REVIEW

1989 ARRL HANDBOOK

Throughout its history, the ARRL Handbook has been considered the bible of Amateur Radio. Originally conceived in the 1930s as a small publication to present the amateur community with tried and proven information in a time when little or nothing was available, since then the ARRL Handbook has attained and retained a pre-eminent position in the literature of the amateur radio fraternity.

The 1989 edition is not only the latest, but also marks the 75th anniversary of the ARRL itself. Accordingly, the latest edition has undergone still more massive updating since the process of completely revamping the Handbook started in 1985; a worthwhile effort for the ARRL's celebrations.



This edition comprises 1200 pages in a hard-bound volume with over 2100 tables, figures and charts. The first five chapters serve as an introduction and cover the fundamentals of electricity, vacuum tube and solid state fundamentals, radio design as well as the language of electronics and Amateur Radio.

Following these are twelve chapters devoted primarily to radio principles, power supplies, audio and video, digital basics, receivers and transmitters, transceivers, repeaters, transmission lines and antenna fundamentals.

A further four chapters cover special modulation techniques, voice, audio and digital modulation. The RF spectrum, propagation and space communications are covered in two chapters.

In the construction and maintenance section we find twelve chapters covering HF and VHF transmitters, receivers and amplifiers, power supplies, test equipment, antennas and measurements, station accessories and a section on trouble-shooting and maintaining your own equipment.

The final five chapters cover getting your licence – American style, component and material data, the index, abbreviations list and artwork copies for the projects found in the main section of the book.

As usual, the handbook attempts to keep us up to date with all the latest techniques. There is more information on phase noise measurement, direct frequency synthesis and spread spectrum communications techniques. In the test equipment sections you will find new information on spectrum analysers and oscilloscopes, as well as new test equipment designs to build.

Many new, small as well as large scale construction projects have been included, some of the simpler offerings being updated pre-amplifier designs for VHF and UHF bands and power supplies. For the more ambitious constructor, there are projects like a 1.8 MHz QSK transverter as well as many amplifier designs for whatever your needs might be.

For satellite enthusiasts there is a new digital TR sequencer for added operating convenience. You'll also find up to date information not only on ATV, SSTV and fax, but also weather fax.

The famous Cubic Incher QRP transmitter is there along with a new 6 W, VXO-controlled CW transmitter for your favourite band between 80 and 15 metres. There are a number of very useful station accessories, DTMF encoders and decoders, PIN diode transmit receive switches, a digital PEP wattmeter and SWR calculator, transmatches and dummy loads.

Altogether, a book well worth buying for anyone involved in amateur radio, and if you haven't had a new one for a few years you won't recognise it, so much has changed. eti

The 1989 ARRL Handbook for the Radio Amateur is published by the American Radio Relay League; 1200 pages, hard-bound, quarto size. Review copy from Stewart Electronic Components, P.O. Box 281 Oakleigh 3166 ☎ (03) 543-3733. Cost: $46.00 post free.

INGENUITY

Programs

A new ERA for CP/M

```
        ORG     00100H          ;change to 0C806H for 64k Standard
BDOS    EQU     5
                                ;File type field of FCB
        ld      IX,F_Type       ; dir *.BAK
        call    Print           ;
        ld      c,19            ; era *.BAK
        ld      de,FCB          ;
        call    BDOS
        ld      (IX+0),'H'
        ld      (IX+1),'E'
        ld      (IX+2),'X'
        call    Print           ;
        ld      c,19            ; era *.HEX
        ld      de,FCB          ;
        call    BDOS
        ld      (IX+0),'P'
        ld      (IX+1),'R'
        ld      (IX+2),'N'
        call    Print           ;
        ld      c,19            ; era *.PRN
        ld      de,FCB          ;
        JP      BDOS
;                               ;Search for first file
Print:  ld      c,17
Prn_J1: ld      de,FCB          ;BDOS returns A=0,1,2,3 or 0FFh
        call    BDOS            ;0FFh means file not found
        OR      A               ;offset in file buffer = A*32
        RET     M               ;not 80h to ignore user number
        ld      hl,81H
        ld      de,String       ;
        RRCA                    ; A = A*32 provided A<8
        RRCA                    ;
        RRCA                    ;
        add     a,l             ; HL = HL + A
        ld      l,a             ;
        Jr      nc,Prn_J2       ;
        inc     h
Prn_J2: ld      bc,8            ;Move file name to String
        LDIR
        ld      a,'.'
        ld      (de),a
        inc     de
        ld      c,3             ; Move file type to String
        LDIR                    ;Print
        ld      c,9             ;String
        ld      de,String
        call    BDOS            ;Search for next file
        ld      c,18
        jr      Prn_J1
;                                       ;16 spaces
String  db      '
        db      '$'
;
FCB     db      0
        db      '????????'
F_Type  db      'BAK'
        db      0,0,0
        ds      20
```

THE program is invoked without any parameters. It then erases all the files of type BAK (backup), HEX (assembler output in hex format) and PRN (complete assembler output with comments and object code). These files usually do little but take up disk space. The program prints the names of every file it erases.

Christopher Pankhurst, Narara, NSW.

Draw on your Apple 11

```
1  REM  *** DRAWER ***
2  REM  *** LOW RESOLUTION DRAI
    R ***
3  REM  *** BY GREG TOMKINS **
4  REM  *** FOR THE APPLE ][ *

5  REM  *** VERSION WITH LOW RI
     AND HI RES COMING SOON!!!
    **
6  REM  *** COMANDS ***
10  TEXT : HOME
20  PRINT "USE I TO MOVE YOUR
    T UP, M TO MOVE DOWN, J TO
    OVE LEFT, K TO MOVE RIGHT
     C TO CHANGE COLOUR, P TO
    ISE YOUR PEN AND D TO LOWE
    IT"
25  PRINT "'Q' TO QUIT"
30  PRINT "PRESS 'S' TO START"
40 S$ = ""
50  GET S$
60  IF S$ = "S" THEN 80
70  GOTO 50
80  GR
90 X% = 20:Y% = 20
100  COLOR= 9
110  PLOT X%,Y%: PRINT "DOT AT
    ;X%;" HORIZONTAL AND ";Y%;
    VERTICAL
120 M$ = ""
130  GET M$
140  IF M$ = "Q" THEN 340
150  IF M$ = "P" THEN  COLOR=
     GOTO 110
160  IF M$ = "D" THEN 100
170  IF M$ = "C" THEN 300
190  IF M$ = "I" THEN  PRINT :
    :Y% = Y% - 1
200  IF M$ = "M" THEN  PRINT :
    :Y% = Y% + 1
210  IF M$ = "J" THEN  PRINT :
    :X% = X% - 1
220  IF M$ = "K" THEN  PRINT :
    :X% = X% + 1
230  REM  *** START OF ***
240  REM  *** BORDERS ***
250  IF X% =  < 0 THEN  PRINT
    "CAN'T GO THERE!!!!!!":X% =
    X% + 1
260  IF X% =  > 39 THEN  PRINT
     PRINT "CAN'T GO THERE!!!!
    :X% = X% - 1
270  IF Y% =  < 0 THEN  PRINT
    "CAN'T GO THERE!!!!!":Y% =
    % + 1
280  IF Y% =  > 39 THEN  PRINT
     PRINT "CAN'T GO THERE!!!!"
    Y% = Y% - 1
290  GOTO 110
300  REM  *** CHANGE COLOUR ***
310 C% = C% + 1
320  IF C% = 16 THEN  LET C% =

330  COLOR= C%: GOTO 110
340  REM  *** END OF PROGRAM **
350  END
```

HERE'S a simple program that lets you draw on-screen with your Apple 11. All instructions are included in the program.

Greg Tomkins, Weston, ACT.

Idea of the month

Improved directory routine for the C128

HERE is a program that makes looking for a file on disk easier. If you have disks like I have, with hundreds of short files, the problem of looking for files becomes worse as the computer quickly scrolls the screen up without giving you a chance to view the filenames.

To fix the problem, I have written this program which stops at the end of a page's worth of files and will not continue until you have finished looking at the screen and pressed a key to continue. Also, this program fits twice as much on the screen when you are using 80 columns, whereas the computer's built-in routine only has one column, whether you are in 40/80 screen columns mode.

To type the program in: enter the built-in machine language monitor (press Function-8). Type in the first line, excluding the colon and characters which follow it, then press <RETURN>. The computer will now give you the next address (>01308). Now just type the two-digit hexadecimal numbers and enter them. Continue this until you've typed in the last line, then press <RETURN> twice.

Now all the machine code is entered, to save it type, S "128 DIR/ML" 08 1300 140F <RETURN>.

Exit the monitor with, X <RETURN> and type in the basic file. Save it with DSAVE"{filename}" <RETURN>.

Turn your computer off and on. Typing RUN"{filename}" <RETURN> will load the directory routine. Pressing the Function-3 key from then on will give you the directory (Function-3 was the computer's old built in directory routine.)

Shane G. Harper,
Lalor, Vic.

```
MONITOR
    PC  SR AC XR YR SP
; 000 00 00 00 00 F8
 ?
>01300 A9 01 D0 02 A9 00 85 FB:
>01308 A9 02 A2 0B A0 14 20 BD:
>01310 FF A9 08 AA A0 00 20 BA:
>01318 FF 20 C0 FF B0 21 A2 08:
>01320 20 C6 FF B0 1A A0 04 20:
>01328 CF FF 88 D0 FA A9 12 20:
>01330 D2 FF A9 FF 85 FC A9 00:
>01338 85 62 85 FD 4C 7E 13 4C:
>01340 D2 13 A2 00 A0 04 20 CF:
>01348 FF 95 60 8A 49 01 AA 88:
>01350 D0 F4 38 20 F0 FF A0 00:
>01358 A5 FC F0 02 A0 28 18 20:
>01360 F0 FF 20 07 BA A9 00 A2:
>01368 08 A0 03 20 5D BA 38 20:
>01370 F0 FF A0 05 A5 FC F0 02:
>01378 A0 2D 18 20 F0 FF A9 00:
>01380 85 61 A9 1C 85 60 20 CF:
>01388 FF C9 22 F0 04 A6 61 F0:
>01390 05 20 D2 FF E6 61 C6 60:
>01398 D0 EC 20 E1 FF F0 33 A5:
>013A0 FC C9 FF D0 19 A0 38 A5:
>013A8 D7 D0 02 A0 10 A9 20 20:
>013B0 D2 FF 88 D0 FA A9 92 20:
>013B8 D2 FF A9 01 85 FC A5 90:
>013C0 F0 1B 20 7D FF 42 4C 4F:
>013C8 43 4B 53 20 46 52 45 45:
>013D0 2E 00 20 CC FF A9 08 20:
>013D8 C3 FF 4C E7 FF A5 FC 49:
>013E0 01 A6 D7 D0 02 A9 00 85:
>013E8 FC A5 FC D0 1B A9 0D 20:
>013F0 D2 FF E6 FD A5 FB F0 10:
>013F8 A5 FD C9 18 D0 0A A9 00:
>01400 85 FD A5 D4 C9 58 F0 FA:
>01408 4C 42 13 24 30 FF FF FF:
10 BLOAD"128 DIR/ML"
20 KEY3, "SYS4864"+CHR$(13)
30 NEW

READY.
```

"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'S COLUMN

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.

Extra details with projects

I have been a casual reader of ETI for 12 years. The 'new' format is great and more projects such as the ETI-1623 Parallel I/O card for PCs, with complete data sheets, should be included in future. Not all projects in magazines are built as presented, and all extra info is greatly appreciated.

S.N. McK.,
Highgate Hill, WA.

OK, glad to oblige where possible and appropriate, but at the same time we don't want to fill the magazine with data sheets, either.

More radio projects

Can you put more shortwave, CB and amateur radio in Electronics Today. It is a great magazine. Keep up the great work.

B.P.,
Fern Tree Gully, Vic.

As you no doubt have already seen in recent issues, we're doing just that, while our competitors are still scrounging for contributions. We deliver!

Protection for the 162 Power Supply

The School of Science & Technology of the University of Western Sydney, Nepean, offer degree programs in Applied Chemistry, Applied Physics and Computing Science as well as transfer courses in Engineering, Applied Geology and Materials Science in conjunction with the University of Technology, Sydney.

To support the experimental program, the ETI Project 162 *(Dec. 1982)* was chosen as a versatile power supply.

In some experiments, the power supplies were called on to provide a full 1 A through a 2 Ohm load, and in others the students, through misadventure, tested the performance of the supplies to their limits.

As a result of this "baptism by fire", a number of modifications have been made to the original design which may well be of relevance and interest to your readers – particularly high school science teachers looking for a student-proof and inexpensive power supply.

When pushed to its limits (1 A) it was found that the pass transistor, Q1, after a period of time, would short circuit "emitter/collector".

This problem can be solved by including a larger heatsink. However, intermittent short circuiting under maximum voltage and current conditions also caused Q1 to short circuit. Admittedly, these situations are not those that most owner/builders would inflict on their power supplies but with students, many situations arise which are not anticipated.

The remedy for this, we found, is not just to use a larger heatsink but a larger MJ2955 pass transistor as well, mounted directly onto the heatsink. Under these conditions it is possible to draw 1 A continuously and the thermal protection is no longer needed.

It is also found that with the voltage set to a maximum (30 V) and current set at a minimum, a short circuit across the output causes IC2 (LM301) to fail. When the current is set to a minimum, both inputs to the op-amp are driven by low impedance sources which can cause a problem. This particular problem was cured by placing a 56k resistor in series with the inverting input.

As a result of these changes to the ETI-162 project circuit, the power supplies are now able to handle severe treatment without failure.

E. Peter Toups,
School of Science & Technology,
University of Western Sydney.

Many thanks for relating your experiences with this supply and the "cures" you found effective. I might also draw your attention to the article, written by yours truly, entitled 'Goof-proofing' the '162 Power Supply on page 113 of the June 1984 issue. Other ETI-162 owners may wish to consider both solutions before attempting any modification. Copies of this article are obtainable in the normal way through ETI's Reader Services.

Car alarm

I was recently looking back through your February 1986 issue (Saturday Arvo Projects section) after remembering the car security system featured. As I am now thinking of installing such a system, this article interested me greatly.

I was wondering if this kit (Project No. 340) is still in production. If so, what is the price. Maybe it has been replaced by a better, more efficient alarm system.

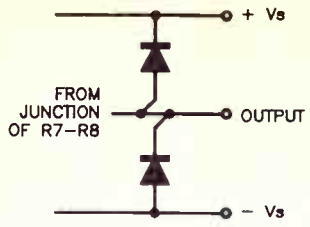
S. M.,
Devonport, Tas.

The ETI-340 Car Alarm was the last fully-featured car alarm project we've published. It is available in kit form from All Electronic Components, 118-122 Lonsdale St, Melbourne Vic 3000, ☎ (03)662-1381. Or, if you just want a pc board, they can supply that, too.

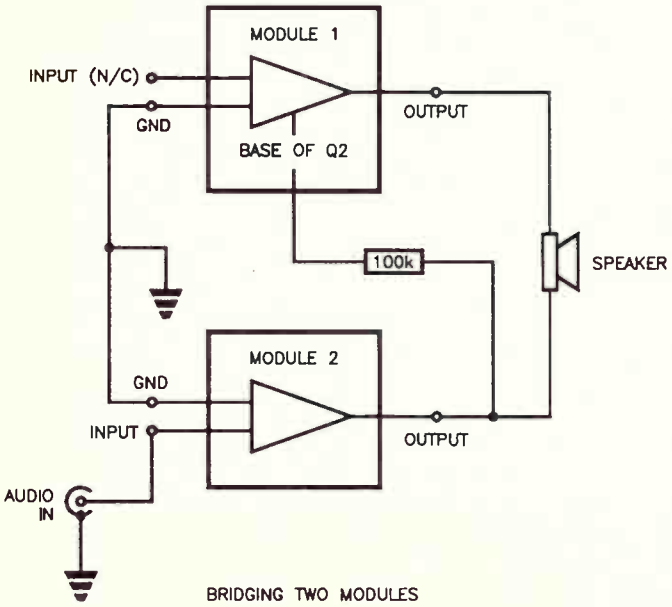
The only other projects that might be of interest to you are the ETI-343 Optical Car Alarm Switch, published in the September and October 1985 issues, and the Shock-triggered Alarm which appeared in the April 1988 issue. Copies of the articles, or back issues where available, can be obtained through ETI's Reader Services.

Digi-125 Amp follow-up

I have a few questions regarding the ETI-1430 Digi-125 Audio Amp Module. I have built a number of these with good success. It's a top performer for such a remarkably simple design! However, one of my modules draws almost zero quiescent current and shows distortion at low volume. Got a cure?



MODIFICATION WHEN USING A 100 VOLT LINE TRANSFORMER



BRIDGING TWO MODULES

Also, I want to build one into a small PA system. Can I drive a 70/100 volt line transformer primary directly from the module's output, or would the tranny's inductance do strange things to it?

Last, I'd like to try bridging a pair of modules for a bass guitar amp project. How do I connect them up?

Any and all assistance would be greatly appreciated.

D.G.,
Marrickville, NSW.

I think we can assist on all three counts. Firstly, the low quiescent current and low level distortion is an output stage bias problem. The forward voltage drop of diodes D1 and D2 is too low here. Just lift the leads at cathode-anode junction of D1-D2 and insert another 1N914 in series, so that all the cathodes face in the same direction, of course. Simple, eh?

While we're talking about this part of the circuit, something missed in the original article is the fact that R6 should be rated at 1 W if you run the module from the maximum recommended rail voltages.

To drive a 70/100 volt line transformer, you need to install two 'kick-back' diodes between the output terminal and the module supply rails, as shown in the circuit here. 1N4007 diodes will do the job. These short any back-emf transients that you get in such installations. Graham Dicker tells me he has used these modules in a number of PA installations and they're doing sterling service.

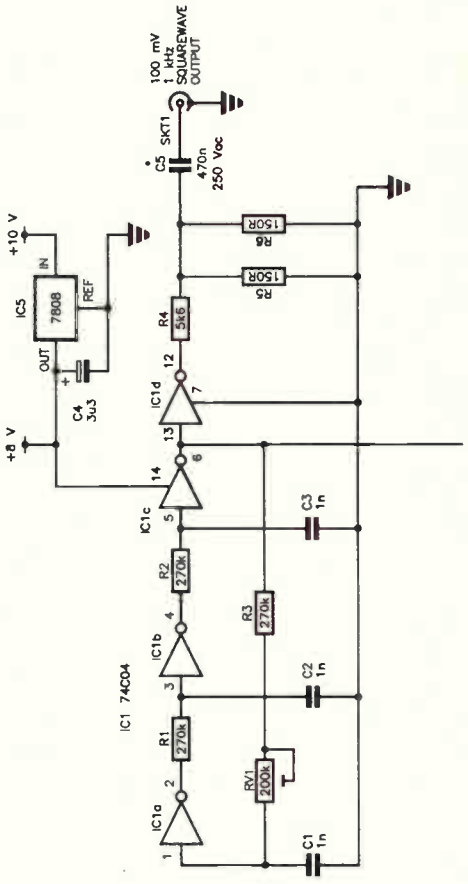
So you want more grunt? Bridging two modules is simple, according to Graham. The scheme is shown in the accompanying diagram. Connect a 100k resistor between the base of Q2 on one module and the output connection on the other module. The speaker connects between the output terminals of the two modules. The input ground terminals should be connected to common ground at one point only. It would be advisable to use a speaker having an impedance no less than 8 Ohms with bridged modules. Make sure your power supply is suitably rated.

Corrections

Project ETI-195
August, pages 47 & 51

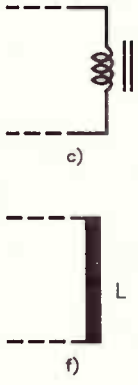
The circuit of the 1 kHz Oscillator, on page 47, shows C2 and C3 incorrectly connected at each end of R3. There are no junctions here, C2 and C3 connect from pin 3 IC1b and pin 5 IC1c to ground, respectively. The incorrect plot of the circuit was used for reproduction, as you can see by the scribble next to the oscillator output socket! The correct circuit is shown here.

On page 51, on the component overlay diagram, the connection at the junction of D10 and D12, on the left of "sinewave out to SW1", should show "T2/15 V".



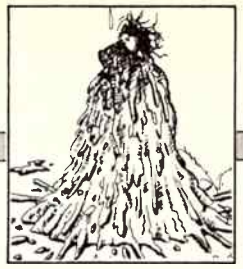
Building Blocks of Electronics
September, page 64

A couple of things were cut off the right hand side of Figure 2.5 during reproduction. At the top, inductor (c) is an iron-cored type with a 'bar' down the right, adjacent to the coil. The inductor (f), at the bottom, has an 'L' to the right of it. The correct symbols are shown here.



Building Blocks of Electronics
October, page 53

Three famous double diode valves are shown in the picture in the top right hand corner of the page. The 6X5 at the right is incorrectly designated as directly heated when it is actually an indirectly heated type.



BUFFOONERY

QUESTIONS, THEORIES & ANSWERS

Every year, the insurance industry trots out its list of risible excuses written in defence of, or in support of (we're not sure which...), insurance claims. You know the sort of thing I mean "I was driving down a dark street, when this tree suddenly jumped out in front of me...", from a gent claiming on serious front end damage to his car. They're usually followed, at this time of the year, by stories from teachers who've just finished marking mountains of students' annual examination papers.

In keeping with the general idea that this publication is largely about electronics in all its facets (well, at least, the last time I looked it was...), let me bring you a few risible replies to questions posed on some fundamental aspects of electricity and electronics, passed on to me by a colleague from a certain academy. The questions here are not necessarily in any given order...

Q: Define the AMP.
A: An AMP is a little animal that crawls along a wire.
Q: What is the function of an AMMETER.
A: An AMMETER is an animal that eats AMPS.
Q: What is the role of the BATTERY in this circuit. *(The circuit showed a battery connected to a simple series and parallel resistor network).*
A: The BATTERY fires AMPS around the circuit.
Q: Show how the current flows in this circuit. *(Same circuit...)*
A: The AMPS ride round the circuit on a megacycle.
Q: What does Fleming's Right Hand Rule state?
A: Fleming's Right Hand Rule states that: "All AMPS must ride their megacycles on the right hand side of the circuit."
Q: What is the difference between CHARGE and CURRENT?
A: A CHARGE occurs when all the AMPS run round the circuit together.
Q: Define the JOULE.
A: A JOULE is a fight between two amps.
Q: Define the OERSTEAD.
A: An OERSTEAD is an OHMSTEAD for "orses?

And no, we did *not* get this one off a computer bulletin board! But, no doubt, within a week of this issue going on sale, *you'll* be able to!

The science of salesmanship

SELLING things – anything – has always been a matter of following time-worn patterns of behaviour until you strike the one that works with the customer you're speaking to at the moment.

But all that has now changed. Selling has been reduced to a set of scientific theorems which can be expressed as mathematical equations. However, as salespeople always get the job *because* of their poor mathematical ability, rather than *despite* it (...look, guys ... although I write this stuff, I *don't* make it up all the time), we'll leave out the equations and just get straight into the theorems. Even if I understood the equations, I wouldn't write 'em down here.

Some of the best scientific minds of this century described some of the fundamental laws of physics – which is nature, after all. So, because these theorems parallel the work of these great scientists, they have been honoured in the theorems of the science of salesmanship. Now, I realise, at this juncture, that to be entirely non-sexist and up-to-date about this, that last word should be *salespersonship*, but the lexicon for the spelling checker in my word processor doesn't have it – and whose fault is that? Anyway, let's lapse into legalese for a moment and say that where the one gender is mentioned then the other is included here.

Back to the theorems of the science of salesmanship...

The Heisenberg Uncertainty Theorem. You can know that a customer will buy at any given time, but not how much they will pay. Or, you may know how much a customer has at any time, but not whether they will buy.

Schrodinger's Theorem. At any given moment there is a positive probability that someone will buy. Sit down and wait. Keep your cat locked up.

Szilard's Chain Reaction Theorem. Sell a chain to one customer in the shop and they'll *all* want to buy one!

Bohr's Theory of The Customer. Customers will circle the store in discrete orbits. They will never approach the sales person because of the repulsive force.

The Theorem of de Broglie. To signal your attention, customers will wave their umbrella at you. To signal dissatisfaction with the price, customers will whip out an umbrella from beneath their cloak and beat you repeatedly about the head and body!

The Papodopolous Topology Theorem. Acknowledging the quantum theory of financial mechanics (all payments are made in lump sums, some sums more often than others), we observe that the customer can be described by a truncated equation of the torus. We then transpose the customer into four-dimensional space. It is then possible to carry out such a deformation that the customer is returned to three-dimensional space in a knotted condition. The customer is then helpless.

d'Espagnat's Set Theoretic. We observe that the store is a separable space. It therefore contains an innumerable dense set of points from which can be extracted a sequence having the customer as the limit. We then approach the customer steadily and stealthily along this sequence using suitable arguments. But the limit of the sequence may be zero.

The Rheinhartz Inversion. Place a spherical Faraday cage in the middle of the store. Go inside it, locking it behind you. Customers entering the store will not be able to enter the cage. Perform a space inversion with respect to the cage. The customers will then be inside the cage and you will be outside. Isn't that where you want them?

Diroc's Theorem. We observe that customers are, ipso facto, observable in the store. Consequently, if there are any customers in the store, they won't see you. Selling something to a customer is left as an exercise for the reader.

Feynmon's Observation. If you can pick any lock, you'll never need to sell anything. Play bongos, instead. eti

SOFTWARE TOOLS FOR SCIENTISTS AND ENGINEERS

A PC is now an everyday hardware tool for scientists and engineers in many fields. But you also need software tools to go with it: unless you set about the daunting task of writing your own. Don't, says Jack Middlehurst.

Professional programmers, analysts and the like are always on the lookout for ways of reducing the amount of software they have to write. If a problem has been solved and there's software for its solution is available and known to be good, there is no point in re-inventing the wheel by writing the stuff all over again. So when this Quinn-Curtis set of two discs became available in Australia I immediately bought one to see whether it contained what I needed for some work I had in hand. The answer was a resounding YES!

The discs contain 150 functions (read it again – 150) written in C and designed for use by busy engineers and scientists and their colleagues working in industry. These discs do not contain executable programs. They are the actual source code written in C. If you want to do a Fast Fourier Transform as part of a program you are writing, the necessary block of code is already written for you on these discs.

The version that I tested and now use regularly was called IPC-MC-006 and is designed for use with Microsoft's Quick C version 2.0, but would clearly work using version 1.5. There is a companion set of discs at the same price for people programming in QuickBasic 4.

The manual

The instruction manual is a physically solid three-ring binder. It is well set out and describes each function in detail, together with hints on its use. There is an index at the front and a small section on link and run-time problems at the back.

At the beginning of the manual is a short section pointing out that a large memory model with a stack of 16K is necessary for the graphics packages. This is followed by a chapter on data structures in QC2, in particular the correct ways of calling one- and two-dimensional arrays into functions.

The contents of the manual, and the first disc, are grouped under 17 headings:

1. Statistics
2. Multiple regression
3. Curve fitting
4. Numerical integration and differentiation
5. Solution of differential equations
6. Fourier analysis
7. File transfer to Lotus 123
8. Solution of real & complex simultaneous equations
9. Matrix maths
10. Complex number maths
11. Data smoothing and convolution
12. 2D graphics
13. 3D graphics
14. Finding roots of non-linear equations
15. Linear programming
16. Special mathematical functions
17. RS232 comms

Disc two

The second disc contains a set of .MAK files for use with QuickBasic 2.0 when using any of the demonstration programs.

Electronics enthusiasts who like to write programs for fun or to help them with their hobby will find a wealth of useful functions here.

The C code

The C code used is that of Microsoft's C version 5.1 with a few simple modifications to permit the use of Quick C. The programming is fully commented wherever it is not self explanatory. Full length variable names are used to improve ease of reading. The coding is high quality without using lots of crafty tricks – in other words it's good sound code rather than spectacular.

For anyone programming or learning to program in C, the fact that you can legally dump all of these programs out to a printer and study them in detail at your leisure is of enormous help.

The rules

Quinn-Curtis has two rules for using this material. You can include any of this code together with your own code in a commercial program provided you only sell the fully compiled and linked executable file.

If you are selling source code you must buy a copy of these programs for each copy of source code that you sell. Since very few programmers are going to sell their source code, this doesn't represent much of a restriction. Of course if you are only writing programs for yourself these rules don't apply.

Impressions

There must be well over a man-year of work in these discs, in writing the programs and testing them to make sure that they do exactly what they are designed to do. All of the blocks of code that I have used so far have worked without any hitches and do exactly what is described in the manual. The graphics are versatile and are eminently suitable for engineers, scientists, or indeed anyone who wishes to visualise the shape of data or mathematical functions in two and three dimensions.

At an all-up price, including postage, of $163, these discs must surely be the bargain of the year. It is not often you can buy about $35,000 worth of good code for such a paltry sum! ETI

"Science and Engineering Tools for Microsoft C 5.1", Rev 6.12, two-disc set of source code produced by Quinn-Curtis. $151 + $12 postage. Review copy from Boston Technology, 12 Glen St, Milsons Point NSW 2061.

BACKDROP: Printout of the function Y = A* exp [– C* (x * x+y * y)] plotted using grid lines and with the axes rotated to the position shown. The computer was a 12 MHz Osborne AT turbo using Hercules graphics, the printer was an Epson EX800.

THE NEW ICOM IC32AT, OVER. WITH ITS DUPLEX FACILITY, OVER. MEANS YOU WON'T HAVE TO TALK LIKE THIS, OVER AND OUT.

The IC32AT is the newest dual band handheld transceiver by Icom.

It has been designed with the most advanced VHF technology the electronics industry can offer.

And this little 2 metres and 70cm compact handheld offers full duplex facility.

Which means instead of a broken conversation, you can now simultaneously transmit on one band and receive on the other. Just like a telephone conversation.

No longer do you have to wait for a long "Over". It's full "Break in".

And with its high output power, you can be sure your words are heard. The IC32AT uses a custom designed power module as the final amplifier. Which means this transceiver puts out 5.5W on 2 metres and 5W on 70cm.

So you will never be at a loss to make that repeater.

What's even more incredible, each of the twenty memory channels can store two frequencies: operating frequency and offset frequency are just a couple of examples.

The Programmed Scan function scans all the frequencies between two programmable scan edge frequencies, while the Memory Scan function scans all memory channels in succession, except, of course, those you lock out. In short, you can scan 2 metres, 70cm or all channels.

Thanks to the handy little pocket beep, you'll never miss a call. By installing the UT-40 Tone Squelch Unit (sold separately) the transceiver functions as a pager.

You can use the built-in DTMF keyboard to access a repeater and to make a phone patch. The key numbers and letters are printed large for quick and easy reading.

As for monitoring the input frequency when you work a repeater, that's as simple as pushing the Monitor switch on the side panel to open the squelch and check the frequency.

Every five seconds, Priority Watch monitors the Call Channel, or one or all the memory channels in succession.

And that's while you operate!

When you want to change the frequency or the memory channel fast, the Dial Select changes the 1MHz, 100kHz digit or the memory channel directly. One push of the button does it.

All these functions not only make the Icom IC32AT the most advanced dual band handheld transceiver available, but also very easy to use.

Call (008) 338 915 for your nearest Icom stockist today.

The telephone conversation in itself will be a very good demonstration of the IC32AT's duplex facility.

Over and out.

ICOM

The Ball Partnership ICO 0024

READER INFO No. 12

TECHNOLOGY

SEMICONDUCTOR WATCH

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

Programmable delay generator

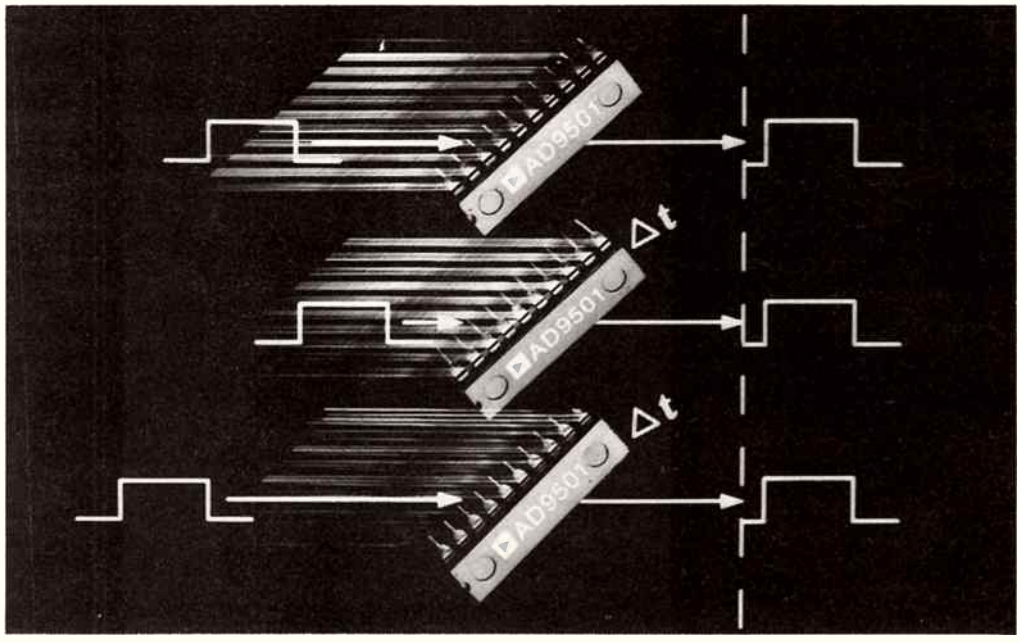
PROGRAMMED with an 8-bit code, Analog Devices' AD9501 delay generator provides precise time delays of digital pulse edges. A TTL/CMOS-compatible alternative to existing ECL-compatible components which require ECL-to-TTL level shifting circuitry, the AD9501 needs just a single +5 V supply.

With a full-scale range of 2.5 ns to 10 us, with 10 ps resolution, the device is designed for pulse deskewing and clock timing adjustments, the company says.

Applications include automatic test equipment (ATE), disk drives, data communication, video and radar applications.

For further information, contact: Avisun Pty Ltd, 11-15 Alexander St Crows Nest NSW 2065. ☎ (02)438 3900.

READER INFO No. 172



Advances on the optoelectronic chip

IBM scientists in New York have successfully put 8000 transistors and four photodetectors onto a single gallium arsenide chip, claiming this to be the densest optoelectronic chip yet produced.

An optoelectronic chip is one that integrates electronic circuits with optical devices. It can detect and process data at speeds of a billion bits per second.

Gallium arsenide was chosen to make the chips because light-emitting components, such as lasers and photodiodes, cannot be made from silicon. But you can't integrate as many components on gallium arsenide as you can on silicon.

Integrating electronic and optical devices permits computer circuits to be faster and more reliable.

John Crow of the IBM Thomas J Watson Research Centre at Yorktown Heights in New York said that another advantage is that integrated transmitters and receivers can fit "right into the processor".

Before this development, integrated chips of only tens of electronic components and a few photodiodes for high speed fibreoptic receivers were available.

READER INFO No. 171

Maxim to produce analogue ICs

MAXIM Integrated Products and VTC Incorporated are to produce a group of bipolar op-amps and comparators, to be manufactured and marketed by the two companies under a joint agreement to develop high performance analogue ICs.

The products were developed using VTC's complementary bipolar process featuring 6.5 GHz NPN and 1.5 GHz PNP transistors claimed to be two-to-three times faster than any other manufacturer building similar devices.

The new MAX408, MAX428 and MAX448 ICs are single, dual and quad package 100 MHz op-amps designed to meet growing demand for high speed devices in test and measurement, video signal processing and telecommunications.

They operate from standard digital supplies of +5 V, −5.2 V which compares with +/− 15 V for conventional devices. They feature 100 uV/second slew rate, offset voltage to 3 mV and ability to drive 50 Ohm transmission lines.

Three new comparators featuring ECL outputs are released – the MAX9690, MAX9685 and MAX9687.

Further details from Veltek Pty Ltd, 22 Harker St, Burwood Vic 3125. ☎ (03)808-7511.

READER INFO No. 170

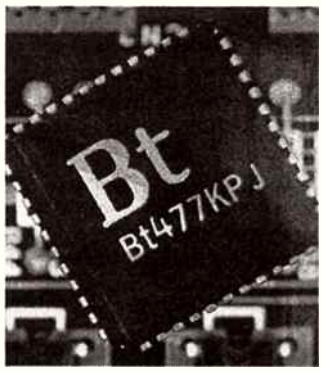
Laptop-specific features for RAMDAC

ENERGY Control International extended its coverage of RAMDACs for hi-res colour graphics applications with the introduction of the Brooktree Bt475 and Bt477 RAMDACs, intended for use in both VGA compatible and laptop computers.

These two devices are similar to their predecessors, the Bt471, Bt476 and Bt478. The Bt475 and '477 are 256 × 18 and 256 × 24 colour palette RAMDACs, respectively, running at 80 MHz.

They are suited for hi-res displays for desktop publishing, CAE/CAD/CAM, image processing, instrumentation etc. Brooktree has included additional features allowing them to be used in laptop computer systems that offer the option of driving a VGA monitor.

A power-down/sleep mode minimises power consumption, dropping current drawn to 1 mA when not in use. An on-chip voltage reference allows a single



external resistor to be used to set full-scale output current of the triple 8-bit DACs on-board.

On-chip comparators verify proper CRT connection and an anti-sparkle circuit that is said to eliminate the scattered white dots that occasionally occur when the system writes to the RAMDAC during active video – both new features.

Full details from Energy Control International, 26 Boron St, Sumner Park Qld 4074. ☎ (07)376-2955.

READER INFO No. 167

14-bit serial/parallel DAC

FABRICATED in low-power linear-compatible CMOS, the AD7840 14-bit DAC from Analog Devices is complete and fully specified for both ac and dc performance. Without any external components, this double-buffered monolithic DAC interfaces to a serial port or parallel data bus, generating a +/–3-V full-scale output.

Incorporating an on-chip reference and output amplifier, it simplifies system design in applications such as high-end modems, speech synthesis, programmable controllers and servos, and adaptive noise cancellation.

An internal 3 V buried Zener reference, trimmed to within +/–1 mV of nominal, also provides up to 0.5 mA for external circuit use. When desired, the AD7840 can accept a system reference in place of this internal reference. Its integral output buffer amplifier develops up to +/–3 V across a 2k, 100 pF load, settling to within 1/2 LSB of final value in typically less than 2.5 us. Small-signal bandwidth of the output amplifier is 1 MHz.

For further information, contact Avisun Pty Ltd 11-15 Alexander St Crows Nest NSW 2065. ☎ (02)438 3900.

READER INFO No. 165

Sony in SRAM output race

SONY is aiming for a 50% production increase for high-end static RAM chips. It wants to build up to an output of 4.5 million units per month.

Most of the Y60 billion Sony has set for investment in semiconductor equipment this financial year will go to its SRAM plant in Kyushu. The production boost is mainly in 256 Kbit and 1 Mbit SRAMs where the market is tightening.

READER INFO No. 164

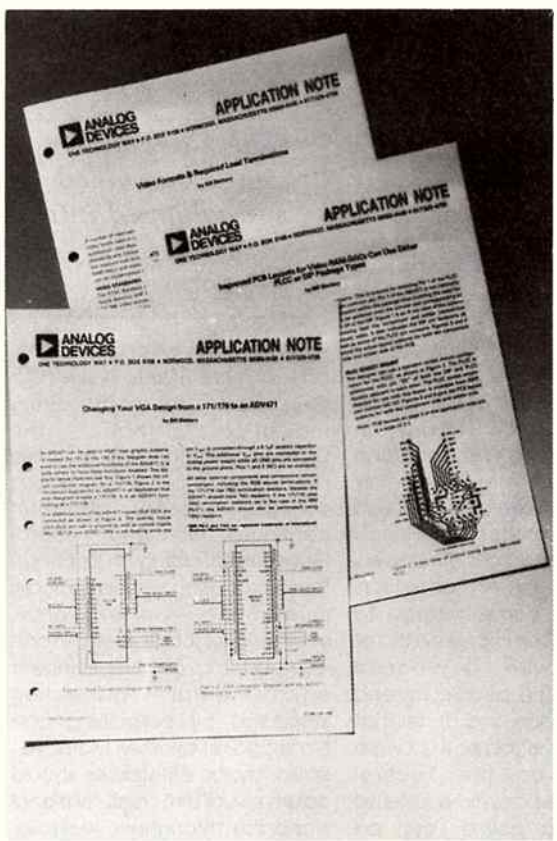
Application notes

THREE new application notes about Analog Devices' ADV-series of low-cost video RAM-DAC ICs are now available.

The paper on PCB layout describes printed circuit board layout schemes for the video RAM-DAC portion of a VGA-compatible graphics card.

Contact Avisun Pty Ltd, 11-15 Alexander St, Crows nest NSW 2065. ☎ (02)438-3900.

READER INFO No. 168



CMOS clock oscillator

THE new CO-440 series high speed CMOS clock oscillator is available up to 125 MHz using ACMOS technology. Stability is +/– 25 ppm over 0 degrees C to +70 degrees C, with a MIL-option of +/– 50 ppm over -55 degrees C to +125 degrees C.

More information from A.J. Distributors Pty Ltd, 44 Prospect Road, Prospect SA 5082.

READER INFO No. 169

JOHN COULTER

CRACKING THE WHIP

A proposed referendum might give the Government a convenient shield behind which to hide from the issue of national regulation on environmental matters. We must not let this happen, says John Coulter.

Senator Richardson recently foreshadowed a referendum in the future to give the Commonwealth specific powers to decide whether or not to legislate for the protection of the environment. For some months I have been pursuing the claim that the Commonwealth already has considerable powers it is not using.

Legislative power is conferred on the Commonwealth under Section 51 of the Constitution. Each clause of Section 51 contains what is called a 'head of power'. Section 51 says:

"The Parliament shall, subject to this Constitution, have power to make laws for the peace, order, and good government of the Commonwealth with respect to:" (and Clause 20 of Section 51 says:)

"Foreign corporations, and trading or financial corporations, formed within the limits of the Commonwealth."

That power, the so-called corporation power, complements Clause 1, the trade and commerce power, and both have been used very widely although not, so far, to protect the environment.

Clause 1 says:

"Trade and commerce with other countries, and among the States."

There is no doubt the Commonwealth has the power to legislate to control trading or financial corporations and trade and commerce among the States (subject to Section 92, which says that laws may not discriminate between the States in these matters). Most applications of these powers have not related to environmental protection, though part of the successful Tasmanian Dams judgement rested on Section 51, 20, the Tasmanian Hydroelectric Commission being judged to be a trading corporation within the meaning of that section.

Most environmental damage could be controlled by regulating the activities of corporations and trading bodies under these heads of power. The Government has been loath to use this power and has sought, rather, to claim that it does not have it. The Opposition would never use these powers because of their dedication to the notion of 'States Rights'.

States Rights is a catch cry much used by the Opposition and frequently heard in Queensland and WA. There is no such thing as 'States Rights'. Only individuals have rights. Through democratic process, individuals collectively grant certain powers to Government. At Federation, the colonies came together to form the Commonwealth of Australia with a Federal Parliament. The people agreed to a constitution, and, under that constitution, certain powers were conferred on the Federal Parliament. At any time, altered or additional powers can be conferred on the Federal Parliament by the people voting in a referendum. Under the Constitution, the laws of the Commonwealth override the laws of the States if conflict arises between the two. It is clear from this structure that State powers are residual powers. They are those powers which have not (yet) been conferred on the Commonwealth by the people, together with those powers which the Commonwealth possesses but has not yet fully applied. This is the case with powers under Section 51, 1 and Section 51, 20 of the Constitution, especially in relation to environmental protection. It is also worth noting in passing that the States did not exist before Federation; there were only colonies. States were co-created with the Commonwealth through the act of federation.

The exercise of these wider powers by the Commonwealth would certainly be challenged by one or more States in the High Court but there is every indication that the Commonwealth's use of these powers would be upheld. As long as the present situation continues, with the Federal Government sitting on its hands, those proposing very large scale investment – often large, international companies – can demand and get less stringent environmental protection standards by bargaining one State against another. Moreover, similar major enterprises should observe uniform high national standards throughout Australia. For example, petrochemical plants, paper pulp mills, refineries and metal smelters, as well as the use and application of synthetic chemicals and pesticides, should be nationally regulated so as to ensure high levels of environmental and occupational health.

> ***'The Government must be bullied and whipped into using those powers'***

Consider now Senator Richardson's call for a referendum. It provides a convenient shield behind which the Government can hide, claiming it does not have the power until the referendum is passed. The referendum, if and when it is put, will be resisted by all the State Righters you have ever dreamed of, and will almost certainly be lost. An even stronger excuse would then exist for the Government not to legislate in the area of environmental protection.

The Government must therefore be bullied and whipped into using those powers which it undoubtedly possesses. These actions will be tested in the High Court and will almost certainly be found sound. If not, we will discover what extra powers the Commonwealth does need to protect the environmental 'Commonwealth'. A referendum under those conditions would also stand a better chance of success. Above all, we must not let the Government continue to hide behind what is probably an untrue claim. Interestingly, in recent weeks, frustrated by the intransigence of the Queensland Government with respect to protection and management of the wet tropics, Senator Richardson has threatened to use Section 51, 20. The same has happened with the south eastern forests of NSW. eti

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

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Win a Marconi 1GHz Active Probe. Precision performance over the widest dynamic range.
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★ Wide frequency range — 50KHz to 1.25 GHz for all HF to UHF applications.
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P.O. Box 227,
WATERLOO, NSW 2017

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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.

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Communications (Elements of Electronics — Book 5)	BP-089	**$11.00**
Audio Projects	BP-090	**$8.50**
Model Railway Projects	BP-095	**$8.50**
IC Projects for Beginners	BP-097	**$8.50**
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Audio (Elements of Electronics — Book 6)	BP-111	**$16.00**

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Audio Amplifier Construction	BP-122	**$9.50**
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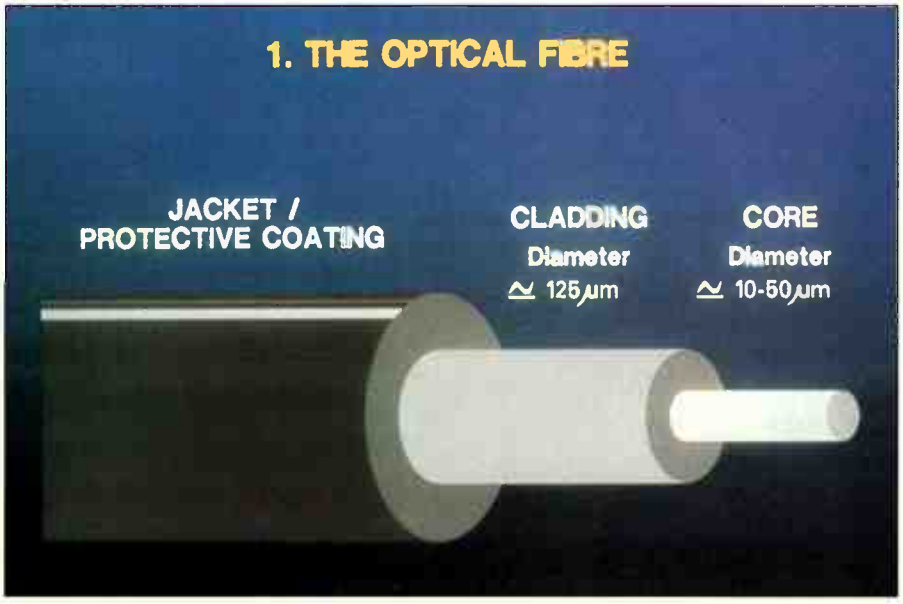
MORE FIBRE IN THE HOME

Barrie Smith looks at the ways in which optical fibre is going to change our lives, in the not too distant future.



Cut-away of optical fibre cable. Made entirely of pure glass, the cable has three parts; core, cladding, protective jacket.

Present and future global spread of optical fibre networks, linking almost every continent.

The Australian diet has changed considerably in recent times, with many people making a determined effort to increase their intake of fibre and avoid cholesterol-laden and fatty foods. Fibre has made for a 'healthy home.'

Now Telecom is intensifying its efforts to give us the 'intelligent home' with the help of fibre – of the optical variety. How? By giving us interactive video and electronic links connecting our homes to the communications world at large: interactive information videos, home video conferencing, electronic mail and electronic banking.

INNOVATION

I know that many of our readers will scan this article for the technological background I will impart – but many (including the writer) may be sceptical of the success of Telecom's aims – not their ambitions in technical terms (in this area they are rapidly moving above any criticism) – but in some of the product benefits to the consumer.

How many of the public really want home conferencing via video? Would the average person appreciate the disruption of his or her domestic routine by clusters of strange faces descending onto the home screen? Or would conferencing really mean an opportunity for research companies to invade our privacy in their fervent search for intimate statistics?

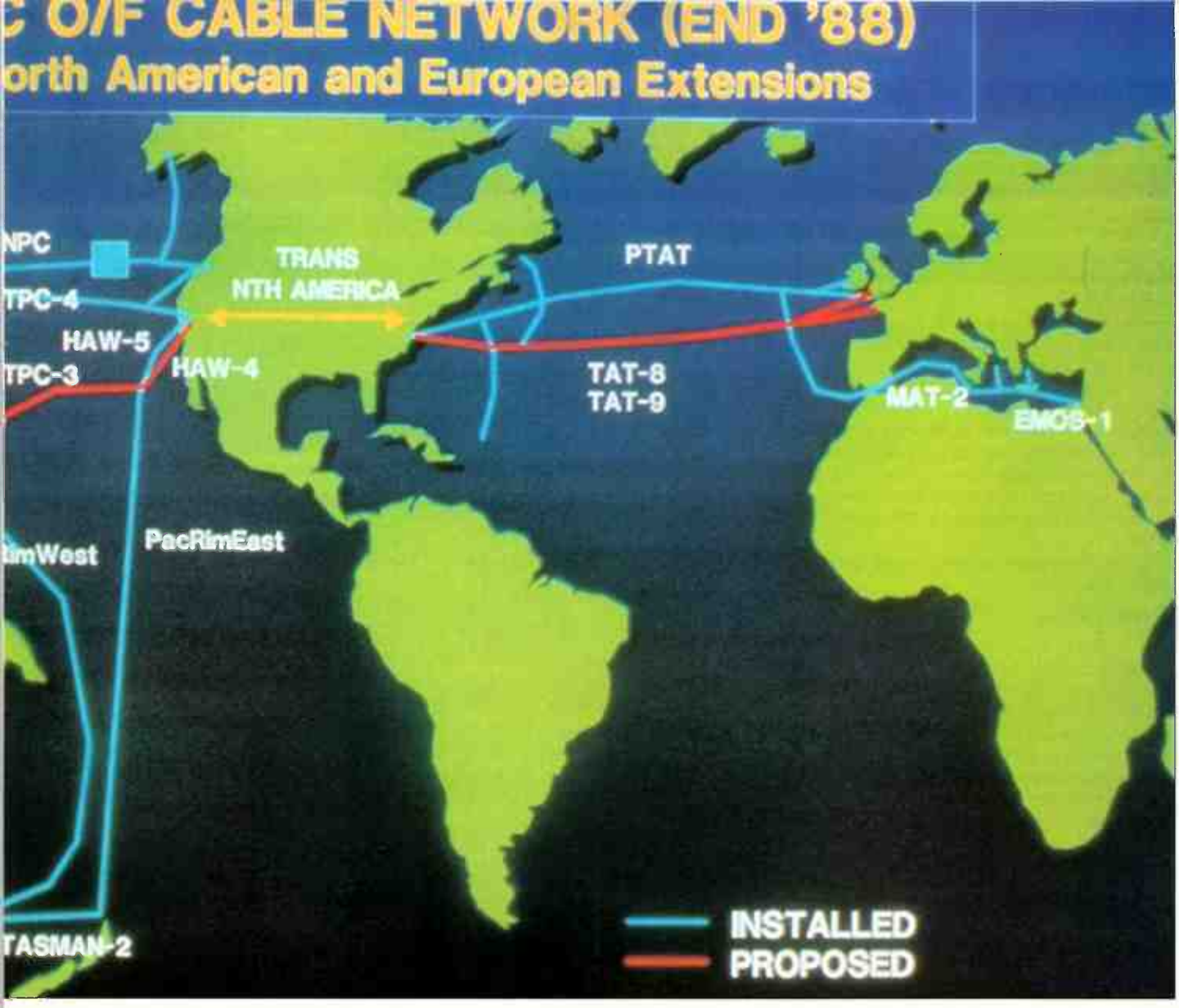
How many could get worthwhile use from electronic mail? In most cases domestic correspondence has little need for rapidity. (even to the point of tardiness being welcome when it comes to bills received!

And is electronic banking for the non-business person practical? How do you withdraw cash for the milk money from a keyboard and a glowing TV screen in your living room?

Courageous march

No, I think the benefits of Telecom's courageous march into advanced electronics technology will lie in other areas. Optical fibre has so many pluses it is almost impossible to raise even the slightest quibble about its deployment in a national communications scheme. Its enormous bandwidth permits mountainous quantities of information to be exchanged. Commissioned in August, 1987, the thousand kilometre Sydney-Canberra-Melbourne optical link can carry 115,200 simultaneous conversations or the equivalent in data transmissions. To match this capacity in co-ax terms would need four 10cm diameter cables.

Before installing the inter-capital link, Telecom investigated the alternatives, with one eye on current demands, and the ability



of rival methods to cope with an expected communications explosion as the country's needs expand.

Already, fibre had proved successful on short distance/high capacity routes. Major trunk links had demands of little difference, and again optical fibre proved to be cheaper than co-ax, microwave links or satellite systems. And, with relative costs steadily decreasing, telephone connections to the home are unlikely to be made with copper by the 1990s. Fibre will be the most likely replacement.

There are savings also in installation, maintenance and overall engineering costs, and optical fibre calls for fewer signal repeaters.

Route selection for the alternatives has always been a problem. With metallic cabling, careful avoidance of induction effects from overhead power lines is important, line of sight requirements for microwave links a sometimes impossible necessity.

Fibre is free from electro-magnetic interference, electrically noisy environments and lightning strikes, and offers virtual immunity from security intrusion – or, at least, if an optical fibre link is tapped, the break-in is detectable. Future signal processing techniques may further extend the capacity of present links.

It is currently believed that Australia is a world leader in long distance optical fibre communications. 1990 will see the Adelaide-Perth fibre highway laid – a distance of 2,500 kms. By then we will possess a network of 30,000 kms, with an actual fibre length of 430,000 kms.

Early in March this year, a convincing demonstration of more immediate optical fibre technology was given, which Telecom has christened Phase II.

Centennial Park in Sydney, home of weather-worn stone Victorian statues, single-minded joggers, frantically keen cyclists, fanatic equestrians and Patrick White, was chosen as a test area for the trials, to prove the technique in domestic environments.

Phase II involves multi-channel video distribution to seven domestic sites. The homes are currently receiving TV transmissions from ABC, SBS, a special Telecom closed circuit channel and a three-way split summary of all incoming programming.

Superior fidelity

Domestic reception of television naturally benefits from optical fibre's superior fidelity and low signal-to-noise figures and, in Centennial Park's case, imparts a much-needed boost to reception quality of the national and ethnic broadcasting duo – both unfortunate victims of Sydney's topography and electrical interference.

TV programming is first received at the City South Exchange in Castlereagh Street, and monitored closely before being passed on to the East Exchange in Liverpool Street, Darlinghurst. From here the signal is emitted via optical fibre to the seven test sites.

In the home, the optical fibre carried signal arrives at a decoder box located inside the house, at a convenient point near aerial and

power inlets. From the decoder, the familiar co-axial aerial lead is run to the TV set.

At a press conference to announce the beginning of the second phase of the optical fibre trials, Kayvan Ohoudiyat, principal engineer with Telecom's Network Planning, described the organisation's approach to the scheme.

He illustrated the spread of the current global link-up between Asia, North America, Europe, Northern Africa and Australia. By 1991 almost all of Australia's capital cities will be linked by fibre networks.

The present Sydney-Melbourne link is single mode type, holding sixty fibres in the main cable, ten in the distributor and two in the leading cable. Each fibre is ten microns and the whole bundle is enclosed in 125 micron cladding.

Links to homes are currently made with single mode cable.

Three types

There are three types of optical fibre:

1. Multi Mode Step Index: due to the sudden (step) change of the refractive index between core and cladding, light entering the fibre at different angles will take different times to travel down the fibre. It, therefore, causes mode dispersion, which in turn results in limited bandwidth. In telecommunication, this fibre is rarely deployed.

2. Multimode Grade Index: this type of fibre has a high refractive index in the centre, tapering to less at the cladding. This results in approximately equal times for all rays, therefore improved bandwidth is possible. Multimode fibres have core diameters of 50, 62.5, 85 microns and cladding diameter of 125 microns. They can be used with LEDs for some applications.

3. Single Mode: has a much smaller core diameter (9mμ) and requires a much more intense light source. Able to transfer a very large bandwidth and low loss:

-0.5dB/km at 1300nm.

The fibres are made by three companies: Austral Standard Cables, Olex and Pirelli.

Taking Sydney as an example of the approach to a city installation, the 130 telephone exchanges in the '02' area will be linked by fibre by 1991; 80% is already in place. The CBD will be served by its own loop.

The home service currently provides four channels (ABC, SBS and two Telecom VCR-generated signals). In practical terms, the signals are fed to the processing equipment. The output signal is multiplex AM at RF, fed into the optical transmitter. This latter sends intensity modulated signals to the East Exchange. Here, the signal is fed to 1:8 passive couplers. Outputs 1 to 7 provide signals to each of the seven Centennial Park customers. Output No 8 is fed back to City South Exchange through a loop back fibre; a Television Operating Centre monitors this eighth signal for continuity and quality.

In the customer's home the optical receiver converts the information to RF, and it is then fed to the TV set itself.

It may be a surprise to learn that signal dissemination along the fibre uses AM processing. The reasoning in the trial stage was to get the system working with minimum complexity of equipment at the customer end.

This has, unfortunately, introduced some disadvantages.

Low capacity – a limited number of channels can be carried due to AM intermodulation effects. Use of more complex frequency modulation techniques will expand this capacity.

Cost: optical transmitters and receivers are currently expensive. Hopefully, the price will drop as the technology expands. eti

Barrie Smith's article in ETI, September '89, "Video piracy – we're the best" stated that Crocodile Dundee II's producers had not filed for copyright. They have now done so.

System layout at (right) local exchange, and (left) customer's home or office.

Your 'intelligent' home in 1995 as Telecom would have it. Note the 40 TV channels.

Down the track

There are five main services to the home: water, sewerage, electricity, gas and the phone.

Today's telephone outlet will transform to a telecommunications port.

For example: electricity is supplied to your home (say 240 volts/100 amps), and it is distributed throughout the house's interior via a network of power points. Regardless of what type of appliance you would like to use, it is simply a matter of plugging it in.

Now, apply the same principle to telecommunications. A certain amount of capacity will be available for each household, eg 2.4 Gigabits on tap throughout the house, regardless of whether it be telephone, computer data, fax, video or audio.

With an optical fibre quietly sneaking into your 'intelligent home' – you just plug it in.

SOUND INSIGHTS

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YAMAHA'S CD5050 CD PLAYER

TANGENT SPEAKERS FROM KLIPSCH

Les Cardilini reviews the Tangent 10 and 50 systems, part of a new series by the legendary US loudspeaker manufacturer, Klipsch.

ON A TANGENT, FROM KLIPSCH

It is not often you would have seen loudspeakers by Paul Klipsch costing less than a thousand dollars, but the Tangent 10 sells here for around $899 a pair (rrp).

The Tangent 10 is the smallest system in the Tangent Series by Klipsch, a new range of five models from the speaker legend himself.

Paul Klipsch, now 85 years old, still chairs the speaker company he founded in Hope, Arkansas, USA, during the mid-1940s, after World War 2. In fact, Klipsch and Associates remains one of only a few family company speaker manufacturers that have resisted takeover or absorption by multi-national and larger organisations in that country, according to The Australian Sound Company, in Melbourne, which distrbutes Klipsch products in Australia.

Of course, the name Klipsch has, over the years, been synonymous with horn loudspeakers and enclosures such as the renowned Belle and La Scala models which are still produced by the company. Many Klipsch horns and systems have found applications in professional audio circles around the globe, as well as in hi-fi systems.

But, in contrast, the new Tangent series is more in the mould of the conventional loudspeaker box enclosure for the hi-fi enthusiast.

In the Klipsch tradition, nonetheless, compression drivers with matching horns are employed to reproduce the midrange-to-treble sound in all models in the Tangent Series. In the four higher-power models the tweeter units are ferro-fluid cooled.

The low frequency drivers used in the Tangents are Klipsch engineered from the voice coil up, using magnets almost as wide as the driver cones they help power. The magnets weigh in at 567 grams (20 ounces) each and are one of the few parts of the speaker made outside the Klipsch organisation. According to Klipsch literature,

the low frequency driver cones are equipped with special cloth surrounds, dual dust caps and geometric design to cope with the higher power afforded by these large magnets. A single, low frequency driver is used in each of the Tangent 10 and Tangent 20 enclosures. Two are used in the Tangent 30 and Tangent 40 models, while the Tangent 50 has three. All drivers, including the high frequency horns, are aligned vertically on the front of the respective enclosures.

As might be expected, the number of drivers in each enclosure is commensurate with the maximum power handling capacity of the channel for the Tangent 10 and Tangent 20, to 150 watts per channel for the Tangent 50. A minimum amplifier power of 20 watts per channel is recommended for each unit in the range. Rated speaker impedance for the Tangents is 6 ohms.

On removing the clip-on cloth covers from the models reviewed, it was evident during loud bassy passages of music that the excursions of the low frequency driver cones were well controlled. This doubtless contributed to the clean, tight bass, apparent especially in the larger Tangent 50s.

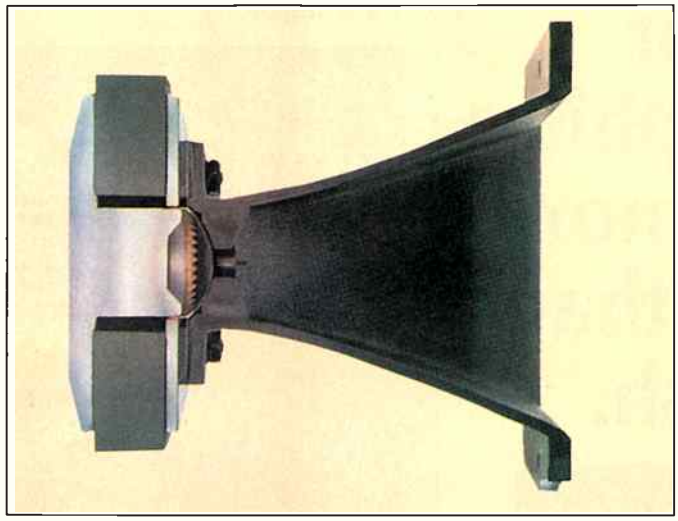
Test tracks played from the Denon test compact disc to detect possible unwanted resonances, intermodulation distortion and delinquent transient responses, in listening tests, showed the systems reviewed to be quite well behaved.

Dynamic range was impressive and stereo imaging very positive over a wide selection of music from solo instrument performances and vocals to orchestral movements. In this regard I think the directional properties of horns and 'stacked' drivers contribute significantly to spatial definition. Polar responses showing the measured horizontal and vertical dispersion characteristics of the speakers were not available at the time of writing.

Some of the inherent directivity of horns in the upper frequency range seemed evident, especially with the smaller Tangent 10s operating at floor level. Normally, however, it might be expected that these units would be placed on stands or bookshelves. The Australian Sound Company advises that they have optional 500 millimetre-high stands for use with the smaller speakers in the Tangent range, if required. With the taller Tangent 50 standing on the floor, the high frequency horns are more or less at ear level for a seated listener, and the centre axis of the low to mid frequency 'line source' is also higher.

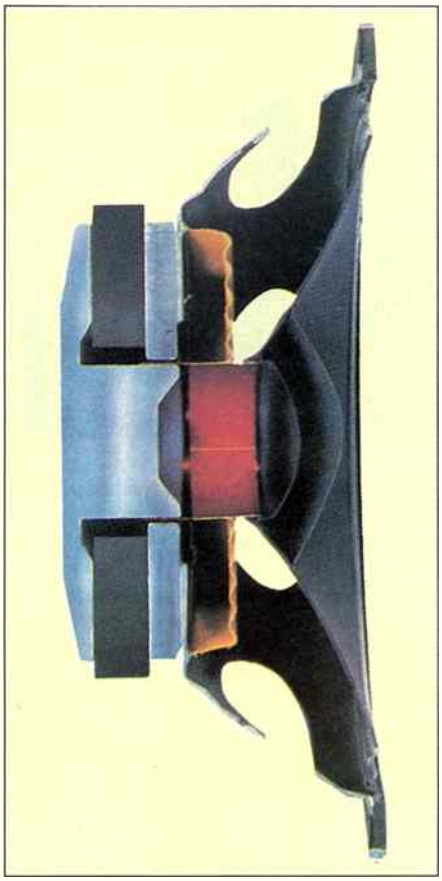
The Tangents seem reasonably efficient, with sensitivities ranging from 94 dB Sound Pressure Level for the Tangent 10 and 20 models to 98 dB Sound Pressure Level for the top of the range Tangent 50.

The sturdy timber sides of the cabinets in the Tangent range are lumber-cored in a sandwich of birch ply and finished in a natural timber veneer. The veneer used on the respective left and right hand sides of each box is matched in grain and colour from the original veneer timber stock, so that each stereo pair of Tangent enclosures is closely twinned in appearance.



The Tangent high frequency compression driver.

The remainder of the cabinet is finished in black vinyl over particleboard. All panels are 19 millimetres thick, braced and glued. In fact, I sneaked a look inside one of the larger models, the Tangent 50, and noticed that even the bracing had been fixed in a horn configuration. In a product from Klipsch, I still cannot help but wonder if the wide bracing was put in that way because of its length or because its horn-like geometry had something to do with coupling the very low frequency, 305 millimetres (12 inches) diameter passive radiator mounted in the rear panel of each cabinet and in the apex formed by the bracing.



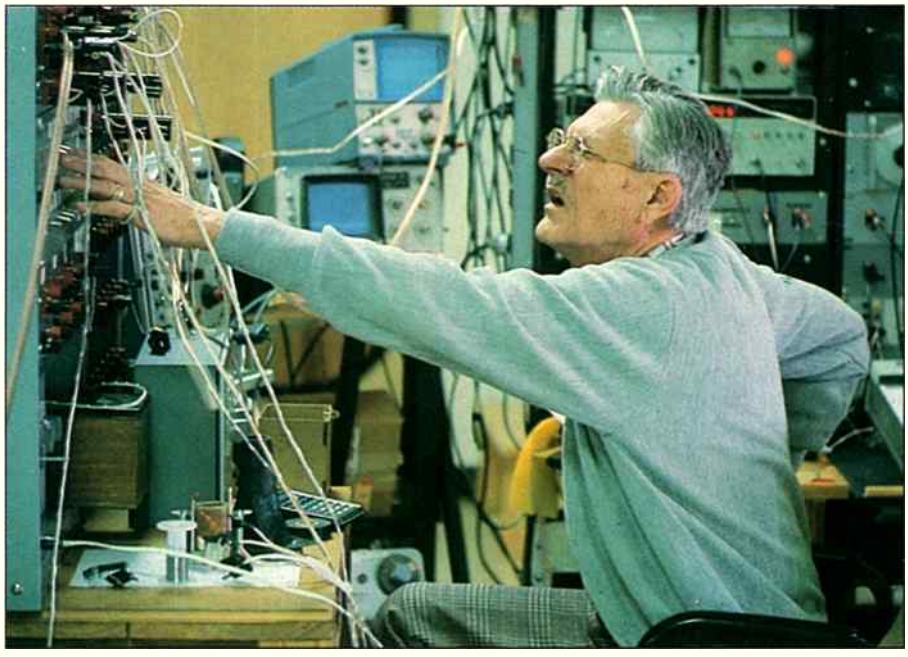
The Tangent woofer has dual dust caps, magnet twice the normal size, special cone geometry and fibre surround.

The passive radiator has all the outward appearance of a speaker the same size. It has a cone with a conventional surround and a dust cap, like a regular speaker. The passive radiator is also mounted in the speaker cabinet, like a regular speaker. The difference is, of course, that the passive radiator has no voice coil or magnet, (hence, passive) and is simply excited by sound energy locked up inside the speaker enclosure, to radiate sound in the low bass range and enhance the overall bass performance of the system.

The principle is similar to that of the bass reflex or vented enclosure where the disc of air in the vent in the enclosure is vibrated to create sound waves outside the cabinet. The passive radiator, being made of material similar to a speaker cone, however, has greater mass than a similar shaped mass of air and helps extend downwards the frequencies it can effectively reproduce.

Perhaps surprisingly, having the passive radiator mounted in the back of the cabinet and facing rearward does not interfere with the directional characteristics and stereo imaging of the speaker system as a whole. Bass speakers generally tend to radiate their low frequency sound in all directions, in effect enveloping the speaker cabinet rather than being impeded by or reflecting from it, unlike the higher mid-range and treble which are more easily obstructed and directional.

The system is also designed so that sound waves in the extended bass range radiated by the passive radiator reinforce those created by the low frequency drivers mounted at the front. Basically, the passive radiator recovers bass energy that would



Above: the legend himself, Paul Klipsch, now 85 years old.

Below: Klipsch in an anechoic chamber.

otherwise be absorbed and wasted inside the speaker cabinet. This makes the system more efficient in the important lower base range.

The effect the passive radiator can have on bass response becomes apparent when we compare the bass performance of the Tangent 10, which does not have a passive radiator, with the next model up the range – the Tangent 20 – which does.

Apart from the slightly larger cabinet, a different high frequency driver (which should not affect the bass response, anyway) and passive radiator in the Tangent 20, the two models are very similar in appearance and power rating. From the specifications supplied by Klipsch and Associates, however, we find that the 3dB point at the lower end of the frequency response is 75 Hz for the Tangent 10, and 42 Hz for the Tangent 20 – almost one additional octave of bass in the Tangent 20!

The overall system bass response was also able to be trimmed by moving each enclosure strategically into and away from the corner of the room, in effect applying horn loading.

For upper mid-range and treble reproduction each of the five models in the Tangent Series has a 2.54 centimetre (1 inch) compression driver matched to a horn to provide three-fold output compared with a typical dome tweeter the same size, according to Klipsch literature. But not all speakers in the range use the same combination of driver and matching horn, the main difference being magnet size, ferro-fluid cooling and the size of the horn.

A high frequency response flat to within plus or minus 3 decibels, out to 20 kHz, is claimed for all five systems in the Tangent Series.

The smallest enclosure in the Tangent Series measures 413 mm high x 292 mm wide x 210 mm deep and weighs 8.39 kg. The largest stands 921 mm high x 359 mm wide x 311 mm deep and weighs 26.3 kg. The Tangents are priced from $899 to $2999 per pair, recommended retail price and have a 5-year warranty on cabinet and components.

The Tangent 10 and Tangent 50 systems reviewed were supplied by Klipsch agents in Australia, The Australian Sound Company Pty. Ltd., 133 Market Street, South Melbourne, Victoria 3205, ☎ (03) 696 2277. eti

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.....

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OCCUPATION:.....

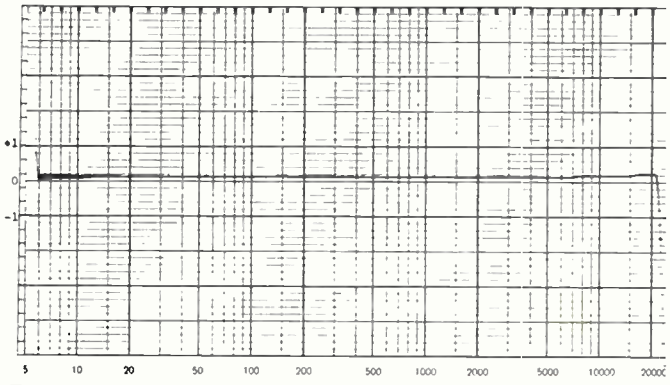
YAMAHA CD 5050 CD PLAYER

Louis Challis reviews the new Yamaha CD 5050 CD player. He believes this 102 year old company really does try harder than its competitors.

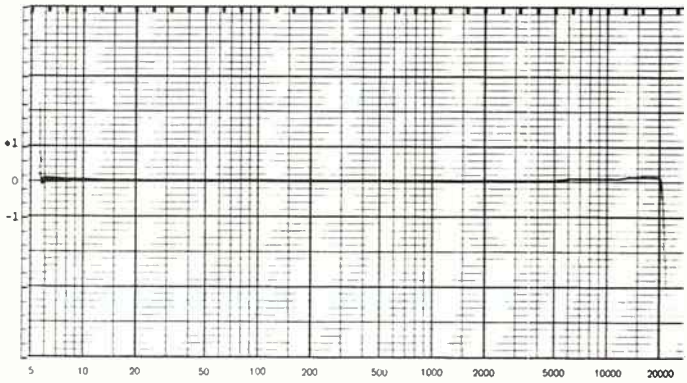
Ever since Yamaha produced its first CD player in 1982, its products have exhibited significant differences to those of its competitors. The background to those differences isn't too hard to find, especially if you take the time and trouble to visit the Yamaha factory at Hamamatsu, about half way between Tokyo and Osaka.

The Yamaha company is now 102 years old and is solidly based on 'craft industries' associated with the development of its range of musical instruments – generally among the best in the world. With a musical background as solid as theirs, it's not really

The CD 5050's hidden panel.



Frequency response with 10dB pot (left channel) 5Hz to 22.05 kHz.



Frequency response with 10dB pot (right channel) 5Hz to 22.05 kHz.

surprising to find that they really do try a little harder than their competitors to retain the "musicality" of their products.

This, of course, has to be achieved while remaining cost competitive in an aggressive market place. This has been no easy task. So, when faced with this problem almost a decade ago, the wise old directors at Nippon Gakki (as the company was then known), with not too gentle pushes from the young hawks in the engineering department, funded a project to build a large scale integrated (LSI) circuit facility, in the firm conviction that, if they could secretly design special ICs, they would be able to compete on an equal footing with their larger Japanese competitors.

While there were obviously some breathless moments, within a few years, that decision had vindicated all the forecasts and promises that those young hawks must have made to top management.

The CD 5050 is just one more example of what the advanced digital technology of the Yamaha plant can produce. The first important feature of both the CD 5050 and the slightly lower-specified 4050 CD player incorporates two pairs of digital to analogue converters in each channel, which achieves 22-bit linearity using 18-bit DACs, supplemented by 4 floating bits. This takes the signal-to-noise performance of the player to new heights.

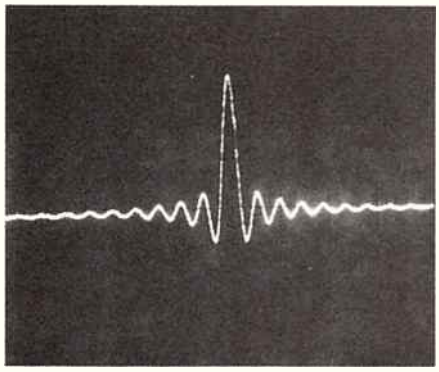
The second feature of the CD 5050 is that it uses digital filters operating at 8 times the basic 44.1 kHz. This places the fundamental sampling frequency so far above the range of the audio signals that it can be easily filtered out by a simple linear phase analogue filter which avoids trace of audible distortion. At the same time, the Super Hi-Bit sampling system removes the quantisation ripples. The DAC output circuitry differs substantially from most of Yamaha's competition as it uses one DAC in the normal phase mode and the other in the reverse phase mode. This stratagem ensures that the common mode rejection ratio is superior under most operating conditions.

No handbook

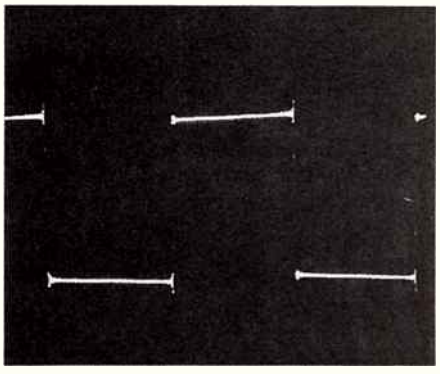
After unpacking the CD 5050, I was puzzled at first by the lack of a handbook in the box. I noted the transport locking key on the bottom of the chassis, which was clearly annotated. But when I looked at the front panel, which is silver hued instead of the famous Yamaha black*, it looked decidedly different from the other CD players around. I could see the mains power switch, the head phone socket, the disc drawer OPEN/CLOSE button, the PLAY button and the STOP, PAUSE button, but none of the other controls which I have come to accept.

It was only then that I noticed a sort of 'cut out', or panel, below the 3 basic function controls. I gently pushed and pulled and down popped a neatly damped rotating panel with copious numbers of controls, certainly enough to satisfy my needs. These were neatly laid out in two rows with two display switches to control DISPLAY MODE (full display or abbreviated) and TIME DISPLAY (first track, remaining time and total time). Next were two repeat switches. The first was

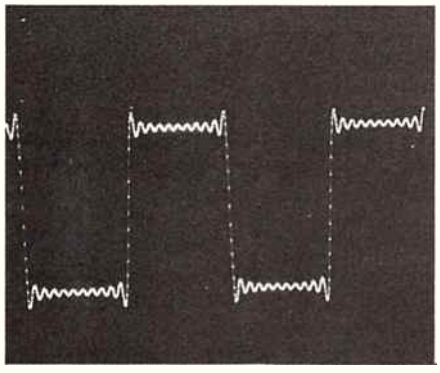
* *The CD 5050 is also available in black.*



Impulse response.

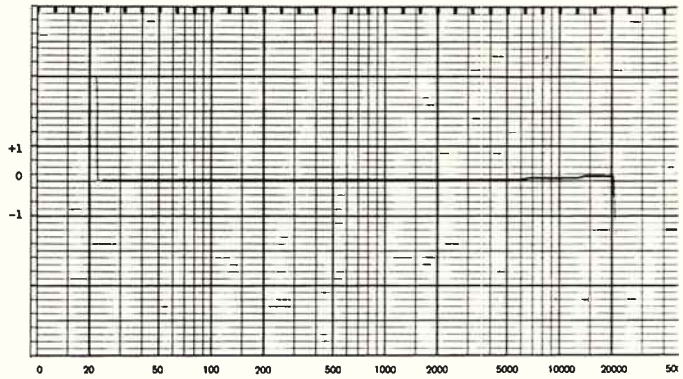


100 Hz square wave.

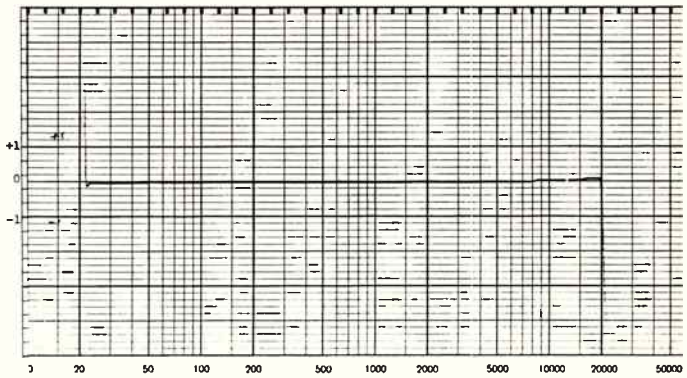


1 kHz square wave.

DIMENSIONS	**Width**	**435 mm**
	Depth	**392 mm**
	Height	**130 mm**
	Weight	**12.0 kg**
	R.R.P.	**$1899**



Frequency response with 10 dB pot (left channel) 20Hz to 20 kHz.



Frequency response with 10dB pot (right channel) 20Hz to 20kHz.

labelled S/F/OFF (for single track repeat, full track repeat or cancel) together with the A – B repeat switch.

Next is the AUTO SPACE switch which places a four second pause between tracks. In the middle are the three PROGRAM selection switches for DELETE, SET/CHECK and CANCEL. The delete allows you to delete tracks from the program, the set/check to set the most complicated program of up to 24 pre-determined sequences in any possible combination from those on the disc in any combination which you key in, in a direct sequence. The sequence can be cancelled with a CANCEL button right along side.

To the right of this is a RANDOM PLAY button, which is a feature I never use (but I know some people do). To the right of these is the elongated toggle bar for FAST FORWARD and REVERSE SEARCH. Next is the FORWARD AND REVERSE SKIP bar, and, last but not least, the INDEX switch, which is only of use if the disc incorporates the index information.

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 152 ohms

The lower row of switches has the '+10' followed by 9 switches from 1-9 for direct entry of track numbers, or programming, as required. On the right hand side is a toggle bar instead of a normal volume control for raising or lowering the output level from 0 dB (maximum gain) right down to – 96 dB (minimum level) in 240 x 0.4 dB steps.

With the display set to full, all of these functions are individually displayed on the bright orange plasma screen. Even though the volume control segment only shows increments of 3 dB (which corresponds to approximately 12 individual steps of the volume control toggle bar) this control responds precisely to your demands. The bar also responds to a hold-down mode to provide a more rapid response should you require it. The output volume control simultaneously provides you with direct control over the headphone output socket level.

The last of the controls is the HI-BIT DIRECT OUTPUT switch which allows you to bypass the analogue filter after the 8 times over sampling filter for true digital sound.

The rear of the CD player has 2 gold plated coaxial line sockets, a coaxial digital socket for feeding the digital signal to digital amplifier (or DAT recorder if you have one) and an optical socket for connecting an optically coupled amplifier or preamplifier if you have the need for the ultimate in interference rejection.

It is only when you remove the cover from the CD 5050 that you can really appreciate the loving care that has gone into the design and assembly of this CD player. At the base of the unit is an extremely heavy moulded chassis fabricated from what appears to be barium or lead filled plastic composite material.

Immediately behind the solidly made 3 beam laser pick up system are the transformers of the double shunt regulation power supply.

To the right of this section is the large mother board which seems to exude a dull black glow instead of the conventional green or yellow. Unlike the latest generation of budget priced CD players, which have a component count you can almost total up on your fingers and toes, this board is covered by a myriad of resistors, transistors, capacitors, ICs and eight very large special purpose LSIs. In addition, there are two separate LSIs on the plasma display board and more ICs on the separate shunt regulator power supply board.

The CD 5050 player is undoubtedly well presented, but, more importantly, every separate sub-section or remote printed circuit board is interconnected using neat ribbon cables terminated with plugs and sockets. The only exception to this are the two power transformers, which are neatly hard wired to wire wrapped terminals.

A delightful task

The laboratory assessment of this CD player proved to be a delightful task as the CD 5050 has outstanding performance figures in virtually every department. The frequency response of the player is exceptionally smooth, with a response that is within ± 0.1 dB from 5 Hz to 22 kHz, and that figure, although equalled, has not been bettered by any other top-line CD players or multi-disc 'combi players' released in Holland or Japan.

What really caught my eye, however, were the linearity figures, which are the best I have yet seen from any CD player all the way down to – 90 dB.

As if not to be outdone, the channel separation figures are outstanding, with the lowest figure of 98.2 dB being logged at 20 kHz and separations much better than 100 dB at all other frequencies. Yes, those shunt regulator supplies and common mode rejection characteristics really do work!

Even the distortion figures are good all the way down to – 80 dB, but of course they are really measurable (but not readily audible) at – 90 dB, where those extra floating bits don;t make up for the limitations of true dynamic range of the software.

Where those floating bits do show up exceptionally well is in the signal-to-noise figures, which have yet to be beaten. An S/N figure of 123.5 dB(A) is tops, even if it is getting well past the range of most people's amplifiers – or their hearing for that matter. Yes, with those sorts of figures you will have to put aside all those old ADD discs if you

want to capitalise on the performance capabilities of the player.

The CD 5050 passed every Dirty Record test and continued to play through all our vibration tests. The only minor criticism is that this particular player was 18 Hz low in frequency with the 20 kHz test signal.

Having convinced myself that this player has the best performance figures of any CD player that I have tested, I took it home to let it loose on my collection of discs.

As I discovered, the remote control unit makes this an absolute pleasure to use.

The first characteristic that I noted was absolute silence from the player between tracks, even with one of my ears glued to my speakers.

I used a Yamaha C2 preamplifier with a Yamaha M 80 amplifier feeding a pair of B & W 801 M speakers for the evaluation. This combination provides superb signal-to-noise ratios at equivalent power outputs of 300 watts peak into each speaker.

The subjective evaluation of the CD 5050 was most enjoyable and relaxed. It offers the simple convenience of three primary controls, without having to resort to the multiple controls on the roll-down control panel. Although I infrequently utilised those supplementary controls for the AB testing of sections of discs, and for other testing, which I subsequently carried out on other loudspeakers which I was reviewing, more than 95% of people would emulate these needs and conditions and, consequently, primary access to the three controls that you really want to use constitutes a better ergonomic design!

In my evaluation, I listened to more than 50 discs from my growing collection with two of the latest discs providing exciting new material.

The first was Jean-Pierre Rampal's latest pot pourris of his flute and piccolo entitled Music My Love (CBS MK 45548), which contains a wide range of previously released material ranging from Bach Adantae III from E-Minor Sonata and Vivaldi Allegro III from G-Minor Concerto for flute, oboe, violin, bassoon and harpsicord, at one end of the spectrum, through to Scott Joplin with The Ragtime Dance and Bolling's Jazzy at the other end. The almost unbelievable signal-to-noise ratio of this player provides an electronic virtuoso's concert hall listening quality with the DDD segments, and, of course, just audible background hiss with the ADD segments.

The second disc I played many times over. It was Emanuel Ax's Haydn Sonatas No 33, 38, 58 and 60. This is an absolutely exquisite rendition of some of Haydn's most glorious piano sonatas.

The CD 5050 is one of the best CD players that Yamaha has produced, and offers superlative technical performance with premium ergonomic design in one neat (if somewhat heavy) package. eti

MEASURED PERFORMANCE OF YAMAHA MODEL NO. CD 5050 SERIAL NO. MO 11079 ZP

1. FREQUENCY RESPONSE — 20Hz to 20 kHz ±0.1 dB; 5 Hz to 22.05 kHz ±0.1 dB

2. LINEARITY @ 1kHz

NOMINAL LEVEL	LEFT OUTPUT	RIGHT OUTPUT
0 dB	0.0	0.0
−1.0	−1.0	−1.0
−3.0	−3.0	−3.0
−6.0	−6.0	−6.0
−10.0	−10.0	−10.0
−20.0	−20.0	−20.0
−30.0	−30.0	−30.0
−40.0	−40.0	−40.0
−50.0	−50.0	−50.0
−60.0	−60.1	−60.1
−70.0	−70.2	−70.2
−80.0	−80.5	−80.4
−90.0	−90.2	−90.1

3. CHANNEL SEPARATION

FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
100 Hz	112.6	111.3
1kHz	112.1	111.7
10kHz	106.8	105.9
20kHz	98.3	98.2

4 DISTORTION (@ 1kHz)

Level	2nd	3rd	4th	5th	THD%
0	113.7	98.7	107.3	104.6	0.0025
−1.0	111.1	98.9	109.0	106.6	0.0025
−3.0	107.2	94.7	114.6	107.7	0.0038
−6.0	121.0	94.6	101.0	97.9	0.0042
−10	—	95.4	114.2	107.7	0.0033
−20	109.9	107.6	104.6	98.4	0.0023
−30	100.7	98.9	91.8	91.2	.0.0066
−40	90.7	86.3	86.3	85.7	0.016
−50	79.3	—	79.6	78.6	0.039
−60	68.7	58.6	66.3	67.0	0.28
−70	49.2	47.1	—	41.1	1.04
−80	40.2	34.3	—	30.0	3.83
−90	33.9	33.5	31.8	14.7	18.8
(@ 100 Hz)					
0	117.1	95.8	106.0	115.7	0.0032
−20	103.5	101.5	108.0	101.0	0.0029
−40	82.7	79.4	87.5	84.6	0.032
−60	55.3	54.8	64.5	64.7	0.26
@ 6.3 kHz					
0	96.5	97.2	102.4	—	0.0053

5. EMPHASIS

Frequency	Recorded Level	Output Level (L)	Output Level (R)
1kHz	−0.37 dB	−0.5	−0.5
5kHz	−4.53 dB	−4.7	−4.7
16kHz	−9.04 dB	−9.1	−9.1

6. SIGNAL TO NOISE RATIO

Without Emphasis	108 (Lin)	123.5 dB(A)
With Emphasis	109.5 (Lin)	125.0 dB(A)

7. FREQUENCY ACCURACY

(19.999 kHz) -18Hz for 20kHz test signal

8. SQUARE WAVE RESPONSE (See photos)

9. IMPULSE TEST (See photo)

CANOVISION A1 VIDEO 8: A CHALLENGE

Barrie Smith tests Canon's top-of-the-range camcorder — the Canovision A1 Video 8.

My first brush with a Canon camcorder was late in 1988 when I took the E708 model on a business trip to Queensland. I remember noticing how different in handling it was to machines made by electronics companies.

It confirmed a theory I had held for some time that video camcorders were devices designed by electronics engineers, for the express purpose of shooting other electronics engineers, to replay to still more electronics engineers!

The 150 year old art of photography had never seemed to raise its head in the camcorder world.

Until Canon. And, apart from a few minor niggles with the 708 model, I was very impressed.

Now there's another challenge to be met: The Canovision A1, the company's top of the range.

And a challenge it is, looking very unlike any other make on the market. Trapezoid-shaped, it tackles the problem of where to put the Video 8 cassette by putting it flush up against the nose of the óperator.

These days, we are faced with 35mm SLR cameras that bridge the role of compacts and look like video camcorders in the process.

The A1 swings us full circle – and looks like a bridge camera! Placing the tape drive so far forward produces one major benefit: the unit is squatter and shorter in length – length, in this instance, meaning eye to lens front element distance.

Superb balance

The balance is superb. The camera feels as though it has lost a third the bulk of any competitor, although it is wider.

Like another Canon model, the E808, the hand grip is rotatable – 90 degrees vertically up and down – just the thing for those ultra low ground shots, or over the crowd's heads. The grip also conceals the battery – in this case a tiny one about the size of two matchboxes, but still delivering up to 70 minutes recording.

Not mentioned in the handbook is the neat fairing aft of the handgrip which stands duty as another 'handle' to hang on to.

The viewfinder eyepiece is orientable through 180°, so, should the whim so take you, the camcorder could be operated at waist level by gripping this convenient fairing. I was able to view the whole frame quite satisfactorily from 15cms away – great for spectacle wearers.

Super 8 film cameras are very much a thing of the past for movie makers. While I regret their passing I have difficulty recalling any that give such a degree of operator ease as some of the new breed of video camcorders. Even such illustrious makes as Leicina (Leica), Bolex and Bauer never gave us oriental viewfinders, nor a choice of grip, nor multiple controls for functions such as zooming.

In ergonomics and layout the camera has such unusual features it's worth close inspection.

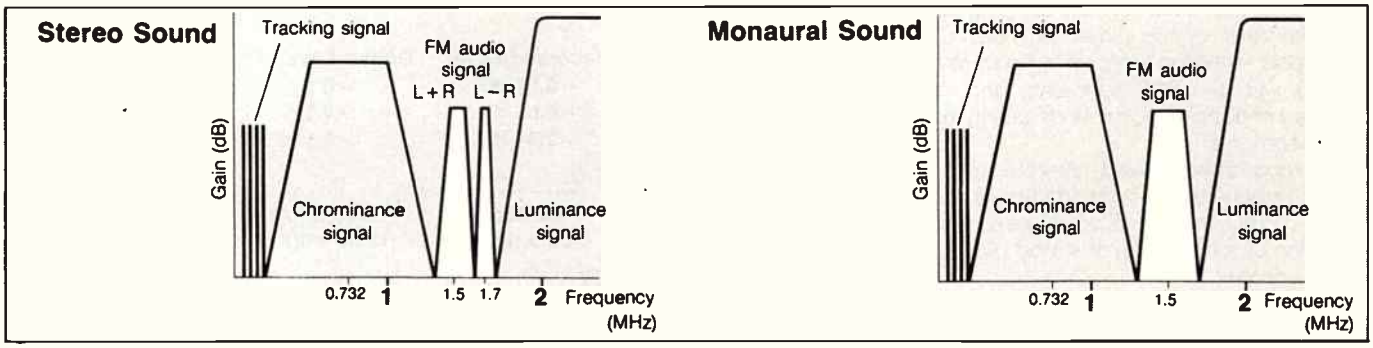
One is immediately aware of the big front element; big because of its 10x1 zoom range. An F1.4 optic, it has a zoom range of 8-80mm, resulting in a very useful wide and tele coverage at either end. Internally, the lens has 14 elements in 12 groups.

As befitting a lens made by one of the world's leading optical companies, the unit allows considerable operator control. Three focussing systems are incorporated: autofocus, manual and push focus. Normally, autofocus is at hand at camera start up time.

The viewfinder display contains a white outlined rectangle. Any subject matter within this oblong gains the full and undivided attention of the autofocus mechanism. In full tele on the zoom I estimated a focus pull from infinity to Close (1.1 metres) took around 3-4 seconds. Not quick, but not bad, either.

To the rear of the lens, on the camera's left hand side, is the first of the unit's four control panels. This arrangement, of thirteen buttons, is almost all you need to run the camera in record mode.

When the AF ZONE button on this control panel is hit, the above-mentioned rectangle changes from a narrow, letterbox proportion



The A1 stereo AFM sound is captured by modulating the L + R and L - R channel signals at different frequencies. But the employment of L + R and L - R signals also means that compatibility is maintained with existing tapes made on 8 mm VTRs with conventional monoaural AFM sound tracks.

Right: the Canovision's dual action hand grip also conceals the battery.

Bottom: a 5-blade iris rather than the conventional 2-blade design gives greater exposure precision.

to one which occupies 80% of the frame. The former is for specific, limited, and relatively stationary areas of the scene – the latter is for wide-ranging action, ducking and weaving.

This choice of two focussing zones removes a lot of my complaints about autofocus. There is nothing worse than a focus system 'pulling and pumping' as the central subject moves around the frame. Being able to control the area of auto operation discards some of the quirkier elements.

More complex

Manual focus is more complex in operation than the automatic. Press M and you simply rotate the lens' focus ring to select your setting; pan, zoom, pull focus to your heart's content – especially useful if you want to employ defocus effects as a device to aid scene transitions. However, if you need to fall back on automatic, simply push the AF/ZONE button and this mode will hold for four seconds.

But there's more to it than that. By allowing the system to find focus for you, it's a quick move to slip back into manual, at that setting. Handy if you want to pan around a scene and know that you can guarantee you'll end up on a chosen portion of the subject – and it will be in focus when you get there.

Interestingly, the manual settings are stored in the camera's memory even after the camera's power is switched off. Sensitively used, it is rather like the predictive focus mode found on some of the newer high tech 35mm SLRs. We can expect to see many more touches added to focussing systems in future camcorders.

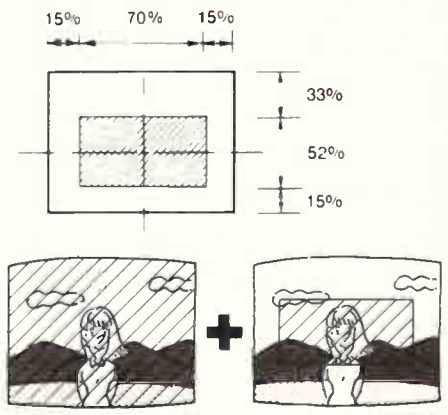
Before we get too far away from the optical department, it's worth mentioning the lens' macro function. Like most other machines, you rotate the zoom stick to the wide end, pull the little black knob, and enter MACRO. This presents the eternal problem – how do you do macro shots when the front element is breathing down the neck of your subject? Fancy shooting a close shot of a taipan's jaws?

The ER8O8 had a nice touch, macro in the wide, or the tele end, which allowed you to shoot a field of 35x47mm from 6Ocm distance. Why not in this model, Mr Canon?

Returning to the control panel and its thirteen buttons, it's commendable that Canon has given each of them a distinctive feel and shape, so that after a little practice you could home in on a particular one without looking.

The exposure control takes an unusual direction in the A1, and one which I fully applaud. You can choose AUTO, letting the aperture go with the light condition prevailing, or MANUAL. But it's manual exposure control with a difference.

As you view the scene, a small icon of a scale with plus and minus signs at each end, and a fulcrum, appears. But the tiny delta shape is not a fulcrum. Press a + or - on the panel and the delta moves along the scale, giving you a larger or smaller aperture. Better still, this manual compensation stays in memory when the camera is switched off. Full marks, Canon.



Multitude of riches

The designers have obviously thought long and hard about the A1's metering system,

and a multitude of riches are concealed beneath a relatively simple, operational exterior. Described as a Correlated Two-field System, two readings are taken – one of the entire frame, the other of the central 36%. The two measurements are then integrated to produce a final aperture setting.

The company claims this system necessitated a change to the construction of the aperture itself; in place of the usual two-bladed iris, a five blade has been installed. A visually pleasing by-product of this change is that hot spot highlights, and out of focus backgrounds, will be of a more pleasing, spherical shape.

Other controls: FADE in and out to white, handy for scene transitions, TITLE (two lines of sixteen characters each) and DATE – with the number of the month preceding the name of the month (for that forgotten percent of the market who don't live Stateside!); WHITE BALANCE, which is normally in auto, but can be set and held manually; RECORD SEARCH, allowing a skip back about three seconds into the previous scene so that new recordings can start 'frame tidy'; CAMERA MODE – in the A setting focus, white balance, and exposure fall under automatic control, plus you are allowed access to the high speed shutter; and the SHUTTER control.

Unlike other makers, Canon has decided to access the shutter speeds by a button pressing routine, which keeps the control panel tidy. The normal speed is 1/50th; the options are 1/250, 1/500, 1/1000 and 1/2000. Using these higher speeds you must place the camera in AUTO CONTROL.

To the rear of the camera control panel is a concealed flap which opens to reveal access ports for audio/video outputs via RCA plugs direct to the AV terminals (if your set has them), or via the familiar RF pack. Bear in mind the audio output is stereo, with audio outputs to match. Also found beneath the flap are EDIT control for dubbing to another VCR and a REMOTE port. The EDIT switch bypasses the final stage video equaliser circuit, reducing loss of signal fidelity in the transfer process.

The rear of the camcorder is taken up by the tape well, and atop it are controls for PLAY, REWIND, FF, PAUSE, etc. A double azimuth 3-head system allows noiseless slow motion replay, frame advance and still frame pause. The arrangement also means that action shots using the high speed shutter can be screened with no flicker or blurring – a bonus for sports analysts.

Cunningly snuggled

Snuggled cunningly into this section are a duplication of the main zoom controls. The handbook offers no explanation for this, but I guess it would be handy if you're operating at waist level. For shooting kids, waist level is the only way to go!

Round the corner another flap is hiding another control panel. Here are found titling set buttons, tape speed change and a timer, to allow you to be in the picture, or to pre-set the unit to record at a point over the following 24 hours.

For TIMER, also read INTERVALOMETER, an extremely useful option, which takes the humdrum camcorder (if you could ever label three and half grand's worth of electronics humdrum) into a very novel area. By entering RECORD mode the TIMER allows you to capture a half second burst of action in intervals of 10, 20 and 60 seconds – ideal for time lapse of flower (if that's your bag) or cute pixillation effects that were beloved of experimental movie makers in the 1930s.

The right side of the camera finds OPERATE (power ON), a HEADPHONE mini-jack, the red RECORD button, battery (neatly housed beneath the hand grip) and the main zoom lens control.

The camcorder is a stereo model, but the handbook carries barely a mention of it, so, I will. Whilst stereo, a tape recorded on the A1 will replay in mono via older camcorders. The A1 stereo AFM sound is captured by modulating the left + right, and left - right, channel signals at different frequencies, approximately 1.5 and 1.7 mHz. Decoded and replayed, the two signals can produce discrete two-track stereo. But the employment of L+R and L-R signals also means that compatibility is maintained with existing tapes made on 8mm VTRs with conventional monaural AFM sound tracks.

The mic fixed to the top of the unit is a stereo electret condenser, and you must live within an auto level environment, not always to the liking of picky videographers. I think a few loud voices should be heard in the corridors of Canon about up-grading the audio side on expensive models such as this. It is possible to connect an outboard microphone via a 6vDC OUTPUT and MIC socket – but how about a simple volume control?

An extremely useful gadget supplied with the A1 is the infrared wireless controller. This small unit can control the camcorder up to 5 metres away, covering a forward horizontal arc of sixty degrees, and vertical of thirty. It is surprisingly comprehensive in its duplication of camera controls, allowing you not only to run and stop the camera in record, plus zoom, but access all the PLAY controls and FADE, TITLE and DATE. About the only functions unavailable via remote are the white balance and shutter.

Summing up

The A1 would have to be one of the better thought-out units on the market, in Video 8. Picture quality is level with, if not a touch ahead of, any make on the market.

But one should not ignore the arrival of Super-VHS in 1989 and the promise of PAL Hi-8 early in 1990. The only penalty with these standards is that you need to invest in new display equipment (TV set and VCR) to enter the realm of near-broadcast quality they promise.

Which allows me to advise that if you're in the mood right now for a top Video 8 unit – this could be your A1 choice. eti

CANON A1 — SPECIFICATIONS

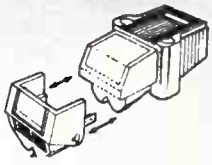
Television system:	**CCIR standard. PAL Colour signal.**
Image sensor:	**420,000 pixels CCD.**
Video recording system:	**2 rotary heads, helical scanning. Luminance signal: FM azimuth recording. Colour signal: converted subcarrier phase shift recording (8mm video standard).**
Audio recording system:	**Frequency multiplexing with the video signal by two rotary heads (two channels).**
Tape format:	**8mm. Metal particle tape recommended.**
Tape speed:	**SP: 20.051 mm/s. LP: 10.026 mm/s.**
Lens:	**F1.4/10x power zoom, 8-80mm focal length, plus macro mode.**
Focussing system:	**TTL piezo-electric autofocus, plus manual facility.**
Minimum autofocus distance:	**1.1m or 4mm in macro mode.**
Minimum illumination:	**7 lux (at max aperture).**
Filter diameter:	**55mm.**
Finder:	**Electronic, mono, 0.7 inch diagonal.**
Output level:	**Video: 1 Vp-p/75 ohms, unbalanced (video terminal). Audio:- 10dBV/less than 3 kohms, unbalanced (audio terminal/stereo audio output).**
Dimensions:	**157x257x149mm.**
Weight:	**1.5kg plus battery.**
Accessories:	**Tele-converter which extends focal length range by a factor of x1.4; Wide converter changes max wide to 6mm; mic boom and accessory stereo mic; sports finder; battery light; rain shield.**
RRP:	**$3499.00**

Stylus wear. By the time you hear it, it's too late.

If you haven't replaced your stylus (needle) in the past year, you may be permanently damaging every record you play.

Replacing your stylus is simple (see diagram). And selecting the proper stylus to replace it *with* is also easy: Make certain it's a genuine Shure stylus.

All Shure styli are designed to exacting specifications for precise stereo reproduction. And *only* a Shure stylus can restore your Shure cartridge to its original standard of performance. Don't accept substitutes. Protect your records *and* your sound. Get a genuine Shure Replacement Stylus. Soon.



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A LITTLE FIGURING

Forecasts of sales in the audio and television markets were released at the end of the year's third quarter, showing continued strong growth, despite the doom-and-gloomsayers.

The demand for stand-alone compact disc players remains strong, the forecast showing an increase of 30 per cent over the 1988 sales figures, according to the Market Forecast Figures released by The Consumer Electronics Suppliers Association (CESA), a body which represents the major Australian importers of audio and hi-fi equipment.

The figures were released as part of CESA's annual Industry Consensus, as a revision of its earlier forecast for 1989 and indicate trends that have occurred up till the middle of the year, they say.

The industry expects some 150,000 component CD players to be sold over 1989, and around 13,000 portables. But the big surprise comes with the figures for CDs built in to music systems. CESA predicts 80,000 units to be sold this year, an increase of 70 per cent over the 1988 sales figures.

"This year could finally prove to be the major turning point in the growth of CD products...", says the CESA report.

And, in this 10th anniversary year of the Sony Walkman – the stereo headset cassette player that turned the consumer electronics industry literally on its ear – CESA forecasts sales of some 540,000 stereo headset players for 1989. The tranny is dead!

Clearly, a large swag of those component CD players will be added on to existing sound systems; amplifier sales forecasts run at around one-fifth component CD sales at a forecast 33,000 units.

CESA's forecasts for the colour TV and video market are interesting, too. "Sales of colour television receivers have remained strong, and anticipated sales have risen to 680,000 units, with an estimated retail value of $458 million. It is anticipated they will be 35 per cent of the estimated sales.

"Higher priced stereo units are continuing to represent a greater proportion of the market, and it is anticipated that they will be 35% of the estimated sales", CESA says.

Likewise, the demand for video cassette decks and video camcorders has strengthened, the report goes on. Sales will be 560,00 units for the year, according to the forecast.

SMPTE Conference

THE 4th Conference and Exhibition of the Society of Motion Picture and Television Engineers – Australian Section, will be held over 3rd to 6th July 1990. The venue will be the RAS Showground in Sydney and the event has been dubbed: "Sound & Vision '90."

The previous conferences have been the foremost events for the film and television industry in Australia.

The program for the conference:

- High definition systems & equipment.
- Production and post-production techniques for film and video.
- Audio production and post production systems & equipment.
- Delivery systems – today, tomorrow & the future.
- Dispiay technology – the future.
- Developments in magnetic recording and technology.
- Computer graphics & animation.
- Digital optics.
- Laboratory development.
- Cinema – the future.

Keen to present a paper? Contact the Papers Chairman, David Edgar, at AAV Australia, 180 Bank St, South Melbourne Vic 3205. ☎ (03)699-1844, fax ☎ (03)696-2895.

DAT again

THE announcement last July that recording and consumer electronics companies had reached an agreement about the introduction of a Serial Copy Management System (SCMS) to limit the copying of pre-recorded material on DAT machines was not accompanied by any literature on exactly *how* the system worked, and how it was to be implemented. Well, since then, more details have come to light, courtesy of Philips.

The SCMS is a system to regulate the serial digital copying on digital audio tape. Serial copying means copying from copies – a dub, to you and me.

SCMS will allow direct digital copying of compact discs onto blank DAT tape (and LPs and audio cassettes, too). SCMS allows you to make as many first-generation dubs as you like. But when you go to make a copy of that, digital-to-digital – no go! Not unless you dub from the DAT player's audio output onto the next medium, thereby losing some clarity.

Direct digital-to-digital copying is near-perfect, hence the recording industry's worry about serial copying because you can make an almost infinite number of dubs – digital audio clones, really – from copies without significant, or noticeable, degradation.

The SCMS restriction only applies to copying from source material which is both protected by copyright and which already has been copied at home.

Current DAT recorders cannot make direct digital dubs from CDs because the digital system sampling frequencies are different between the two machines. However, in future, a DAT recorder equipped with SCMS can record using the CD sampling frequency of 44.1 kHz.

SCMS will encourage copying of originals at home, resulting in copies of great quality, but will prevent serial copying.

New DAT recorders will have the SCMS system incorporated in the ICs which make up the player's electronics.

The SCMS will add a code to copies of original recordings, in effect labelling the tape as a home-made copy and thus copyright protected. If, subsequently, the digital output of one DAT machine is connected to the digital input of another, to make a direct digital-to-digital copy, the machine being used for the copying will check for the code and, if found, refuse to record.

The International Federation of the Phonographic Industry (IFPI) and the Recording Industry Association of America Inc (RIAA) got together with three European consumer electronics companies – Philips, Thomson and Grundig, and 12 major Japanese consumer electronics companies: Fujitsu General, Hitachi, Matsushita (Panasonic, Technics), Mitsubishi, NEC Home Electronics, Pioneer, Sanyo, Sharp, Sony, TDK, Toshiba and the Victor Company of Japan (JVC).

New Stanton Club Series cartridges

THE 890AL Club Series is Stanton's newest Pro DJ cartridge. This state-of-the-art cartridge provides the best sound quality ever offered for DJ use and is specifically designed for back-cueing, scratching, mixing and other heavy use, according to the company.

The 890AL is manufactured with a unique suspension system that is highly responsive to extremes in groove modulation changes. It features an ultra high polished spherical diamond and a thin wall aluminium alloy cantilever reinforced with an exclusive tie wire design that stabilises the stylus in the groove. The 890AL is supplied with an extra stylus.

The 680 MkII Club Series offers three models, the 680EL MkII, the 680EL MkII-MP and the 680AL MkII. Each of these models includes an extra stylus, with the exception of the 680EL MkII-MP.

The 680 series has long been one of Stanton's most popular cartridges for the professional. The new 680 MkII is said to provide an excellent balance between a responsive musical cartridge and rugged construction that will stand up to the demands of the professional DJ. The 680 MkII's new cantilever suspension system is designed for optimum strength and minimum mass. Its thin wall, smaller diameter aluminium alloy tube is highly responsive to groove modulation yet very durable.

The 500 MkII Club Series comes in three models, the 500AL MkII, the 500AL MkII-MP and the 500EL MkII.

Stanton's new design of the 500 MkII includes a Samarium Cobalt Magnet which offers a lower mass and a higher output plus a new cantilever suspension system. The 500 MkII series is said to provide a perfect blend of economy, reliability, ruggedness and optimum performance, ideal for heavy use, scratching and mixing.

READER INFO No. 179

Meridian gets active

BRITISH speaker manufacturer has gained a reputation for active loudspeaker design. Unlike the more usual arrangement in which passive loudspeakers are driven from a separate amplifier, the Meridian active speakers contain purpose-designed electronics – amplifier and electronic crossover – which allow them to be driven from a preamplifier or directly from a CD player.

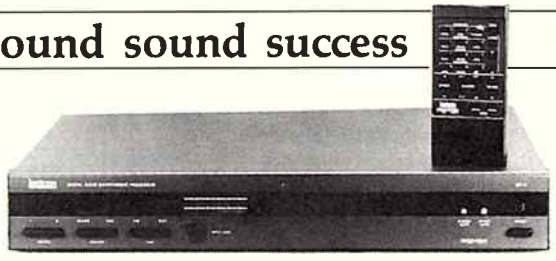
The new generation of Meridian active loudspeakers, the M30, M20, M60 and D600, have user switchable features including auto music turn on from standby, and a range of response selections allow the speakers to be adjusted for room acoustics or to operate close to a wall or on a bookshelf. They also feature a multi-way connector intended for use with Meridian's multi-room system.

The D600 is the world's first digital loudspeaker, the company claims. The dedicated electronics housed within the speaker contains the digital to analogue converters, so signal from the digital output of a compact disc player may be directed in its digital form to the D600 for conversion, rather than the conversion taking place in the CD player or external amplifier.

More information is available from the distributor, Audio 2000, PO Box 94 Drummoyne NSW 2047. ☎ (02)819 6533.

READER INFO No. 178

Surround sound success



THE Lexicon CP-1 Digital Audio Environment Processor, launched in Australia early last year, has been a resounding success as a first entry into the home listening market for Amber Technology, the company says.

Amber distributes a full range of Lexicon professional audio products, but the CP-1, aimed specifically at the domestic consumer market, has been a major breakthrough in applying world class studio technology to a home listening product, they say.

According to Amber Technology's David Hudson, Lexicon set the standard for advanced digital technology in the professional recording industry years ago. "The CP-1 Digital Audio Environment Processor placed this technology within the reach of home listeners, to provide them with the same high quality processing as that of the world's top recording studios."

The Lexicon CP-1 will enhance the home listening experience with a basic stereo system or with up to six additional speakers.

It processes sound in true stereo – that is, all sounds are independently digitally processed, unlike other competing products that produce a stereo output from a mixed mono input.

Further information from David Hudson, Amber Technology, PO Box 942 Brookvale NSW 2100. ☎ (02)975-1211.

READER INFO No. 177

New Grado cartridge

THE Grado signature XTZ cartridge is the latest edition to Grado's acclaimed signature series cartridges. The XTZ is the pinnacle of the "optimised transmission line" signatures, and joins the accomplished 8MZ, MCZ and TLZ.

The optimised transmission line design provides an excellent soundstage, extremely low background noise and state of the art sound with the convenience of the stylus being user replaceable and compatibility with most quality arms, Grado says.

The three-piece optimised transmission line cantilever technology consists of separate sections that are telescoped into each other.

All sections are made of different alloys, some sections hollow, others solid. These sections are bonded together with materials that act as dampers, and are coated with a black proprietary material which contains and absorbs resonances that travel on the surface of the cantilever.

The OTL stylus/cantilever transmission line technology will make your records sound quieter, improve the height, width and depth of the soundstage and offer exceptional detail. For further information, contact Grado's Australian agent, Audio 2000, PO Box 94 Drummoyne NSW 2047. ☎ (02)819 6533.

READER INFO No. 176

New Pioneer car CD

THE new Pioneer KEX-M800 Multi-Play CD Controller has a unique detachable front panel which can be taken by the driver when leaving his or her vehicle to prevent theft.

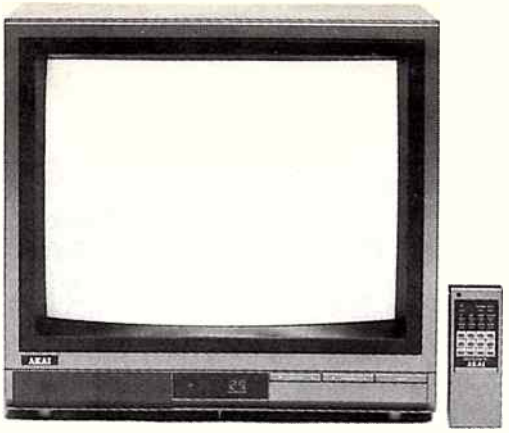
The front panel is flicked down for normal operation of the cassette deck and with an easy press of the button comes away from the controller leaving a blank panel behind.

The detachable front panel is compact and lightweight to carry around or conceal until the driver replaces the control panel and once again the system is ready for use. The KEX-M800 also includes an auto reverse cassette deck.

The KEX-M800 is ideally matched to the new CDX-M70 Multi-Play Compact Disc Player, says Pioneer. The CDX-M70 takes the same six-disc magazine used in Pioneer's home Multi-Play CD players. The compatibility between car and home players extends the use of the magazine and at the same time the discs are protected from dust and damage.

The boot mounted CD player has a double-float suspension system to ensure accurate laser tracking of discs even under the extremities of Australian road conditions. More details from your nearest Pioneer dealer.

READER INFO No. 175



Going against the grain

SEEMINGLY swimming against the tide in colour television sales trends, which dictates that 25-inch and over screen sizes and 14-inch and under are all the rage in the market place, Akai has released a new 21-inch colour TV featuring a flat-square tube and remote control.

Known as the CTK-211, it boasts a 30-channel tuner and input facilities to accommodate a VCR with video input and audio output. It is directed towards unit owners requiring a modest-sized screen TV, and consumers wanting to integrate a television receiver into a midi-size hi-fi system.

The CTK-211 is available from selected Akai dealers and department stores and sells for a recommended retail price of $899. It is covered by a three-year warranty.

READER INFO No. 173

15-hour play time VCR?

TWO separate developments from West Germany have upset the VHS applecart. It is now possible to get up to 15 hours playing time from a single VHS video cassette following developments at Nokia in West Germany.

Nokia engineers found a way of tripling the playing time of any VHS cassette, by simply running the cassette at one-third its normal speed. Nokia's developmental recorder runs the VHS tape past the head at 0.78 cm/second instead of 2.34 cm/second. Conventional half-speed VHS VCRs run the tape at 1.17 cm/second.

Reducing the speed reduces the width of each diagonal magnetic stripe or track to 16 micrometres; the track is 49 micrometres wide for conventional recordings. Such a narrow track width would normally result in unacceptable crosstalk between adjacent tracks, but Nokia has avoided this compiication by a cunning and simple device: reversing the phase between adjacent tracks.

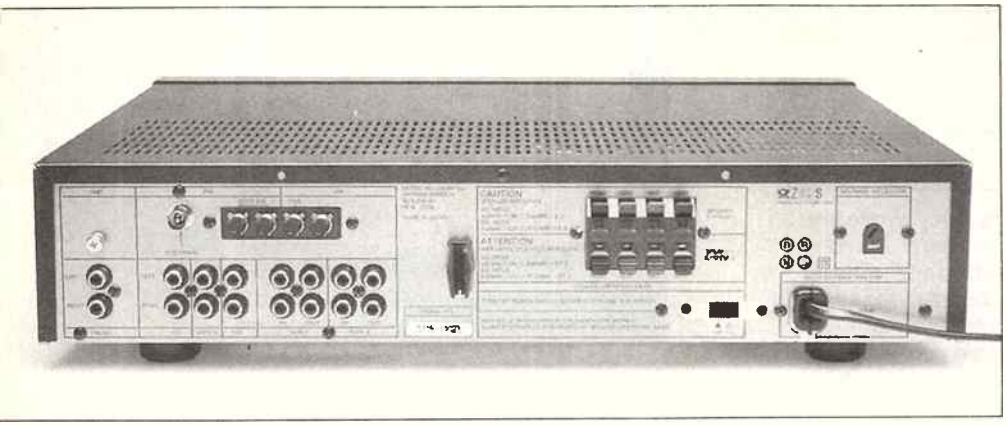
This cancels any track-to-track crosstalk. Nokia says that this simple technique, which costs very little to implement, produces pictures which are said to be almost as clear as those from full-speed tapes.

However, you can't replay tapes recorded in this way on a conventional machine. JVC objects to the Nokia development as it falls outside the VHS standard, for which the company is responsible.

In a separate development, West German tape manufacturer BASF has produced an E300 VHS cassette which gives five hours recording time at normal speed, and 10 hours at half speed. Used on Nokia's developmental machine, it would provide 15 hours playing time. Currently, the longest-playing VHS cassette meeting the VHS standard is the E240, providing four hours recording at normal speed, eight hours at half speed.

JVC has issued warnings that the thin E300 tape (it has a 9 um base compared to a 12 um base on an E240) will tangle and break in some VCRs. News has it that E300 VHS video cassettes will be on sale in Europe this month.

READER INFO No. 174



HARMAN/KARDON hk550Vxi STEREO RECEIVER

A good place to start assembling a component hi-fi system is with a receiver, because you get a tuner, preamp and power amp in one box. Roger Harrison reviews this economical receiver from Harman/Kardon.

Harman/Kardon would have to be considered a maverick in the hi-fi market here. In the first place, it's American-designed and Japanese-manufactured gear. In the second place, it's distributed in Australia by a company best known for distributing the best in British loudspeakers – Convoy International.

Last year, Convoy picked up the Harman/Kardon agency following a period when H/K had been virtually off the market here. Since then, Convoy has quietly set about re-establishing the brand's presence, importing a range of quality components and integrated units, such as this receiver.

Harman/Kardon has a deserved reputation for providing sturdy, functional, no-nonsense, cosmetically understated, reliable, quality-manufactured hi-fi equipment which delivers good performance at not-outrageous prices. The item of equipment reviewed here fits solidly into that mould.

Basics

The hk550Vxi is an AM-FM stereo tuner and preamp/amp integrated into a single cabinet. The amplifier delivers 45 watts per channel (continuous) and the preamp will accept inputs from a turntable, compact disc player, video cassette recorder or two audio tape decks. An additional auxiliary input is also provided. This allows you to connect up almost any of today's diverse range of audio source equipment: turntable, cassette deck, CD player, DAT, VCR, videodisc player or stereo TV, etc.

The amp has two sets of speaker output connectors, making it possible to hook up one set of speakers in the listening room, with the equipment, and a set of extension speakers in another room. The speaker connectors are a spring-lever type that make speaker cable connection a breeze.

The tuner section has three antenna connections: a 75 Ohm unbalanced male coax connector for FM, a pair of of binding posts for 300 Ohm balanced FM antenna input, and a pair of binding posts for an AM antenna input (one of which is ground). For AM reception, a small loop antenna is provided, while an indoor dipole is provided for FM reception.

The front panel has a brushed aluminium finish, the metal cabinet a fine, dense wrinkle paint finish. The front panel lettering is in gold. A groove or channel runs the length of the front panel, separating the top and bottom halves. Centrally located in the top half is the display panel, which takes up some one-third of the width. This contains the five-digit, seven-segment frequency readout and the various annunciators and indicators.

Immediately to the left of the display are eight small, rectangular pushbuttons which provide the station memory facility. You can commit up to six stations to memory on either the AM or FM bands. Immediately to the right of the display is a large, rectangular rocker switch for tuning the receiver up or down the selected band. Just to its right is a small pushbutton marked "Seek". When pressed, this sets the tuner automatically tuning up and down the band, pausing as it comes to each station. Press it again and the auto-tuning will cease.

In the lower half of the panel, beginning at the extreme left, is the large, square power switch. It's a push-push type. Then, moving to the right, there's the headphone jack socket (standard 6.5 mm stereo jack), speaker selector switch, bass-treble-balance controls, the tape monitor switch, the function switch and then the large diameter volume control knob. Note that the bass, treble and balance controls all have a centre detent. On the extreme right is a loudness pushbutton. This provides a 10 dB lift at 50 Hz and a 3 dB lift at 10 kHz, according to the specifications.

Immediately above the power switch, in the top half of the panel, are two LED indicators marked "High voltage" and "High current". I shall return to these a little later.

The front panel layout is logical and uncluttered. A delight, in fact. With the exception of the volume control, all the rotary knobs are of the thumb-and-forefinger type. The volume knob is 40 mm in diameter, making for comfortable handling.

The hk550Vxi receiver measures 443 mm wide by 103 mm high (which includes the 13 mm high feet) by 368 mm deep. It weighs 7 kg.

On the air

The hk550Vxi acquits itself like the old BOAC airlines slogan – "with a minimum of fuss." All the controls work smoothly and do just as you expect them to do; there are no little surprises. The memory presets are easy to set and the auto tuning is simple and works well. Note that you can preset up to 12 FM stations and six AM stations.

The facility of being able to select either of two speaker pairs, or both together, is a welcome one. The handbook, however, cautions that the combined impedance should not be lower than 4 Ohms. There is a switch on the rear panel that allows selection of an 8 Ohm or a 4 Ohm speaker load, but does not reveal exactly what it does. From a look inside the chassis, it appears that it changes the output stage's supply rail voltages, which would keep the output devices' dissipation within safe limits with a lower impedance load. I note that the specifications quote the same continuous power output at both 8 Ohms and 4 Ohms. A nice feature, and one I haven't seen before.

It protects the speakers as much as the amplifier because, with an uncommonly low impedance load it's easier to drive the amplifier into clipping. The power in the high frequency distortion products then often destroys the speakers' tweeters, followed by collapse of the amp's output stage.

The sound quality is quite good, with no obvious imbalances or peculiarities. It drove the pair of bookshelf bass reflex speakers I used to uncomfortably loud levels with ease. Residual hum and noise is well down, being unnoticeable in a quiet room, except when switched to phono and with the volume control set for high level output.

Incidentally, all the input sockets are mounted on a pc board which also contains the phono input stage, this board being secured to the rear panel. Only high level signal wiring runs to the front panel selector switches.

The tuner exhibits good sensitivity on FM, sufficient to receive all the major Sydney stations and a goodly number of the community FM transmitters. Sound quality is quite good, and A-B'd with an expensive top-end tuner, did not give too much away here.

An indoor wire dipole was supplied, which the handbook suggests you connect to the 300 Ohm balanced antenno input terminals. Not ideal, but adequate. Our offices are located in Balmain and in an RF hotspot. Like every other tuner I have used at this location, crossmodulation products are evident across the dial. However, all the stations I could locate on these frequencies were clean, showing no evidence of the modulation products of other stations.

The AM tuner is best described as adequate. No AM stereo decoder is included, but, as I have said previously, this seems to be aimed at the car radio listener, or just ignored. Reception on the supplied loop was good for all the local stations. This loop does not show much directionality.

In manual tuning mode, it steps at 9 kHz intervals on AM and 50 kHz intervals on FM. You can store up to 12 FM stations because the FM/AM switch to the left of the display gives you two FM registers (FM1 and FM2), but only one AM register.

The bass, treble and balance controls all work as expected and the centre detents are a welcome feature. The specifications indicate the tone controls provide + / – 10 dB of boost and cut at 50 Hz and 10 kHz. The loudness switch works as expected, with no audible clicks or plops. The tape monitor and function selector switches also work without any trace of switching transients.

Internally, the construction is of solid, conservative design, with the main amplifier pc board dominating the base of the chassis, the tuner board being mounted above it. The preamp "front end", as mentioned before, is mounted to the rear panel. Various other small boards complete the complement. The generous power transformer is mounted at left rear, well away from the sensitive circuitry. A single, large heatsink at the rear dissipates the output stage devices' heat. Slots in the chassis beneath this area and in the cabinet cover above provide good, free, air circulation.

I said I would return to the "High voltage" and "High current" indicators. Harman/Kardon's full description of the hk550Vxi is "High Voltage/High Current Stereo Receiver". This, basically, seems to refer to the speaker load setting switch. When set to the 4 Ohm position, the high currrent LED lights. When set to the 8 Ohm position, both LEDs light.

The handbook supplied is simple to follow, well laid out and clearly illustrated. One niggling little point, though: in the description of the Operating Mode Indicator Lights (the above mentioned High Voltage, High Current LEDs), it says their operation "...is covered in the *Hook-Up* section farther on in this manual." Well, I couldn't, for the life of me, find the Hook-Up section, or any further mention of these indicators.

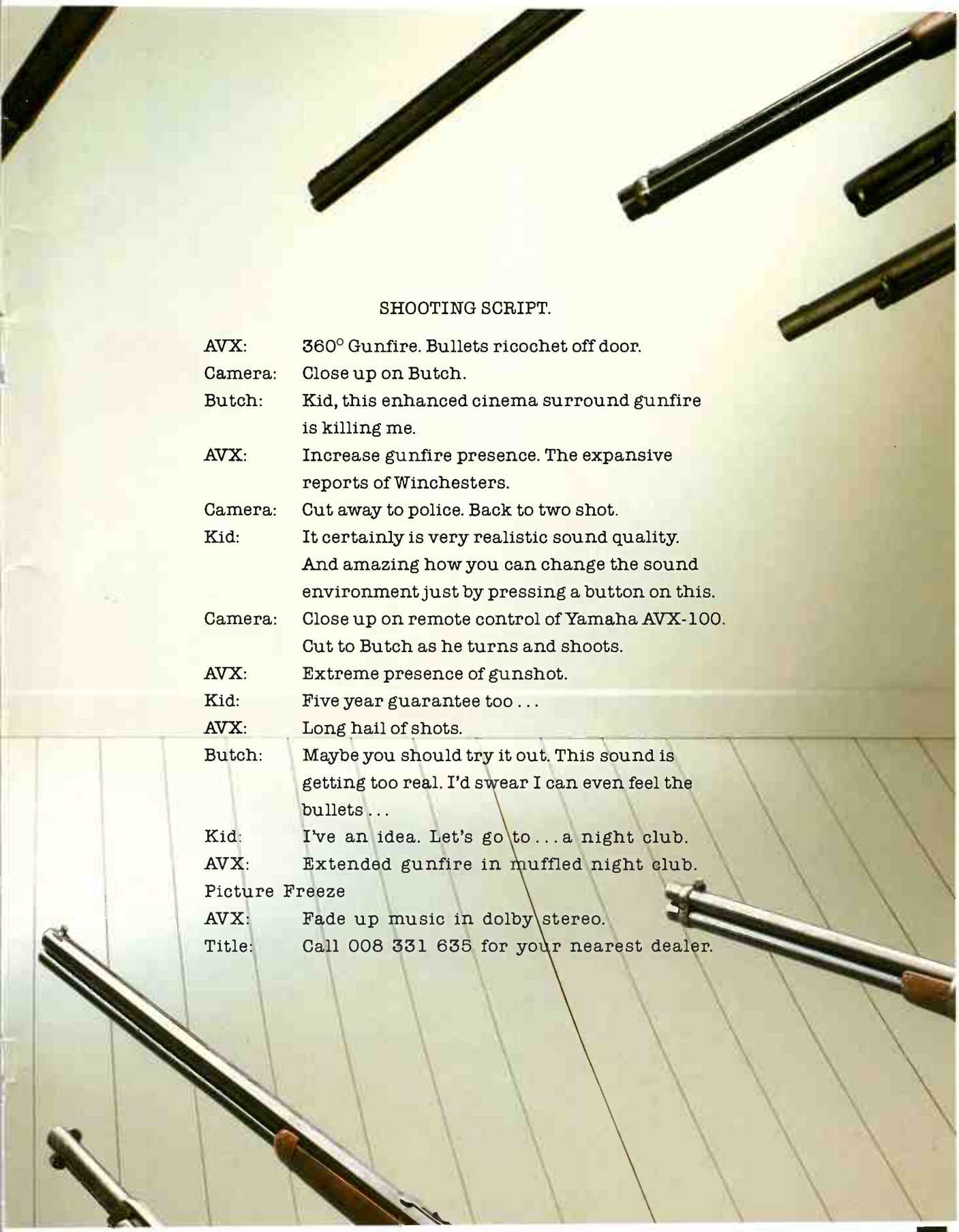
Summing up

The hk550Vxi is entirely without pretence. It delivers solid performance, and at a recommended retail price of $999, represents excellent value for money. It would make a very good basis for a component hi-fi sound system. Just add, say, a turntable or CD player and a quality pair of bookshelf loudspeakers, and you'd end up with a quality system for under $2000 that would give many years of enjoyment. eti

Review unit supplied by the distributor, Convoy International, 400 Botany Road, Alexandria 2015. ☎ (02)698-7300.

Saatchi YAM 062/B

READER INFO No. 35



SHOOTING SCRIPT.

AVX: 360° Gunfire. Bullets ricochet off door.
Camera: Close up on Butch.
Butch: Kid, this enhanced cinema surround gunfire is killing me.
AVX: Increase gunfire presence. The expansive reports of Winchesters.
Camera: Cut away to police. Back to two shot.
Kid: It certainly is very realistic sound quality. And amazing how you can change the sound environment just by pressing a button on this.
Camera: Close up on remote control of Yamaha AVX-100. Cut to Butch as he turns and shoots.
AVX: Extreme presence of gunshot.
Kid: Five year guarantee too . . .
AVX: Long hail of shots.
Butch: Maybe you should try it out. This sound is getting too real. I'd swear I can even feel the bullets . . .
Kid: I've an idea. Let's go to . . . a night club.
AVX: Extended gunfire in muffled night club.
Picture Freeze
AVX: Fade up music in dolby stereo.
Title: Call 008 331 635 for your nearest dealer.

YAMAHA

AUDIO – VIDEO AMPLIFIERS • 5 YEAR WARRANTY

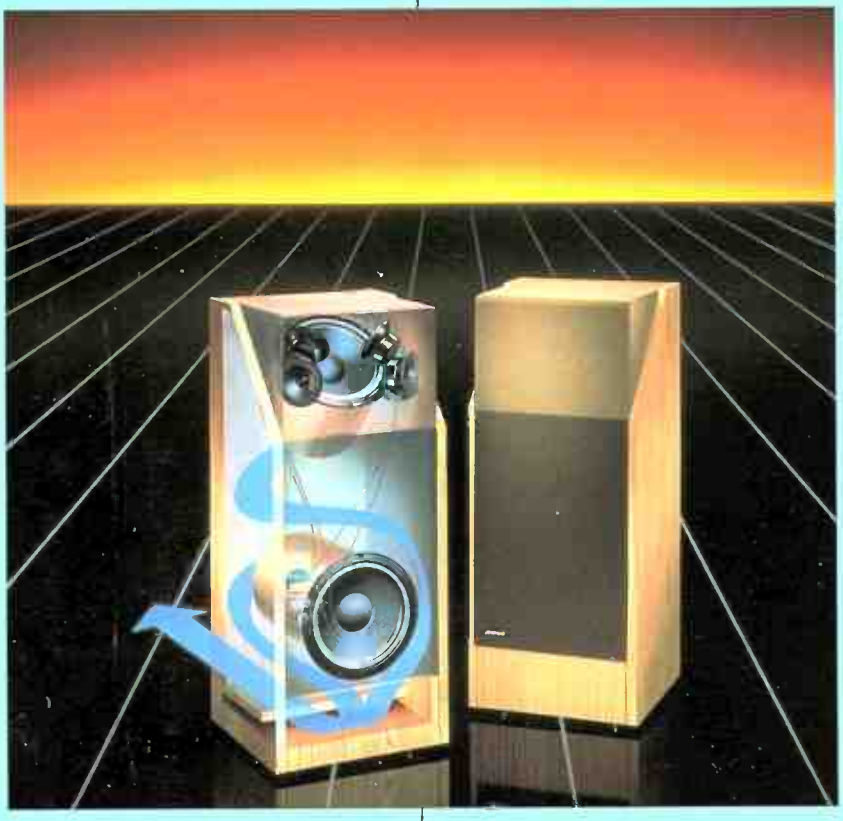
BOSE®

The Bose® 601™ Series III Direct/Reflecting® Loudspeaker System

Bose engineers have invested more than 25 years of ongoing research seeking one goal—re-creating the realism 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.



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.

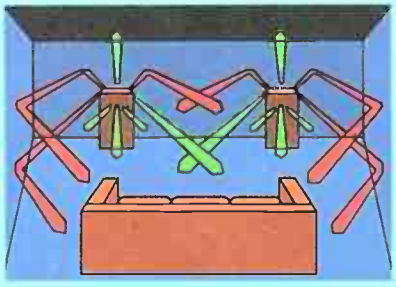
The 601 system brings a three dimensional sensation to music—giving the sound depth, height and width. In short, it seems to come alive!

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.

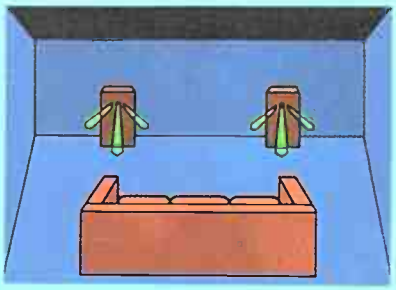
With most conventional speakers, you hear stereo in one or two parts of the room. Everywhere else, you hear primarily one speaker. The 601 system allows you to hear true stereo *everywhere* in the room—even when you are directly in front of one of the speakers.

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.

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Bose17

READER INFO No. 36