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Electronics Australia

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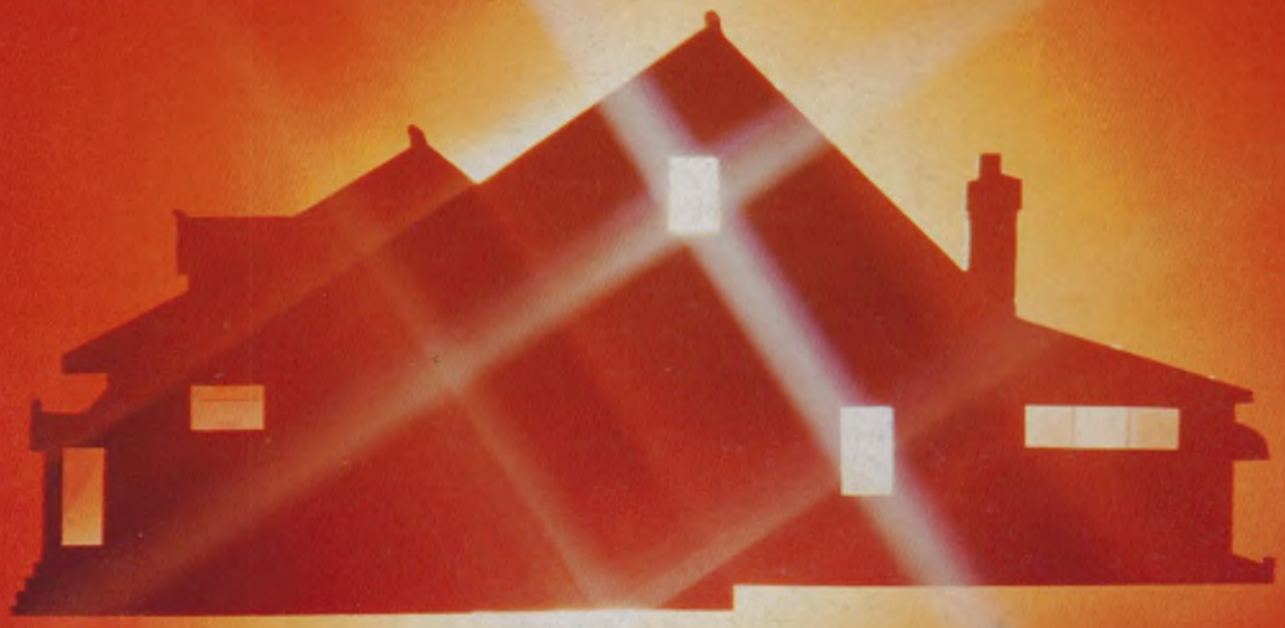

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Volume 48, No. 6

Electronics Australia

June 1986

THIS MONTH'S COVER

Does your house eat light bulbs? Our new Lamp Saver will greatly extend the life of those expensive downlights and spotlights. Details page 24.

Features

Entertainment Electronics

Projects and Technical

News and Comment

Departments

Control appliances by telephone

With this project, you can dial your home number and turn on outside lights, an electric blanket or some other mains appliance without paying for the call. Construction begins on page 42.

What's coming

Next month we intend to describe a dynamic noise reduction unit and present an article on Tasmania's hydroelectric scheme. See page 119 for further details.

Build this VHF wattmeter

Are you getting the most out of your VHF rig? Find out by building this VHF Wattmeter. It measures RF power in both forward and reverse directions and lets you check antenna SWR. Details page 72.

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Letters to the editor

An exploding picture tube?

I would like to point out that, in a strict technical sense, picture tubes do not explode (see EA, Letters, April 1986). Picture tubes "implode" or burst inwards — the air pressure on the outside surface and a high vacuum inside the tube sets the stage for a disaster.

When a fault occurs, the glass and all parts of the tube burst inwards. The electron gun, being one of the more solid and heavier components, flies towards the front of the tube and very often straight on. That's why there was a safety glass screen fitted and why it shattered and ended up in front of the set.

The valves were broken most probably by the side or front pieces of the tube, as these pieces are usually pushed in at right angles to the inner surface. Note that more modern picture tubes, whether black and white or colour, have a bonded safety glass as part of the tube.

The first one I saw "implode" happened outside the cabinet, on the bench. The electron gun buried itself into the wall a good 2.5-metres across the room. It's a case of once seen, never forgotten.

Alyn Maschette, VK6KWN,
South Perth, WA.

Error in CD catalog

I applaud your publication of a compact disc catalog. At least I did, but now I don't, because I used it to order by phone a copy of Liszt Piano Works, Vol. 5, played by Jorge Bolet. I now have two discs of volume 4, one of which I already had, because the number given for volume 5 is the same as the number for volume 4.

R. M. Leigh,
Oxford Park, Qld.

Editor: We apologise for the error. The correct number for the compact disc Piano Works, Vol. 5 is Decca 410 160-2. Volume 6 of these works is also listed incorrectly. The correct listing is Decca 411 163-2.

Alignment tapes for cassette decks

This letter is prompted by one published in the March 1986 issue of EA, regarding the varying speeds of different cassette decks.

A more serious problem is that of incorrect azimuth alignment of the head gap which can result in a loss of high frequency response. Servicing grade alignment tapes are available, but their price is out of the reach of many of your readers.

Perhaps one of your advertisers could consider it worthwhile offering a "hobby" grade test cassette at around $10. It could also include "beeps" at intervals for checking tape speeds and a range of test frequencies.

J. Emery,
Bullcreek, WA.

Parts for projects: a kit supplier's view

The very interesting letter by N.M. of Rosebud, Victoria, and Neville Williams' response in the May Forum column compels me to reply.

As good as it was, Mr Williams' reply basically explains realities from the perspective of the magazine producer. He also gave N.M. some idea of the historical reasons for the kit vs component situation and attempted to explain the kit suppliers position.

In reality, the kit suppliers position is even more complicated. I am sure that Mr Williams would not object if I took the time to further explain to N.M. the hard facts behind the kit vs component dilemma.

Firstly, I would like to qualify Mr Williams' "halycon days BK (Before Kits)". This time roughly equates to the period before 1970. In those days projects were almost invariably constructed by rugged enthusiasts who had the wherewithall to source out the individual component, fabricate a chasis or enclosure, build the project, troubleshoot it and finally display the masterpiece for all to see! I am old enough to have been such a "rugged enthusiast!" The

final product was indeed 'home made' and, in most cases, entirely suited that description.

This was considered quite satisfactory at the time, particularly as there was no other viable alternative.

Then along came the Japanese.

The attack by the Japanese on world car markets is well documented and well known. What is not as well known is the profound effect they have had in other areas — in this case the home constructor.

From the early '70s the Japanese began to provide the world with low-cost, medium-performance amateur radio equipment, hifi gear, and other consumer electronic products. Their products were modest in cost and, significantly, did not look 'home made'. They now dominate consumer electronics. Many "rugged enthusiasts" — especially amateurs and kit constructors-left the field and became equipment buyers.

But it is now 1986 and the kit suppliers are still here. Why is this so? Quite frankly, I don't think that as many kits are sold these days, but the quality and diversity have never been better.

The bulk of the credit for this (in Australia) must go to the electronics magazines. They have consistently produced project articles of such quality that a still significant number of readers have concluded that they are still better off building a project than simply purchasing a ready made.

Notwithstanding this, the enthusiast's expectations of the look of the finished product had been heightened considerably. No longer was it good enough for a magazine to design a project that was cheap to build and offered astonishing performance. It needed another ingredient — finish.

Fortunately, the magazines recognised this.

The classic case of this was the *Electronics Australia* Twin Twenty Five stereo amplifier described in the mid 70s. This amplifier project had great performance figures at the time but the big feature was the looks! The amp featured an aluminium front panel with matching aluminium knobs — all anodised in gold. At the time it looked great — but the only way to get the good finish was to do what the Japanese did: mass produce. It was impossible for the backyard constructor to achieve that finish himself.

Over 10,000 kits were produced by the marketing genius, Dick Smith. He coined a famous line to describe the

Continued on page 118.

Editorial Viewpoint

Special parts can be hard to get

Last month's Forum pages opened debate on a subject which has been increasingly occupying readers of this magazine. The subject is whether or not kitset suppliers should make specialised parts available to constructors instead of locking them into kits. A long letter from Jaycar Electronics, beginning on the opposite page, puts a case for the kitset suppliers and we readily admit that it has considerable merit.

All the same, we recognise that some constructors do wish to go it alone, improvising some of the parts themselves, perhaps making their own metalwork, using some parts they already have and so on. And there may be quite a few of these rugged individuals still soldiering on. This could present a good opportunity for those kitset suppliers who are prepared to "unbundle" some of these special bits and pieces.

But there is a related subject which is also troubling would-be constructors: hard-to-get parts for projects that are old. These projects may not have been made available in kit form when first published or the kit may have been discontinued after several years when the kitset supplier judged that sales no longer justified it or, and here lies the rub, perhaps one of the key parts has become unavailable.

From time to time we receive irate letters from readers complaining that they have invested in most of the parts for a certain kit and then found that a key part was no longer available. They are considerably frustrated and hence the whole effort has been for naught. Sometimes a constructor will decide to build a project soon after it is published and begins to gather the bits and pieces together but is then distracted and the parts lie on the shelf for years. Later on, he will decide to finish the project and then be stymied because some of the remaining parts are once again unavailable.

The point of this long-winded essay is some friendly advice to would-be constructors. If you decide to build a project from scratch rather than from a kit, do not spend any money until you have made sure you can buy the key parts. They are usually not hard to identify, being special modules or transformers, unusual wirewound or multi-turn potentiometers, special purpose integrated circuits and so on.

If you can buy them, buy 'em now, while you can. Then don't dally about; go out and buy all the rest of the parts so you can complete the unit. And the older the kit is, the more important it is to investigate the availability of the key parts. While we do our very best to ensure that parts are available when a project is published, it is all together a different ball-game after several years have passed.

Leo Simpson

Readers who have subscriptions should note they can receive the complimentary Compact Disc Buyer's Guide which has been included with copies sold from newagents. Because of packaging problems, it has not been included. Subscribers who want the publication should write to "Electronics Australia", PO Box 227, Waterloo, NSW 2017.

News Highlights

The word is Brian

A fast, accurate Australian system for processing satellite images is set to win a significant share of the world computerised image analysis market.

Based on the CSIRO's BRIAN — Barrier Reef Image Analysis — the new system, called Micro-BRIAN, is being packaged as a microcomputer for commercial release by the CSIRO and the Australian company MPA Pty Ltd. It will sell at around half the price of its nearest competitor.

Originally planned as a reconnaissance device to carry out a full survey of the Great Barrier Reef, BRIAN saved the Federal Government over $20 million and 10 years of survey effort.

However, it has certainly not been limited to this concept and, in its present form, can also be used for basic image processing, mapping and monitoring of erosion, crops, forests and other vegetation.

What's new in robots

Toshiba's Auto Sweepy is the first step towards the retrenchment of the ubiquitous office cleaner.

A commercial robot capable of cleaning large open spaces, the Auto Sweepy uses a semiconductor laser distance sensor and a gyroscope to determine its route. Together, these enable it to negotiate pillars and other obstacles. The auto-pilot system also eliminates the need for troublesome programming, guidelines and tapes while rechargeable batteries eliminate the need for power cords.

A number of safety measures have been incorporated into the robot, including an ultrasonic sensor which reduces the travelling speed as the robot approaches an obstacle. The robot also has a touch sensor that stops it as soon as contact is made with an obstacle. Dimensions are 1.42 x 0.7 x 1.2m.

The robot is capable of three types of cleaning. First, the water cleaning function sprinkles detergent and water over the surface, scrubs it clean and then vacuums. The second function combines vacuuming and then dry-mopping. Finally, it can pick up loose dust through vacuuming alone.

According to Toshiba, the Auto-Sweepy is 10 times faster than a human and can clean almost all of the floor's space, leaving only the corners for manual cleaning. And the price of all this efficiency? — 10 million yen or $US50,000.

Money flows into high-technology

Accoding to a recent report in *The Sydney Morning Herald* there has been a dramatic rise in investment in high-technology companies and in research and development (R&D) over the last two years.

A study of the industry by Wollongong University's Centre for Technology and Social Change found 54 companies listed publicly on the stock exchange by the middle of 1985.

It was also found that the total value of initial share floats had risen from just over $1 million in 1983 to $49 million in 1984. By the end of 1985 it was well over $100 million.

Investor interest was noted as being very strong, while various Federal Government schemes have also boosted the amount of money flowing into R&D.

Even so, the benefits to the economy have not yet emerged. High-technology patents make up only 13% of the low level of Australian patents in the US.

A third of those originate from industry, mainly in medical technology, while the Federal Government plays the main role in the strongly export-oriented scientific instruments sector.

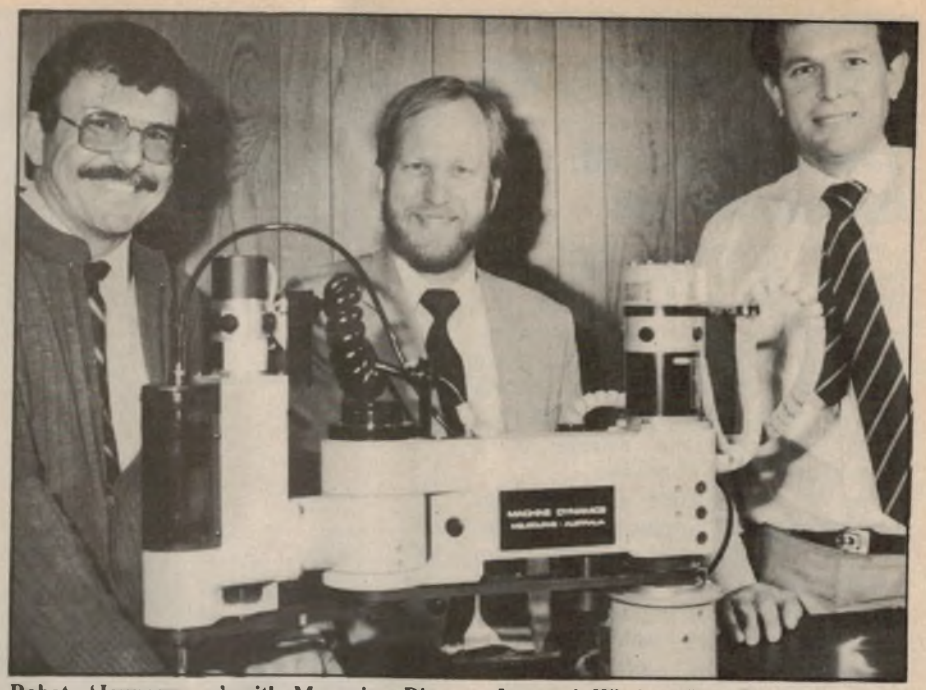
1986 Perth Electronics Show

Forget the America's Cup for the time being — the countdown has begun for the 1986 Perth Electronics Show. The Show runs from July 31 to August 3 at Perth's Claremont Showgrounds and includes an exclusive trade and media day on July 30.

The Perth show has built a reputation over the years as the biggest and best in Australia. This year, the show is bigger than ever with some 12,000 square metres of exhibition space sold over a total of 13 pavillions.

On show will be the latest in consumer electronics, computers, satellite ground stations, whitegoods, appliances, and photographic, video and business equipment. Special trade seminars have been organised and the show will be heavily promoted in the media.

For further information, contact Chris Gulland, Show Manager, 94 Hay St, Subiaco, WA 6008. Phone (09) 382-3122.



Robot 'Journeyman' with Managing Director Leonard Whelan, Ron Deane and Paul Herbison from Machine Dynamics.

Aussie-made robots for industry

Robots are playing an increasingly important role in manufacturing industry. In Victoria, a company called Machine Dynamics has spent four years designing four robots of the "pick and place" type, with a capacity of up to 25kg.

Their research program has led to the development of a six axis DC motor-driven servo-controlled "point to point" robot. The project, partially funded through government Industrial Research and Development grants, has led to the development of a robot called Journeyman.

Built in a gantry configuration that can be extended and customised to suit a wide variety of applications, it is suitable for a range of industrial processes, including machine loading, packaging/palletising, water jet cutting, welding and assembly.

The gantry style also allows the operating mechanisms to be elevated above the work area and supported on dimensionally small but strong columns. The potentially large working envelope that this gives means the robot does not suffer reach limitations. Nor does it need large amounts of floor area.

Currently, these units are in service with four major companies in Australia: Borg Warner, Nissan Australia, Visyboard and Nabisco. Machine Dynamics say that it aims to supply other Australian companies with advanced robotics as the marketplace develops and industry modernises.

British Bobbies in computer fiddle

A recent investigation in Britain by the Police Complaints Authority has uncovered police attempts to fiddle a car registration competition.

The competition involved awarding a £1000 prize to motorists who spot their car numbers on signs at BP petrol stations. Apparently, police officers have been using the Police National Computer to discover the names and addresses of winning drivers, and tipping them off in the hope of a cut in the winnings.

Some 343 officers and 14 civilian staff were investigated by the authority although, thus far, only 19 officers face disciplinary charges because guidelines regulating the use of the computer vary from force to force. One outcome of the attempted fiddle is likely to be a nationwide code of practice to regulate use of the computer.

News Highlights

The charm of the windmill

Anyone surveying this scene would think that H. G. Wells' 'War of the Worlds' had really begun. In fact, this scene constitutes the world's largest collection of wind turbines. They have been erected in California by a Scottish company and, recently, were sold to a major US institutional investor on a lease basis for $US48 million.

The 86 three-bladed wind turbines produce about 30 megawatts of electricity. This is equivalent to more than 100,000 barrels of oil which would otherwise have to be imported to generate power by conventional means.

Organisations which currently operate small diesel networks as their power source are a potential market for medium wind turbines producing between 200 and 500kW. In California, where such diesel systems are quite commonplace, the 300kW machine has been an immediate success.

How to collar a camel — with good ol' American technology

Australia has the largest number of wild camels in the world, yet almost nothing is known about them. Now US-made radio tracking collars are to be used to find out something about their movements and their effects on the environment.

The researcher in charge of the project, Associate Professor Gordon Grigg of Sydney University's School of Biological Sciences, says it is hoped that information from the study will be useful in mounting a similar project with kangaroos in a few years' time.

The American-made camel collars are no ordinary collars. They carry compact transmitters which enable the position of an animal to be pinpointed by satellite six to eight hours after each pass of a weather satellite. Information from the satellites is processed in France and can be called up on the screen of a personal computer in the University's Zoology Building.

Each collar has two radio transmitters: a VHF transmitter which allows short range location from 20-25km, and a main 1W transmitter that transmits data to the satellite. The collars are designed for a life of two years, after which they will be recovered and overhauled for further use.

At present, the collar is too heavy and cumbersome for kangaroos, but Professor Grigg anticipates that a lighter collar containing more compact equipment will become available in the next few years. The collars have previously been used with great success to track caribou and polar bears in the Arctic region.

According to Professor Grigg, camels were first brought into Australia in 1840 for transport in the interior. More were brought in during the 1860s and, in the 25 years that followed, some 10,000 were imported. Today, there are few domestic camels in Australia but large numbers of feral camels roam the Simpson Desert, south-west Queensland and parts of Western Australia.

In fact, the population is so fit and healthy that Australian feral camels have for some time been exported to the Middle East where they are highly prized for racing and breeding.

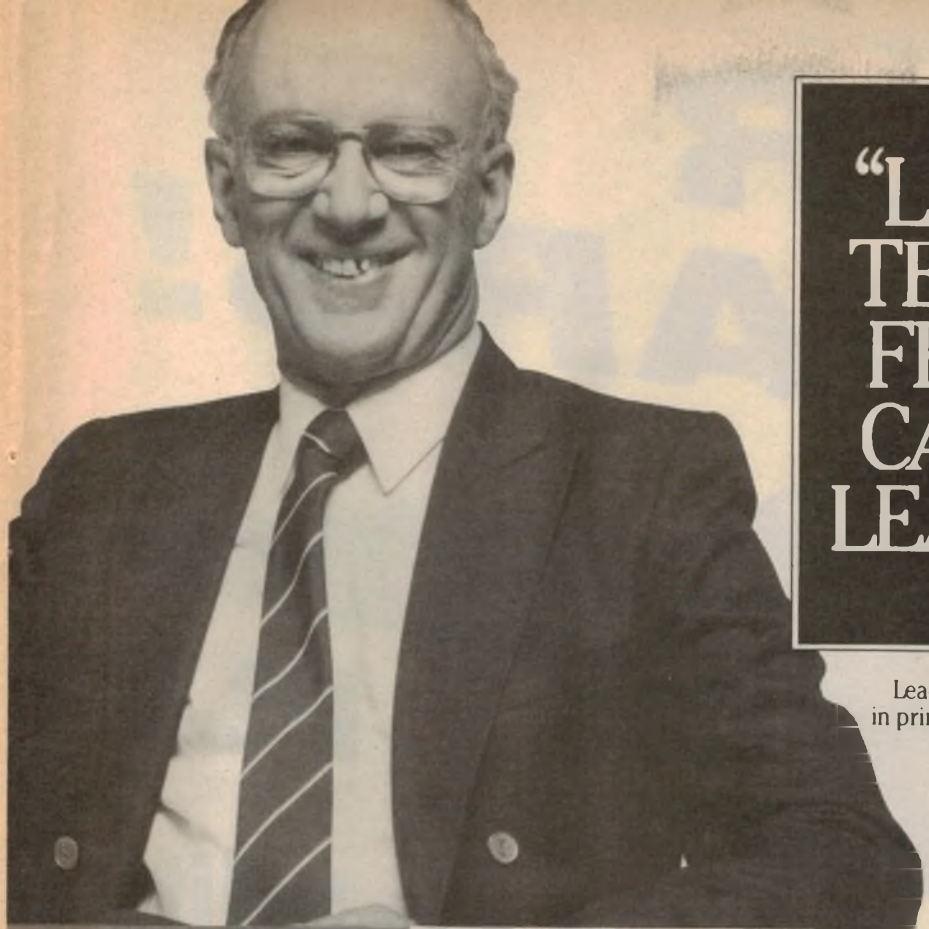
Amstrad swallows Sinclair

Sir Clive Sinclair, the British marketing whiz whose computer empire was once valued at $A277 million, recently sold his company to Amstrad Consumer Electronics for approximately $A10.17 million.

The disastrous slump in the home computer market over the last two years, during which Sinclair recorded a $A37.22 million loss, is the main reason for the sale. At one time, Sinclair's Spectrum was the world's top-selling personal computer.

The deal involved Sinclair selling the brand name, intellectual property rights and the right to manufacture and sell all existing and future Sinclair Research products. Experts estimate that it will give Amstrad about 85% of the British home computer market.

Sinclair earned his reputation in Britain during the 1970s by designing what was said to be the world's first pocket calculator and by pioneering digital watches. He later became involved in the design and manufacture of miniature black and white TV sets and, more recently, was known for his disastrous venture into the production of an electric-powered three-wheeled vehicle.



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JAMES DIBBLE

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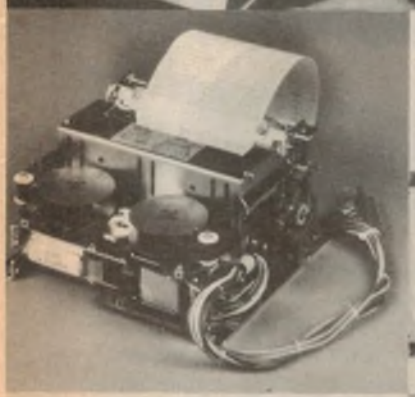
The 500 series offer even higher performance and extraordinarily long life, making them ideal for use wherever hard copies of transactions are needed in high volume.



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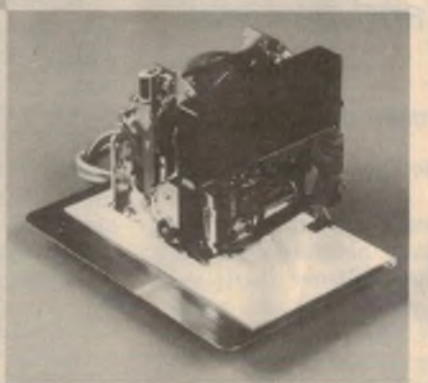

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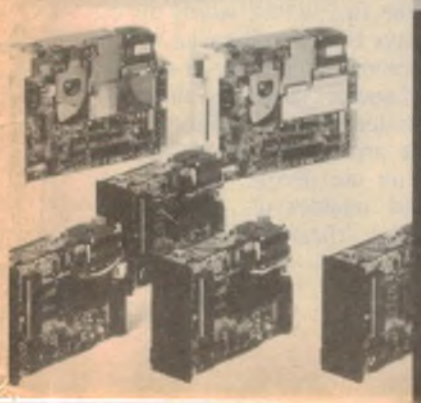

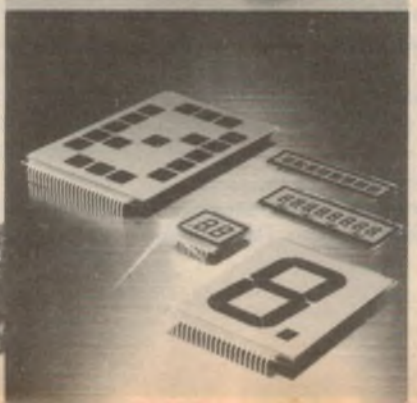

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STAR WARS!

Pt.2

survivability and stability

If vulnerable, space-based weapons would encourage both sides to strike first. The Soviets could employ countermeasures ranging from fast-burn rockets to space mines and powerful X-ray lasers.

by ERIC J. LERNER* * *Electronics Editor, Aerospace America.*

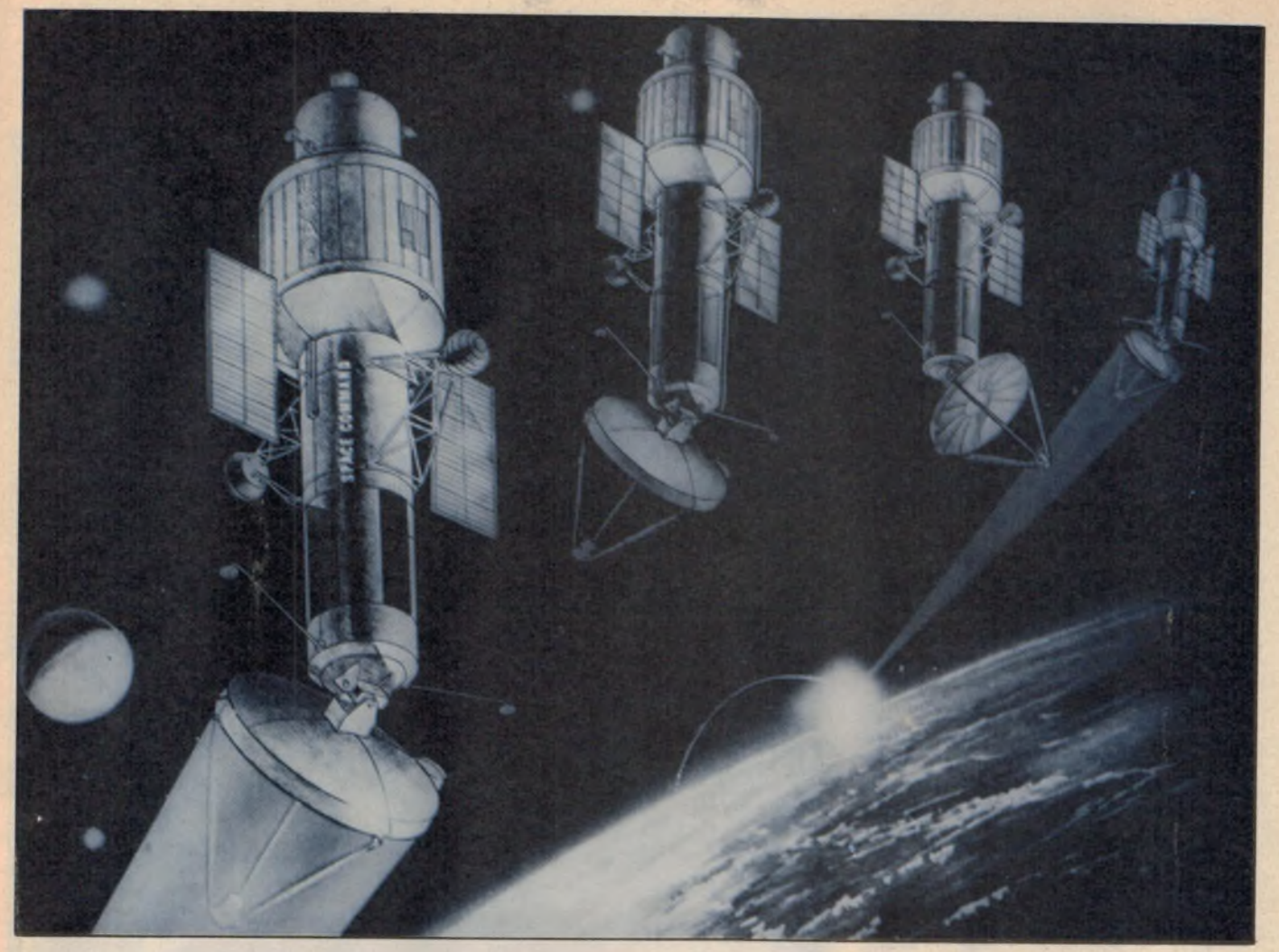
It is the mid-1990s. The United States has just launched its first strategic defence laser battle station into space. The US government warns the Soviet Union that it must not place any satellite in an orbit that comes within 10km of the battle station. Intruders will be attacked without warning. The Soviets denounce the US defensive system as a way of defeating Soviet retaliation and preparing for a first strike. They proclaim as "fundamental" the freedom of space. To challenge the US "keep-out zone", the Soviets launch a satellite into an almost identical orbit, warning that any attack on it will be viewed as an act of war "which will meet with an appropriate response." The two satellites slowly converge . . .

This hypothetical sequence of events illustrates the issue that the critics of the Strategic Defence Initiative (SDI) view as one of the most important: vulnerability. In their view, defense weapons located in space are too vulnerable, and efforts to protect them could lead to war. A defensive system must be able to defend itself: A system that could not withstand an attack aimed against it could only be used by a nation that struck first.

Such a defence would, in the terms of nuclear strategists and arms control experts, be "destabilizing". The Soviet Union has consistently used this idea of space weapons as an adjunct to a first strike as the principal reason for its violent hostility toward the SDI program.

"If you start to deploy a defence in space that is moderately effective," says Richard Garwin of IBM, "then the other side will put up space mines — satellites with nuclear weapons — next to them, ready to be detonated on command. You cannot tolerate that. You shoot them down and say to the Soviets: 'You can't put things into space without our permission.' The Russians reject that and start retaliating, and now you have a war."

Supporters of SDI agree that the issue is critical. "Survivability and stability — these are the two hottest words on the subject," says Gregory Canavan of Los Alamos National Laboratory, a scientist who has frequently supported the feasibility of strategic defence. But to supporters, the problem of survival can be solved. "You use decoys, you use deception and manoeuvre, you harden your satellites. There is much you can



do," insists Gerald Yonas, chief scientist and deputy director of SDI.

However, SDI officials admit an element of reality in critics' scenarios. "There's no doubt if we saw the Soviet tracking one of our satellites with one of theirs, we'd consider it an act of war, and we'd destroy it," said Major Peter Worden, assistant to Lt. Gen. James Abrahamson, director of SDI.

Survivability of space-based weapons is crucial to the SDI concept. All space-based weapons proposed for boost-phase intercept can be attacked. In the view of both supporters and critics of strategic defence, attacking missiles during boost phase is vital to the success of the system. Only by drastically cutting the missiles surviving this first phase can defenders hope to deal with the remaining ones during mid-course and terminal phases.

There are a number of ways to attack space-based weapons. The simplest method is with a space mine, a nuclear weapon put into an orbit close to that of the battle station and able to

SPACE BELONGS TO NO ONE

Starting with the orbiting of the first Earth satellites in 1958, the US has consistently maintained that no nation can claim sovereign or other exclusive rights over space. In November 1958, President Dwight D. Eisenhower sent then-Senate Majority Leader Lyndon B. Johnson to the United Nations to emphasize American views that space could not be subject to any nation. This approach, later codified in the 1967 Outer Space Treaty signed by the US, the USSR, and over 80 other countries has been adopted by almost all nations. The treaty states that "space is not subject to national appropriation . . . by any means."

To a large extent, the US attitude on space continues its similar vigorous defence of freedom of the high seas. In both the War of 1812 and World War I, the US used preservation of the absolute right of free passage on the seas as a reason for going to war. As both a prominent seafaring and now space-faring nation, it has always seen as basic American self-interest to prohibit any limit on the use of international territory either on Earth or in space.

In recent years, the US has opposed efforts by nations lying along the equator to lay claims to portions of the equatorial geosynchronous orbit.

The proposals by some supporters of SDI to set up national "exclusion zones" in space — zones where only US satellites would be allowed — would represent a major shift in this long-standing policy. Such a move would also require either violating the Outer Space Treaty or renegotiating it through the United Nations, and replacing it with some other agreement that allocated different parts of space — presumably different altitude zones — to the various countries of the world. The latter course would be exceedingly difficult at best.

STAR WARS

manoeuvre. Under international law, it is legal for any satellite to move close to another. Space, like the high seas, is considered international territory.

During peacetime, such a space mine would just tag along nearby. If the station owning the space mine decided to launch a nuclear attack, its first action would be to detonate the mine, instantly destroying the defence battle station and clearing the way for the offensive missile strike. Even if the owner of the battle station struck first, attacking the mine, the weapon could be "salvage fused" to go off before the attack could destroy it.

Garwin, who has long experience in weapons design, suggested another way of attacking space weapons in recent testimony before the Senate Appropriations Committee. Referring to a defence based on orbiting antimissile rockets, Garwin said that this system "would be vulnerable the day it was deployed to counter-measures which the Soviet Union would have had in being for more than 20 years" — the Galosh ballistic-missile defense. Galosh is a fast-acceleration, nuclear-tipped missile that burns out in 30 seconds. "That's too short for a rocket, or particle-beam weapon to reach it," says Garwin. Galosh floats up into space, protected against attack by a shroud and surrounded by balloon decoys, and can destroy a satellite at a range of 10km.

Galosh is not the only defensive weapon that can be turned against the defence. In his report on space weapons for the Congressional Office of Technology Assessment, Harvard's Ashton Carter suggested that the X-ray laser would make a formidable space mine. X-ray lasers are nuclear weapons surrounded by extremely fine lasing rods. X-rays from the detonating bomb cause the rods to emit X-rays in a directed beam along their length just before they are vaporized. Such a weapon, if it can be developed, could deliver a fatal blow to a battle station at many thousands of kilometres.

In the same report, Carter points out that both powerful space-based lasers and space-based particle beams (as well as ground-based lasers) could be used by the Soviets to destroy US battle stations immediately prior to a Soviet attack. The same would, of course, be true for US weapons. In either case, the first strike could be delivered at nearly

the speed of light, with no forewarning or opportunity for retaliation.

How can space weapons defend themselves? "First of all, we'd use thousands of decoys, just like the offense does. They won't be able to find us," says Worden. Yonas agrees: "We'd deploy decoys and get the hell out of there. Let the mine follow the decoy."

"But could the defence use decoys so easily?" counters Kosta Tsipis of MIT. "Laser satellites might have mirrors six or ten metres across. You would need decoys at least as big, not small and balloon-like, for decoying offensive reentry vehicles."

Yonas agrees this is a problem. "I think you would have to be able to fold the mirror up during peacetime, so that you could make the thing like a balloon." Rapidly unfolding it in seconds when an attack is launched and fitting the pieces in place to an accuracy of less than a micron is a formidable but not impossible task, he believes.

Another problem with decoying the battle stations is the amount of time available to the offense. "If you're trying to detect decoys during the midcourse phase of a nuclear attack, you've got less than 30 minutes," Garwin explains, "but if you're sorting them out with satellites in orbits, you could take six months to do it. It's much easier."

In fact, Yonas feels that it is possible to detect decoys even during an attack, for example, by tapping decoy balloons with a laser beam and seeing how much they move. Light balloons will move but not those tethered to heavy warheads. He admits similar means might be used to detect decoys of defensive satellites.

"You can't rely on decoys alone. You also have to use hardening," says Yonas. "Today's satellites just wouldn't work. We have to develop electronics that are much, much harder." Armour, too, may be needed, says Worden.

But nuclear-armed space mines could defeat armour by moving closer. "Within five miles, you could probably destroy anything," Worden concedes.

If decoys and armour are insufficient, then what can be done about a Soviet space mine that slowly moved in and stayed close to a US battle station? Suggests Yonas: "We may have agreed upon keep-out zones" — zones around US satellites that Soviet satellites would not be allowed to penetrate. If the Soviets get within this zone of several kilometres, "we destroy it", says Worden. Robert Jastrow, an astronomer and vocal supporter of SDI agrees. "We can't allow them too close. If they get within so many miles of us, we shoot them down."

Would this lead to war? Worden doubts it. "It's no different than our policy at sea," he says. "Supposing we see a large number of our critical ships — aircraft carriers — being closely followed by Soviet ships or subs. We will shoot back. This is our policy today."

Navy officials, however, contradict Worden. "No, that's not our policy," says Cmdr. John B. Foley of the Office of the Assistant Secretary of the Navy.

"We can't allow them too close. If they get within so many miles of us, we shoot them down" — Robert Jastrow.

"There are rules of engagement to prevent collisions. But there's nothing that says a Soviet ship following too close will be attacked on the high seas." Lt. David Morris of the Navy Office of Information elaborates. "They can't cross close in front of our bow or do something to risk an accident. But the rules of engagement are only for surface ships anyway. If a sub got close to one of our aircraft carriers, we would track it with sonar, but we would not attack it."

Garwin scoffs at the notion that the Soviets would accept threats of shooting their satellites down. "What if the Soviets said we have a defence that will require your satellite stay away. I think the US would say, 'As soon as you start such a policy, we will go to war.' It's like being pushed off the high seas, and we've fought for that before. I don't see why the Soviets would do any different."

"I think we could get the Soviets to agree to keep-out zones," Yonas replies. "Rules of the road are something both sides want. They have space assets like early-warning satellites they want to maintain anyway."

"Besides, putting a nuclear weapon in space violates the Outer Space Treaty," Worden adds. But critics like Garwin question whether the Soviets will feel bound by such treaties if the US voids the ABM Treaty, which prohibits placing defensive weapons in space.

Exclusion zones in space would probably have to be extensive, Carter points out. If a minimum distance of, say, 10km is to be maintained around all satellites (and their decoys), Soviet satellites would have to be excluded

from any orbit within a 10km altitude, since all other orbits would, at least twice a year, bring Soviet craft within the exclusion zones.

Nonetheless, Yonas feels agreement is possible. "Look, if the technology is convincing, it will show them defence is the way to go. Then they'll want agreements. The technology has to be so good they believe in it as well as we believe in it. If it's not, we don't go down the road."

To Garwin, the Soviets' co-operating to make defence easier is laughable. "Sure, if the Soviets co-operate, boost-phase defence is feasible. After all, with their co-operation we can put machine guns next to the silos and shoot the missiles as they come out. The problem is that if they view our defence as a way of defeating their retaliation, of making them totally at our mercy, as they say they do, they'll do everything to destroy it." Thus, if the Soviets persist in their uncompromising opposition to SDI, launching the first battle station could set off a dangerous game of nuclear chicken.

This is not the only problem with keep-out zones. The X-ray laser, if such a device can be built, would negate such zones. "There's no doubt the X-ray laser is a problem for the defence," admits Yonas. "We have to first find out if it works. If it does, the offense could launch prior to a first strike and destroy or blind the sensors on any pre-deployed satellite." In that case, the concept of space-based defence would be utterly impossible. "We'd be right back to the retaliation," Yonas insists.

The same line of reasoning leads Edward Teller, chief proponent of the X-ray laser, to state that space-based weapons are "too costly to put up and too easy to shoot down". By contrast, X-ray lasers, based during peacetime on submarines would share the sub's invulnerability and would be popped up on a small missile once enemy missiles were launched.

The X-ray laser at present is the least certain of any of the technologies proposed by strategic defence. Some in the Reagan administration, notably Presidential Science Advisor George Keyworth, have also publicly rejected the idea that nuclear weapons can or should be used to defend against nuclear weapons. Another major potential problem of X-ray lasers, or any popped-up weapon, is its inability to deal with fast-burning boosters which reach space before a pop-up weapon can rise over the horizon. In addition, the X-ray laser would become vulnerable once launched. "If the Soviets have X-ray lasers too, they could just launch their lasers a little before the big missiles, and as our X-ray lasers climb up, they get zapped by theirs," Garwin points out. "Any counter-defence use of X-ray lasers is bound to greatly complicate the defence," Yonas agrees.

Still worse, X-ray lasers accompanying a first strike could disrupt a retaliatory attack. Teller does not dispute the possibility of using X-ray lasers as a first-strike weapon. But, in his view, this threat is all the more reason for us to acquire the weapon. If we do something and they have it, we will be helpless, Russia will rule the world. But if we develop it, the Soviets will not know how well ours work, and they will not, therefore, know which side will succeed. "There are X-ray lasers and X-ray lasers, just like there are muskets and rifles. The side with the better gun — and a better position to fire it — will be ahead."

"Space-based weapons are too costly to put up and too easy to shoot down" — Edward Teller.

If both sides feared an X-ray laser first strike, they might put their missile forces on a permanent high state of alert, ready to be automatically launched within seconds of an enemy launch. There simply would be no time for human intervention. Everything would be controlled by computers. One false move by either side could trigger a war.

What is the way out from this nightmarish scenario? How can humans check a computer's assessment of an attack during the few seconds available? "I don't know the answer to that question," says Yonas. "If we can't solve it and get a human in the loop, it would certainly limit the usefulness of that weapon. It's part of our battle management research to find any answer, if we can."

"I would not necessarily agree with Yonas," retorts Teller. "If a decision is to be made in a short time, I'd rather trust a computer, designed with years of thought, rather than a person. If you think people can act rationally with so much at stake, you have more confidence than I." As to the possibility of a false alert, as has happened repeatedly with the present US warning system, Teller replies, "The false alerts have been greatly exaggerated. Besides, you are talking about a totally obsolete system."

Teller's vision of a world relying on flawless computers and computer programs, linked to nuclear missiles with response times measured in seconds, with little or no assurance of protecting populations, bears slight resemblance to the president's goal of making nuclear bombs "impotent". "This is the best we can attain soon," Teller insists.

A pop-up weapon may not have to use nuclear weapons. In one version of a laser defence, the laser itself is located on the ground in the US. Once an enemy attack is detected, a series of mirrors is launched by sub-based missiles. These mirrors relay beams shot from the ground to fighting mirrors popped-up near the Soviet Union, which in turn focus the beams on the ICBMs as they rise over the horizon. Such a system would avoid having to launch nuclear weapons by computer, as with the X-ray laser.

But such a pop-up mirror system would suffer most of the other shortcomings of the X-ray laser and some of its own. For one thing, the feasibility of shooting 5-metre mirrors into space on seconds notice is not at all certain.

Potentially, then, some of the Star Wars ideas seem to lead to a still more unstable world than the current "balance of terror", a world in which an erring microchip could launch a holocaust. However, X-ray lasers and other pop-ups may prove technically impossible to develop. In their stead, the US may pursue another scheme for defeating attacks on space-based weapons. "Just make them so inexpensive that they cost far less than the space mine that will blow them up," recommends Worden. "That way you can defeat counter defence just by putting up more and more."

But can laser and particle-beam battle stations, electromagnetic launchers, or defensive rockets be made that cheaply?

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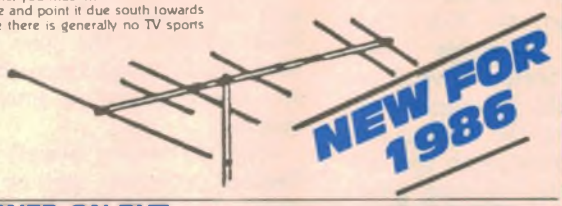

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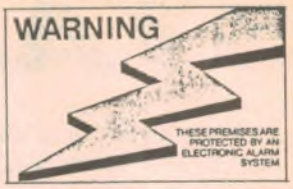

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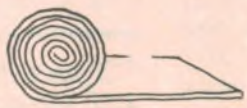

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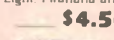

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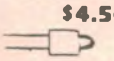

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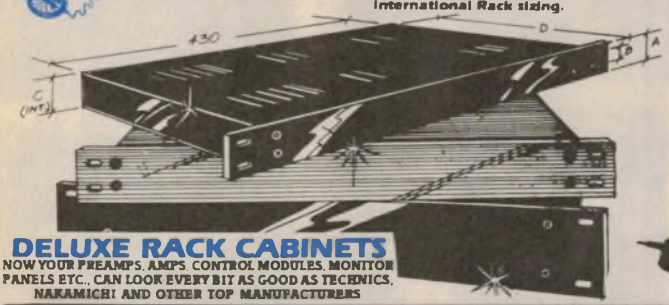

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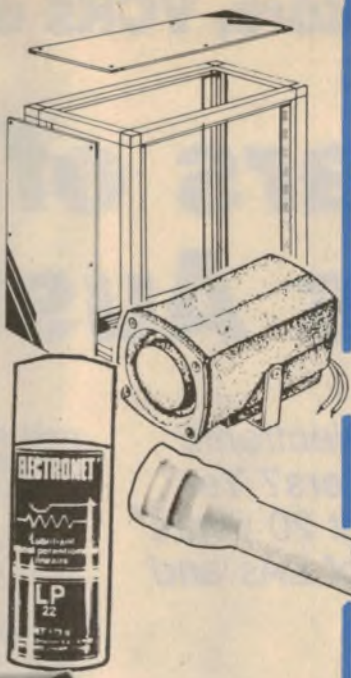

AM-4071

AM-4073

AM-4072

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If you want an FM mic to experiment with or use in a small public address system, this is the one. Only 100 available. Transmitting frequency range 88.1MHz to 106MHz. Omnidirectional. Field strength is less than 50uV/m at 50 feet. Supplied with windscreen, frequency adjuster, Lavalier and battery.

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PROFESSIONAL ELECTRET CONDENSER UNIDIRECTIONAL DUAL IMP - DUAL TONE

This mic has a unique dual tone switch. At the "flat" position it is suited to music, recording and other Hi Fi purposes due to its perfectly flat character at all frequencies. At the "Vocal" position it is suited to PA work which prevents too much low tone or indistinct sound when mic is held close to the mouth. Freq. Response 30-20,000Hz. Impedance Lo 1k, Hi 10k. Sensitivity Lo −68dB ±3dB, Hi −57dB ±3dB. Complete with cable and 6.5mm plug. A TRULY PROFESSIONAL MICROPHONE.

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Incorporates 155mm gooseneck on a heavy base with on/off switch. Frequency 50-13,000Hz. Impedance 500 ohms. Sensitivity −78dB. 4 metres cables with plug.

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With 155mm gooseneck on heavy base with on/off switch. Frequency response 50-13,000Hz. Impedance 400 ohms. Sensitivity −78dB. 4 metres of cable with plug.

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AM-4076

AM-4077

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A world without calculators, VCRs or computers

Twenty years of Electronics Australia

Can you imagine a world without electronic calculators, VCRs or home computers? Yet such was the state of the world just 20 years ago. Let's thumb through a stack of EAs and find out what happened.

by JIM LAWLER

"Whereas most modern minicomputers have a memory with at least a thousand or so storage locations, the memory of this machine has only a modest thirty-two".

So wrote Jamieson Rowe in *Electronics Australia* in August 1974 in the introduction to the series of articles describing the construction of the EDUC-8 minicomputer.

Today, the EDUC-8 is less powerful than any pocket calculator yet it is not quite twelve years since it was a state-of-the-art small computer and one of the first ever described for home construction.

I came across the gem of trivia while searching through back issues of *Electronics Australia* for some information on computer programming.

I wanted to find out something about machine code programming and a machine as simple as EDUC-8 should have spelled out the basics. However, the search led off in different directions and left me wondering where microcomputers are going during the next twelve years. In detail, I wanted to find out when microcomputers first made their appearance and incidentally to note some of the electronic milestones that paralleled the micro.

I have nearly two metres of *Electronics Australia* on my shelves, dating back to 1964 when the magazine was *Radio Television and Hobbies*. Those early issues described projects based on valve technology and there is nothing about digital techniques, nor a word about calculators or micro computers.

Remember, 1964 was only 22 years ago — within the lifetime of some people who are still students today. Can you imagine a student without his pocket calculator?

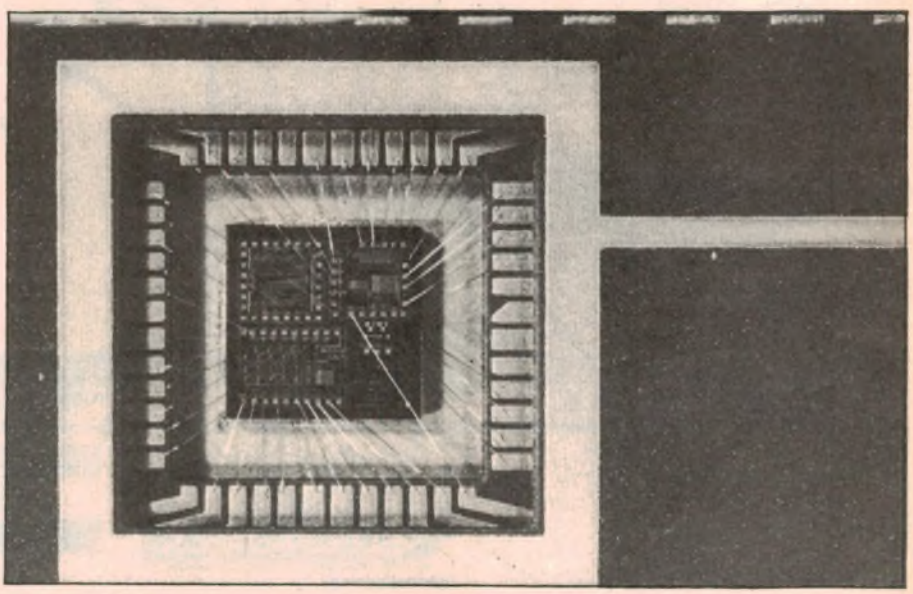
Data banks

In the December 1964 edition, Neville Williams editorialised on a report of proposed memory banks from which could be drawn information on specific subjects. Mr Williams may have visualised today's vast data banks, but could he have then imagined the size and complexity of the memory needed for the proposed national identity card?

Five years later, in 1969, another writer noted that — *"For many years only the rich will be able to install terminals in their private homes, but I have no doubt that the coming decade will see public telephone boxes upgraded to include keyboards connected to the computing grid and it is well within the reach of foreseeable software technology to offer services which will tempt people to place a coin in the slot." (1)*

The predicted decade is long past and the public keyboards never eventuated, but terminals are readily available and we need not be rich to own one.

But going back to 1964, the magazine did carry an advertisement for a kind of minicomputer, and a home built one at that. It was a Heathkit analog computer, priced at £1000. And that is 1964 pounds, possibly equal to $20,000 in today's terms.



Twenty years ago, large scale integrated circuits were unthought of. Now we have progressed to the stage where 1 megabit RAMS are possible and multi-project ICs are a reality.

By 1966, the magazine was running a series of articles on logic and basic computing principles, and some of the projects were using more and more solid state devices.

In 1968 one of the first projects to make extensive use of integrated circuits appeared. It was a gated tone burst generator using lots and lots of packaged gates. The schematic looks quite archaic today but it was a sign of things to come. Still, old habits die hard and the same issue carried a project utilising the old valve technology — the 1968 3-inch audio oscilloscope.

Cassette tapes

Other signs of modern technology were beginning to appear in the magazine. The first reference to cassette tapes as distinct from cartridge tapes appeared in March 1968, and about this time there were items about videotape recorders, invariably one and two-inch professional types. But still no microcomputers.

When the 1970s were very young, EA was reporting on much newfangled technology. There was four channel audio, for instance, which was having a very mixed reception. And colour TV was not all that far away. In the professional computer field, second generation machines were replacing the older, 60s models and disposal stores were selling computer panels to hobbyists.

Cassette tape recorders were becoming popular and pre-recorded tapes were on the market. In the August 1970 edition, EA asked "HiFi Cassettes — will they supercede discs?" There was no immediate answer because the magazine continued to carry many advertisements for open reel recorders and for the tape to feed them. But still nothing on micros.

In the July 1971 edition there was an extensive article on computers in schools with the emphasis on a Hewlett Packard small professional machine, not on micros. The same edition carries mention of the Philips video cassette recorder. But only for industry and education — not yet for home use. The idea of complex electronic devices in the home environment seemed quite alien to designers and marketers alike.

Those of us who are driven barmy by the interminable replays of goals, run-outs or holes in one might be interested to know that our troubles started with the Hitachi "Memory Vision" machine, reported in EA in July 1972. The single freeze frame was stored on a disc rotating at 3600rpm. There was no slow motion on this machine, but it was a pointer to the shape of things to come.

Video players

By December 1972, EA was able to try out the Philips N1500 colour VCR and eleven months later, the Philips VLP laser videodisc player. These reviews were as much as two years ahead of colour TV in Australia.

The November 1973 edition "News Highlights" page, carried an item headed 'Digital watch has LCD' — at that time something quite unusual. Then the very next month the first reference to a pocket calculator, by National Semiconductor and for less than $30! But still no micros.

By the time we got to mid-1974, the pages of EA were beginning to look like they do today. Valves were still used in the 'Slow Scan TV Monitor' in the May edition, but most projects used transistors and ICs that are not out of place today.

In June the Plessey group offered a special deal on a new calculator to EA readers and, later, Dick Smith had a whole page of calculators at "tax free" prices. However, the magazine's index was still devoid of any mention of computer subjects, either mainframe or micro.

EDUC-8 arrives

Then suddenly it was August 1974 and EA presented EDUC-8, the computer project that opened this article. The description and construction articles went on for several months but the advertising pages showed little interest in computers or computer related activities.

[Editor's note: EDUC-8 was intended by the author to be an acronym for the word "educate". However, much to Jim Rowe's chagrin, it came to be known by the philistines on the EA staff as "e-duck-eight" (which meant nothing at all) and it subsequently waddled through life with that tag.]

If we can be sidetracked for a few minutes, the December 1974 edition reminds us just how totally wrong the predictions of "those who know" can be. In the News Highlights section there was a report that Philips were to market their VLP (laser videodisc) for home use, having signed an agreement with MCA Universal who were to supply the films to fuel the system.

Philips and the video pundits of those days had decided that the public wanted video replay but not necessarily video recording facilities. Philips were probably influenced in their decision by their inability to get a movie length tape into their N1500 VCR cassettes. The program suppliers probably felt that viewers would not want to record off air because of the possible degradation from interference and the interruptions from commercials.

If a precedent was required, it could be pointed to audio discs where records were still selling well, in spite of the availability of convenient cassette recorders. The videodisc seemed to be the way to go.

Then in May 1975, EA reported that "Videodisc contenders prepare for battle". The laser disc survived the battle, but the public had other ideas about its commercial success. When VHS and Beta VCRs were available, with 3-hour playing times, the public showed that they wanted record as well as replay facilities. And, despite the potentially

20 years of EA

cheaper videodiscs, viewers were prepared to pay high prices for movies on tape.

Rather than waste the effort put into the development of the laser disc technology, Philips joined with the Japanese firm Sony to produce the Compact Disc. This idea has really taken off and one day the silver disc will replace the black disc completely.

Now, back to the micro.

In January and February 1975, an article entitled "The European Calculator War" discussed the difficulties being encountered by manufacturers of calculators when faced by stiff competition from Japanese and US companies. This competition probably marked the beginning of the electronics revolution as calculator makers turned to other digital products in order to utilise their manufacturing capacity.

What might be considered the first shot in the microcomputer war was signalled in the February edition. The item reported on a microprocessor-controlled 'smart terminal' from Hewlett Packard. The terminal worked to and from a remote central processing unit, but only required its own CPU and a memory to become what we know today as a microcomputer.

Electronics Australia's interest in computers accelerated in 1975 with an article headed "Workshop Computers for Tomorrow's Executives". The story discussed the potential for small computers in commerce and industry. It even introduced the concept of working at home and sending the output to the office by phone from a home computer.

Through 1975 *Electronics Australia* continued to work on EDUC-8, increasing its power and versatility. The computer eventually had a keyboard, printer, sound output and a punched tape reader. For its time it was quite an impressive machine but it could not be called a true microcomputer by today's standards.

The microprocessor

The first advertisement for what looked like a true home computer appeared in the March 1976 edition. The firm "WHK Electronic and Scientific Instrumentation" announced the MITS Altair 680 computer, in kit form, for $350. The Altair used the 6800 microprocessor chip which was to appear in hundreds of different computers in the years to come.

And finally it arrived. In April 1976 a news article announced "An even lower priced microprocessor", the National Semiconductor SC/MP which sold for around $10. It could be used in all kinds of controller situations and made an ideal starter for experimental packs. It wasn't long before EA had a project under way for using the chip, and evaluation kits were widely advertised.

[Editor's second note: the microcomputer project based on the SC/MP chip was christened "Miniscamp". Those same EA philistines referred to it as "Miniscunge".]

In August 1976 the magazine ran a "Special Feature on Microprocessors", the first of many such articles. In the same edition Dick Smith was advertising microprocessor chips, memory chips, keyboards etc, and the home computer was away.

At this point my curiosity in the prehistory of the microcomputer was more or less satisfied. I had scanned through a hundred copies of the magazine, every fourth or fifth one in considerable detail. While I may have missed a few points, the broad chronology is accurate.

It is only ten years since technology made possible the home computer. In that time we have seen all the Apples, the Commodores and Sorcerers and BBCs and IBMs etc. Of the millions of items of microcomputer software that are available today, all without exception have been written in the past 10 years.

Microcomputers have been delivered in all sorts of packages, from bare boards to self contained units with every accessory built in for user convenience. Some complete computers have been sold for less than $100 though most worthwhile units are around the $1000 mark.

Today, children in primary school are quite familiar with computers and High School students generally are very proficient indeed. Yet only ten years ago we knew not what micros were and we didn't know how much we needed them. How times have changed.

I wish I had access to the next 20 years of *Electronics Australia*. I would like to look forward as I have just looked backward. I wonder what I might find from such an exercise.

(1) 'Computer — Servant or Master'. Prof. Donald Michie (Edinburgh) EA. March 1969, page 11.

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- High Surge Voltage protection 1.5 KV-3 KV.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS
Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C.
Power Supply: one 9 volt battery (006P or FC-1 type or equivalent)

Cat. Q91530 **Normally $99.95**
SPECIAL $79.95

METEX 3530 MULTIMETER

Features:
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- 1/2" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV.
- Capacitance measurements to 1pF.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
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Double sided, double density, 1 M/Byte unformatted, 80 track per side.

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3 1/2" Standard size disk drive. Single sided, double density.

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M4854
Slimline 5 1/4" disk drive. Double sided, double density. 96 track/inch 9621 bit/inch. 1.6Mbyte unformatted 3ms track to track access. 77 track/side.

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M4853
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Cat. C11903 **$260**

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Cat. C11901 **$219**
Case & Power Supply to suit

Cat. X11011 **$109**

M4855
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- Length 10 metres.

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- Cream colour cable.

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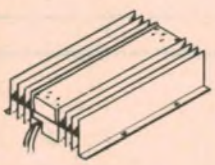

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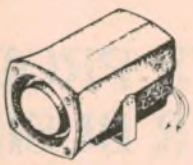

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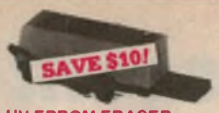

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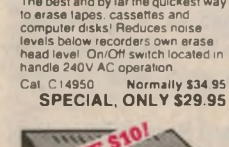

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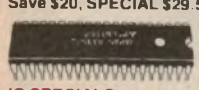

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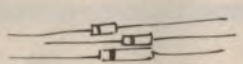
8257	3.50	3.10
8259	3.50	3.10
8279	3.50	3.10
2532	7.50	6.90
2764	5.50	5.10
27128	7.50	6.90
1488	.55	.45
1489	.55	.45



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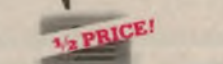

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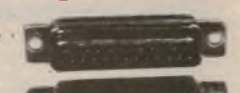

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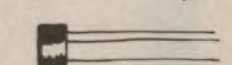

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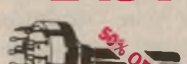

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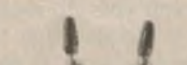

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Save money on incandescent lamps

Build this Lamp Saver for spotlights

Does your house eat lamps? Does it seem that you are always having to replace expensive spotlights, ornamental lamps or bulbs in inaccessible places? The solution to these problems is the Lamp Saver which will greatly extend the life of any 240VAC incandescent lamp.

by COLIN DAWSON & LEO SIMPSON

In recent years there has been a considerable reaction against the use of fluorescent lighting in homes apart from in utility areas such as the laundry, garage and workshop. For all other areas of the home, the trend to incandescent lighting has been overwhelming and so now there are a multitude of special purpose light fittings designed, often as not, to take special lamps.

The most popular of these are the spotlight and downlight fittings which take Edison-screw lamps rated at around 75 to 100 watts. Now while these work well they can be quite expensive to replace and generally cost between $5 and $7 or more. Moreover, they tend to have a fairly short life because they have a relatively small bulb to begin with and they are used in fittings which are poorly ventilated. As a result, the lamps overheat and fail prematurely.

If you have several of these fittings in your home you can count yourself lucky if you do not have to replace each of these lamps several times a year. It can add up to quite a lot of money over a period.

So that is the purpose of the Lamp Saver; to protect and extend the life of these more expensive lamps. It is not intended to be used with ordinary domestic light bulbs which are dirt cheap. At around 60 cents for an ordinary light bulb, it would be hard to justify the cost of the Lamp Saver. But if you have a lamp in a particularly inaccessible spot, such as right up high on a "cathedral" ceiling, the Lamp Saver could be justified, even if it was used with an ordinary light bulb.

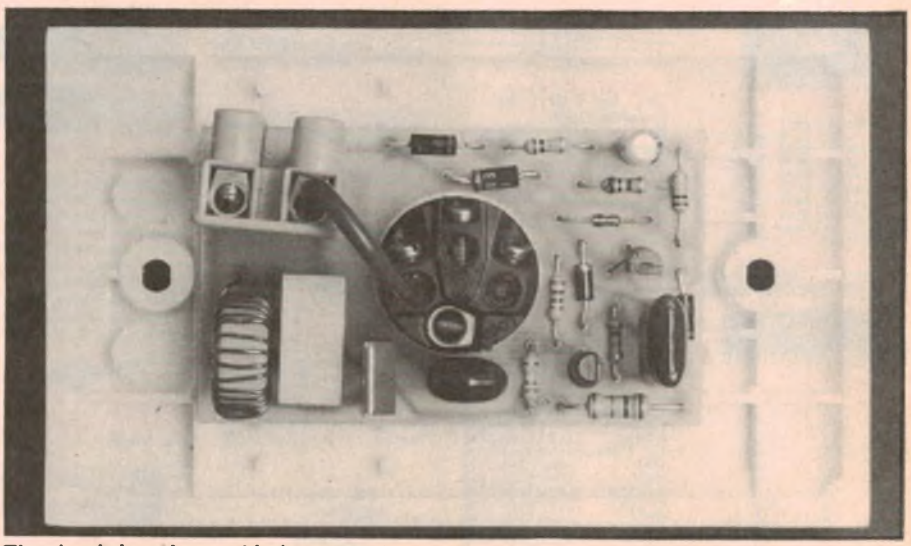
So what is the Lamp Saver? It's a simple, inexpensive circuit that incorporates three-way protection for a lamp. It is designed to fit on the back of a standard switch plate, thereafter never to be seen or thought of again. It combines three proven methods of lamp protection: soft-start, derating and over-voltage protection.

Soft start

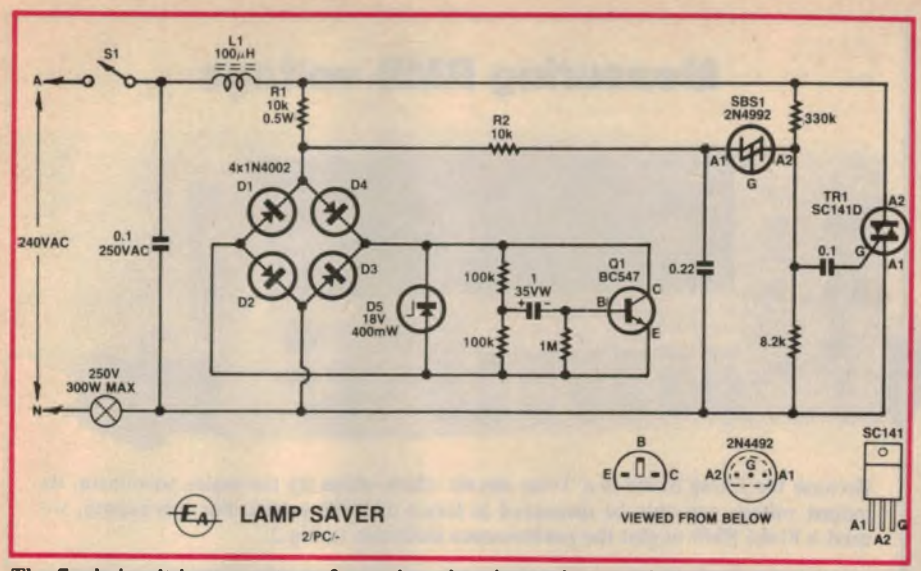
One of the problems with incandescent lamps is their "cold resistance". If you measure the filament of a 240VAC lamp rated at 100 watts you might expect to find that its resistance would be around 570Ω (or exactly 576Ω, by calculation from Ohm's Law). In reality, the filament resistance when measured by a multimeter is likely to be around 50Ω or less. Measurements taken in this way give the "cold" resistance of the filament whereas when it is operating it presents a much higher "hot" resistance to the AC mains supply.

When power is first applied to the lamp, the fact that its filament is cold means that a very high surge current will flow until the filament heats up. This initial surge current will be ten to 15 times the normal operating current and flows for the first ten milliseconds or so after switch-on. As short as this surge period is, it can blow the lamp as the very high current causes a high magnetic field which literally shakes the filament apart.

So next time you hear the dreaded



The circuit board assembly is mounted on the back of a standard switch plate.



The final circuit incorporates soft-starting, derating and over-voltage protection.

"plink" as another lamp fails at switch-on you'll know that initial surge current has claimed another victim.

Protecting lamps against the initial surge current is a simple matter of having a soft turn-on. By letting the initial voltage across the filament build up gradually over half a second or so, there will be virtually no switch-on surge and no high filament stresses.

Over-voltage protection

Another factor which kills incandescent lamps is over-voltage. In simple terms, operating an incandescent lamp at 10 percent more than its rated voltage will halve its expected life. Even a 5% increase in applied voltage means a significant reduction in lamp life. Accordingly, our circuit has a clamp action which prevents the voltage across the lamp filament from going much over 240VAC, regardless of how high the mains voltage may go.

An extension of this concept is to derate the lamp. If a small increase in applied voltage means a considerable reduction in lamp life, then a slight decrease in voltage will give a considerable increase in lamp life. The drawback is that if the voltage is reduced by more than a small amount, there will be a noticeable decrease in lamp brilliance which may be undesirable.

Circuit description

The circuit is similar in principle to a typical light dimmer. It uses a phase controlled Triac to control the voltage applied to the lamp. A Triac controls the amount of power it feeds to its load by turning on earlier or later in each mains half cycle. And when it turns on, it stays on until the voltage across it

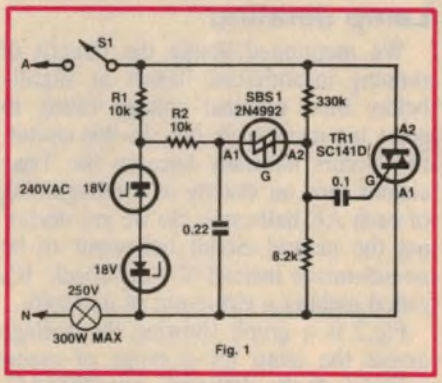


Fig.1: a phase-controlled Triac is used to control the voltage applied to the lamp.

drops to zero, at the end of each half-cycle.

The general circuit concept of the Lamp Saver is depicted in Fig.1 which looks like a modified light dimmer. It works in the following way. A clipped version of the mains waveform from across the back-to-back zener diodes is used to charge the 0.22μF capacitor via a 10kΩ resistor.

As the voltage across the capacitor rises, the voltage across the 2N4992 silicon bilateral switch (SBS) will rise accordingly until the breakover voltage of the SBS is reached. At this point the SBS breaks down to a low resistance and delivers a pulse of current via the 0.1μF capacitor to the Triac gate, turning it on.

This sequence of events is repeated for each half cycle of the mains voltage and the circuit components are selected so that the Triac fires early in the half-cycle, therefore applying almost the maximum AC voltage to the lamp load.

So far so good but the circuit also includes some components which effectively limit how much voltage is applied to the lamp. These work as follows.

Consider that the breakover voltage of the 2N4992 SBS is reached when the voltage across it, ie, between its A1 and A2 terminals, is more than about 10V. Now if the A2 terminal of the SBS was connected directly to the gate of the Triac, the SBS would break down as soon as the voltage across the 0.22μF capacitor rose above 10V (or whatever the actual SBS breakover voltage was).

But note that the A2 end of the SBS is connected to the gate via a 0.1μF capacitor and tied to a potential above the Neutral line by the voltage divider consisting of the 330kΩ and 8.2kΩ resistors.

Now, the breakover condition can only exist when the timing capacitor charge exceeds the divider voltage by 10V. An increase in the AC mains voltage therefore increases the divider voltage and so the 0.22μF capacitor takes longer to reach the requisite charge and thus the Triac will fire later in the half cycle.

With correct component selection, the later firing angle will just compensate for the increased voltage. The power delivered to the load will be constant.

Ideally, this voltage limited effect should not interfere with power delivery to the load at all until 240VAC is reached. For any mains voltage above 240VAC, the output power should remain constant. The circuit only approximates this characteristic, but still, it is much better than having no limiting at all. We'll discuss the achieved characteristic later.

The soft starting characteristic could be added to the circuit simply by connecting a suitable NTC (negative temperature co-efficient) thermistor in series with R1. This would have the effect of reducing the voltage across the zener diodes D1 and D2 to a low level at switch-on and then allowing it to build up gradually. This would have the effect of initially allowing the Triac to fire only late in each half cycle and thus severely limit the power delivered to the lamp. Thus the lamp filament would be protected against initial surge current.

Well, we haven't used a thermistor. While a thermistor has the virtue of simplicity, they can be very hard to obtain. So we used a slightly more complicated circuit with readily available components. We now refer to the full circuit diagram of the Lamp Saver.

Instead of having two zener diodes D1 and D2 back to back in the circuit to clip the mains voltage we have used a bridge rectifier (diodes D1 to D4) and a single 18V zener diode D5. This func-

Lamp Saver to build

tions the same way as the back to back zeners but allows us to incorporate transistor Q1 and associated components into the circuit.

During normal operation, Q1, an NPN BC547, is biased off by the 1MΩ resistor connected from its base to the negative line from D1/D2. It is only during the period immediately after switch-on that current flowing through the 1μF capacitor biases Q1 on. The actual period for which Q1 is biased on is determined by the combination of the 1μF capacitor and the two 100kΩ resistors. It works out to be around 0.5s.

At the first instant after switch on, Q1 is biased fully on via the 1μF capacitor. Q1 virtually shorts the 10kΩ charging resistor R2 to the Neutral line, via the diode bridge. So the 0.22μF timing capacitor does not reach the SBS breakover voltage and the Triac remains untriggered.

Then the 1μF capacitor begins to charge which has the effect of turning Q1 off, which allows the voltage across zener D5 to rise to the full 18V. This allows the 0.22μF capacitor to charge more rapidly via R2. and thus turn on the Triac earlier in each AC half-cycle.

The net effect of this sequence is that the lamp comes up to operating brightness over a 0.5s period. This is barely noticeable unless you are looking for it but still much slower than the 50ms or so that it normally takes the bulb current to stabilise. Most importantly, the massive switch on surge current in the filament is avoided.

Measuring RMS voltage

Because the Lamp Saver is a Triac circuit which chops up the mains waveform, its output voltage can only be measured in terms of RMS values. For this reason, we used a Fluke 8840 to plot the performance indicated in Fig.2.

Lamp derating

We mentioned above the benefit of running incandescent lamps at slightly below their nominal voltage rating to get a big increase in life. In this circuit, this occurs naturally because the Triac cannot turn on exactly at the beginning of each AC half-cycle. So we are declaring the natural circuit behaviour to be an advantage instead of a drawback. It's called making a virtue out of necessity.

Fig.2 is a graph showing the voltage across the lamp for a range of mains voltages from 200VAC to 290VAC. Normally, if you applied a voltage much more above 260VAC to a typical lamp it would fail very quickly, if not immediately in the case of 290VAC. Our circuit progressively reduces the voltage so that at 280VAC there is actually less voltage across the lamp than with 220-VAC input. And note that with 250-VAC input the lamp voltage is about 239VAC which is a good operational compromise considering the mains voltage in most Australian towns and cities.

Also included in the circuit is an effective interference suppression circuit consisting of the 100μH choke in series with the Active supply to the Triac and the 0.1μF/250VAC capacitor. An essential factor in the effectiveness of this interference suppression filter is the use of a Neosid iron powder toroid, type 17-132-10.

Maximum lamp load for the circuit as presented is 300 watts which should be more than adequate for most domestic applications.

Construction

All of the circuit components mount on a PCB measuring 41 x 69mm and coded 86pc5. The board has a central 23mm diameter cutout which allows it

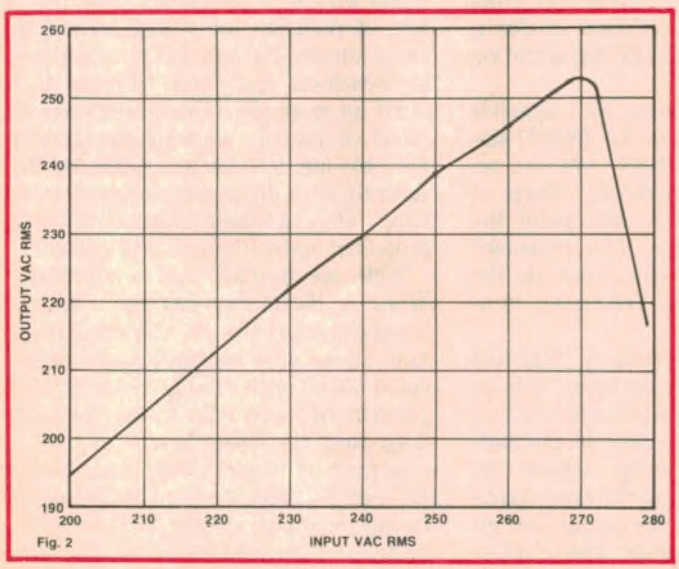
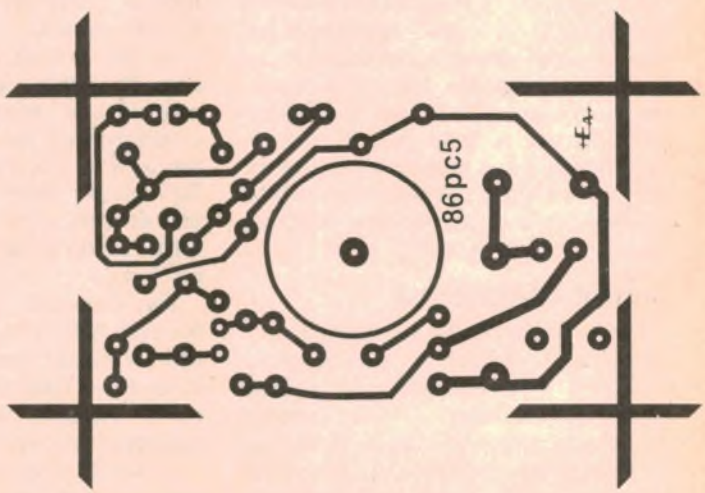
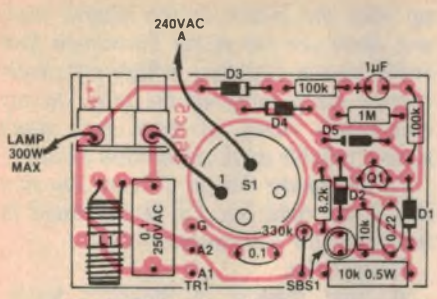


Fig.2: lamp voltage as a function of mains input voltage.



Above: actual-size artwork for the PC board. Ready-etched boards are available from parts retailers.



Parts layout diagram for the Lamp Saver. Take care with mains wiring.

to mount directly over the switch barrel on a standard switch plate.

We assume that kitset suppliers will make the printed circuit board available with a ready-made cutout but if not, the cutout should be made before any component assembly begins.

It is most convenient to mount all of the small components, such as resistors and diodes, first. Follow the overlay diagram exactly for the diodes, transistor and electrolytic capacitor. The silicon bilateral switch may be mounted either way round since it is not polarity conscious.

Preferably, 1/4W resistors should be used throughout, except for R1 which is specified as a 1/2W type.

The two-way mains terminal block mounts vertically and is fixed to the board by means of two short wire "stubs" which can be made with 16-gauge tinned copper wire.

The toroidal inductor is prepared by winding on 37 turns of 0.5mm enamelled copper wire. The turns should be made tightly with each one touching the next on the inside of the core. When the winding is complete, use a razor blade to clean the enamel from the two ends of the winding and tin them ready for soldering into the board.

The inductor is held in place with a loop of wire through the PCB. Two pads are provided on the PCB for this purpose — solder one end of the loop to a pad, pass the other end through the toroid and spare PCB hole and pull the loop tight. Solder the free end to the pad.

Check your assembly and soldering very carefully before affixing the completed printed circuit board to the switch plate. The board can be secured to the rear of the switch-plate by a couple of spots of epoxy adhesive.

Installation

Only one wiring change will have to be made to a normal switch installation. This involves the wire from the switch to the lamp. This wire must be connected to the terminal block on the PCB. A link from the other PCB terminal to the switch then completes the circuit.

Most modern mains switches of the circular format have three enclosed terminals on the back although some have four. The fourth, where present, is only a "loop" terminal used to join two wires.

Of the three main terminals, only two are used in a typical installation. The third (marked "2") is used only for two-way switches. Of the remaining two, one is marked "1" (normally opened) and the other "C" (common). The mains active wire is connected to one of these terminals and the lamp to the other. It is the switch/lamp connection which is of interest. The wire must be disconnected from the switch and secured to the terminal on the PCB marked "lamp".

The other terminal (active) connects to the switch. A short insulated link must be used here. It is connected to whichever terminal was previously used for the switch/lamp connection. EA

PARTS LIST

1 PCB, 41 x 69mm, code 86pc5
1 standard 240VAC/10A switch plate, HPM series P 770 GF or equivalent
1 2-way mains terminal block
1 Neosid iron powder ring core, 17-132-10
1 2m length of 0.5mm enamelled copper wire
1 3cm length of 240VAC insulated hook-up wire

Semiconductors
1 SC141D, BT137 Triac
4 1N4002 diodes
1 2N4992 silicon bilateral switch
1 BC547 NPN transistor
1 18V 400mW zener diode

Capacitors
1 1µF 35VW PC electrolytic
1 0.22µF metallised polyester (greencap)
1 0.1µF/250VAC dual dielectric (Philips series MKT-P or equivalent)
1 0.1µF greencap

Resistors
(1/2W, 5% unless specified)
1 x 1MΩ, 1 x 330kΩ, 2 x 100kΩ, 1 x 10kΩ, 1 x 10kΩ 0.5W, 1 x 8.2kΩ

Miscellaneous
Epoxy adhesive, tinned copper wire, solder.

FORUM

Conducted by Neville Williams

Static electricity and computers

If computer hackers want to conserve their chips (cash) they should be careful how they handle chips (ICs). But one of our correspondents is spitting chips (figuratively) about what he considers to be misinformation promulgated by a number of well known computer companies.

It so happens that the correspondent concerned is a former staff member, Stewart Fist, editor of our one-time associate magazine "Videomag". It also happens that, over and above his broad-ranging interest in video and film technology, he's something of a computer nut, freak or hacker — whatever the appropriate term, these days.

Being a freelance professional writer, he is well able to explain the reason for the chip on his shoulder.

Dear Neville,

It is now conventional wisdom in the hacker world that the way to prevent damage to chips, when handling plug-in boards, replacing RAM chips, etc, is to:

(a) Switch off the power at the computer;

(b) Leave the computer plugged into the power point; and

(c) Touch the casing of the power supply before handling any chips.

The theory is that, by leaving the computer plugged in, the earth lead will conduct away any static electricity when you touch the power supply box and therefore remove all risks of static damage.

I think this procedure is silly and dangerous and I've written to a number of computer manufacturers (who advocate it in their manuals) pointing out the danger — but to no avail. To date, they haven't even replied.

My argument is as follows:

(1) A high level of static charge is not, by itself, a problem. What must be avoided is a difference in electrostatic level between my body and the computer.

(2) This difference in potential is removed as soon as I touch the power supply case — whether the case is at earth potential or not.

(3) If the prevailing electrostatic potential in the room is high then, in fact, it is better for the computer to remain at the high level. Dropping the machine to earth potential increases the risk of an accidental discharge through the chips if I pick up extra charge from the room after having touched the power supply case — and this is possible, if not probable.

(4) Since the existence of an earth connection doesn't decrease (and can increase) the risk of potential difference, then leaving the computer plugged into a mains power point is a dangerous practice and should be discontinued.

I don't want to exaggerate the dangers — after all, the computer boards only have a few volts when everything is running okay, in store-bought computers, anyway. But houses are often incorrectly wired and power supplies get faulty. It's a bit like casual handling of a rifle or shotgun — its perfectly all right as long as it's unloaded. Unfortunately, people get themselves killed every year by 'unloaded' guns.

Since a large number of open-architecture computer owners are kids, I think it is pretty close to criminal negligence for computer companies to advocate poking around inside any piece of computer gear with the power cable still plugged into the power point.

Too many Australian houses are wired up with the switch in the neutral lead, and there are too many Taiwanese fans (with power switches) which effectively reverse the polarity of the plug. In my experience, many of these fans don't have a reliable earth connection anyway.

I'd like to stir this up if I can. I'm sure that I am right but I'd be interested to hear your (or any contrary) views.

Stewart Fist.

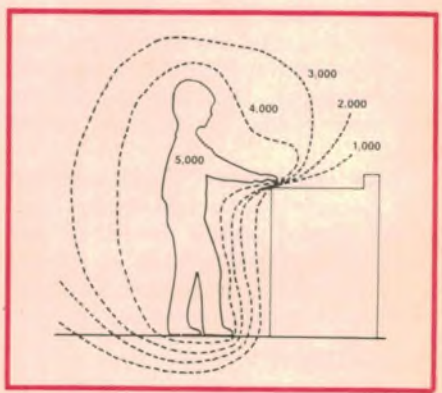
At first reading of Stewart's letter, one might jump to the conclusion that changing a computer board or RAM chip is a consistently hazardous procedure, if not to the actual chip(s), then to the individual involved, by reason of inadvertently exposed mains voltage.

Realistically, the chance of zapping either chips or chaps in the average Australian domestic hacker situation is probably fairly remote, but nevertheless sufficient to warrant the kind of commonsense that one should always exercise when probing the innards of any electronic equipment — especially if fragile and/or mains powered.

At the heart of the present matter is the risk of a person picking up an electrostatic charge from the room environment, sufficient to zap MOS chips if inadvertently applied to them. "Zap" may signify anything from total destruction to the creation of an obscure bug-size fault.

Some years ago, I recall a discussion in these columns of electrostatic charges of the "people" kind as evidenced, for example, by a shock when one touches a metal door knob, after walking across a nylon carpeted room.

The discussion served to underline the fact that the build-up of such charges varies enormously with the prevailing level of humidity in the atmosphere. It can be plainly apparent in artificially dehumidified (air-conditioned) situations, and in places like central Europe, cen-



Electrical field surrounding a statically charged person.

Reproduced by courtesy of 3M and Circuit Components (A'Asia) Pty Ltd.

tral USA and inland Australia. It is less frequently evident in the relatively humid coastal areas where most Australians live.

That doesn't mean that most of us can ignore the problem; it simply signifies that the actual risk of zapping MOS chips varies widely with time, place and situation. The hazard can be consistently high — or negligible for much of the time.

Plastic parlour

I was told of one lady in this city who set up a small typesetting operation using a modern high-tech word processor in a modern air-conditioned office fitted out with modern moulded furnishings and modern nylon carpeting. In this "plastic" environment, wearing modern nylon under-garments, she was capable of unwittingly generating an electrostatic charge of many thousands of volts — sufficient, apparently, to scramble the memory banks in the new processor, merely by her presence at the keyboard!

It was an extreme case requiring antistatic precautions around the work station to overcome the problem. But, back to the original theme:

Leaving a computer plugged into a power point, as reportedly suggested by some suppliers, should keep the equipment itself at nominal earth potential, which is okay — provided the person needing to fiddle with its "works" remembers to discharge possible body potentials beforehand and at subsequent frequent intervals.

Stewart F. objects to this proposition, suggesting that the same objective could be achieved by having both person and equipment at a common ambient level. More to the point, disconnecting the computer from the mains would obviate the risk of accidental contact with mains voltage, arising from a faulty component or incorrect wiring.

What do I think?

Frankly, my own reaction is to be less than enthusiastic about either point of view. If protection is warranted, then it's better to do the job properly than by halves.

The metalwork of the computer should logically be maintained at earth potential, but independently of the mains chord, using a separate and permanent lead to the electrical wiring earth or a water pipe. (Please, not a spade connector pushed into a power point.) During service procedures, the mains cord would be plugged into the wall socket only when the computer needed to be powered up.

And, rather than relying on occasional contact with the power supply case, the person working on the computer should be electrically connected to it by an antistatic wrist strap and a flexible clip-lead exhibiting a DC resistance of at least 1MΩ. This should be sufficient to bleed away any charge that tends to accumulate, while also limiting current that might flow through the person's body in the event of accidental contact with a high voltage source.

To provide this kind of safeguard should not pose any great problem and, to me, it makes a lot more sense than the half-measures previously mentioned.

As an added precaution, "earthy" antistatic table and floor mats are commonly used in computer workstations — an observation which, for the writer, has its humourous side.

. . . the thunderstorms of the past summer had been "very good for business"

Back in the '60s, when we relocated the EA laboratory in the Jones St premises of our then parent company, we had the work benches covered with traditional brown industrial quality "lino" — appropriately tough and easy to keep clean.

We discovered later that it exhibited sufficient intrinsic conductivity to be quite a nuisance when checking out a "rats nest" of high impedance circuitry. Maybe Stewart F. and the hacker fraternity should keep an eye out for the odd square metre of the stuff to serve as an antistatic mat for their computer workspace. This, in addition to the aforementioned wrist strap and resistive lead.

[If you need information about commercial antistatic wrist straps and leads, antistatic workstation mats, etc, I suggest a letter or phone call to Circuit Components (A'Asia) Pty Ltd, 383 Forest Rd, Bexley, NSW 2207; phone (02) 59 6550 or 59 3720.]

Lightning also

In discussing this whole matter with various acquaintances, one of them came up with the observation that, over the past summer, computer MOS chips in the Sydney area, at least, were more likely to be zapped by lightning than by electrostatic discharges from the tips of hackers' fingers.

Ever a man for detail, he went on to suggest voltage, current and energy figures for typical lightning bolts, and related how one nearby strike had produced enough spatial magnetic induction to zap the input circuitry of an electrician's stud finder, lying on his workbench.

In addition to direct induction, numerous strikes on electricity supply mains have caused potentially damaging voltage spikes, along with actual dropouts and a consequent loss of data.

His observations led me to ring Clive Chamberlain of Promark Electronics at Crows Nest, in Sydney. Clive had recently attended a conference in Germany and remarked that the electrostatic charges evident in hotels, etc, during the European winter had to be experienced to be believed.

The problem was not nearly as acute in Sydney but he confirmed that, by way of compensation, the thunderstorms of the past summer had been "very good for business" — his business anyway!

Among the lines carried by Promark is a range of zener-like devices to clamp or short supply lines in the event of potentially destructive voltage surges, along with gas-filled arresters, comprehensive line filters, etc.

I was left with the distinct impression that, over and above concern about electrostatic charges, hackers might do well to give some thought to the thunderstorms that might be awaiting them next summer.

[To anticipate another likely question, Promark Electronics is at 6 Clark St, Crows Nest, NSW 2065. Phone (02) 439 6477. Promark can provide data but actual distribution is being arranged through selected suppliers.]

"Wireless" microphones

By way of a complete change of subject, we carried a letter from R.B. of Canberra in our February '86 issue, detailing problems he had experienced with an FM "wireless" microphone in a public address situation. Although the system had operated satisfactorily when checked out beforehand, it had suffered disconcerting variations in level and even complete dropouts when an audience was present.

R.B. suggested that it probably had something to do with peaks and nulls in the signal strength, related to the wavelength of the FM carrier.

By way of comment, we said that we had not observed problems, in similar situations, of the magnitude of those described and felt that they were possibly indicative of inadequate signal strength, causing the FM receiver to operate under the equivalent of "fringe" conditions — in the region below limiting and into muting.

FORUM – *continued*

The guest speakers, on the occasion, may possibly have aggravated the variations in speech level by inadvertently turning the head away from the lapel microphone.

In a letter to hand, a reader from Victoria reports that he had also experienced problems with wireless microphones similar to those described by R.B. but had the facilities to analyse what was going on.

He had checked the frequency of the respective transmitters and receivers and found everything to be in order, the sensitivity of the receivers being measured at around 2μV.

He had also taken note of the signal strength reaching the receivers in typical situations and this proved to be a most revealing exercise. I quote from his letter:

Signal levels of several millivolts were evident with the transmitter in some locations but movement of even a few centimetres could cause the received signal to drop to as little as one or two microvolts. In such circumstances, I had to shift the radio microphone receiver aerial to some other position where the variations in signal level were less severe.

The receivers we use have hard limiting and the level does not drop before the mute operates, although the signal does become quite noisy. If R.B.'s receiver does not hard-limit, he will certainly experience trouble with variations in output level.

R. C. (Benalla, Vic.)

The above letter, reflecting the voice of practical experience, tends to support our own observations in the February issue.

So also does a letter from A.H., reproduced in the accompanying panel, although his emphasis is on the "dress" of the transmitting antenna. If it is to radiate an effective signal, it should be as uncluttered as possible, preferably not associated with microphone audio leads and certainly not bunched up, as can easily happen.

Overall, the message for volunteer, non-professional P.A. operators is clear enough: to ensure a good, reliable signal from a wireless microphone, keep the transmitting antenna as far away as possible from other leads and from the performer's body. Radiate a good signal, place the receiver and antenna in a suitably advantageous position and, as A.H. suggests, even stone walls won't stop it!

Thank you for your respective contributions.

"Wireless" microphones, good and bad

Dear Mr Williams,

I followed with interest your articles on public address systems. The letter in the Feb. '86 issue from R.B. of Canberra, regarding wireless microphones, posed an unusual problem but I doubt that his theory about wavelength, etc, had much to do with it.

In our church (Anglican), we use two FM radio mics with the P.A. system, each operating on a different frequency. Erected in 1850, with stone walls 60cm or more thick, the church is in the form of a crucifix, with the amplifier and FM receivers in one of the side chambers.

Rectors using the FM mics can walk all around the church, even when full of people, and out through the front entrnace, which puts four 60cm stone walls between the transmitters and receivers. The volume remains the same up to about six metres beyond the entrance, beyond which it dies away — apparently the limit of the transmitting range.

Both units use a lapel microphone, with the transmitter clipped to the wearer's belt and an antenna dangling nearly to the ground.

At a club I attend, the FM mic unit has the antenna incorporated in the lead from microphone to transmitter. That causes a lot of trouble when mic and transmitter are brought too close together (to within 30cm or so) and the lead becomes twisted or bunched up. They now run the lead up over the user's shoulder to the lapel mic but, while this helps, it is still not entirely satisfactory.

At another club, to which my son-in-law belongs, they use a hand-held microphone with the FM transmitter built-in, and a trailing antenna about a metre long. That works perfectly.

I thought that perhaps those examples might be of interest and may shed some light on R.B.'s problems. Thanks again for the interesting articles in EA, which I first started reading back in the early R&H era.

A. H., Evanston, SA.

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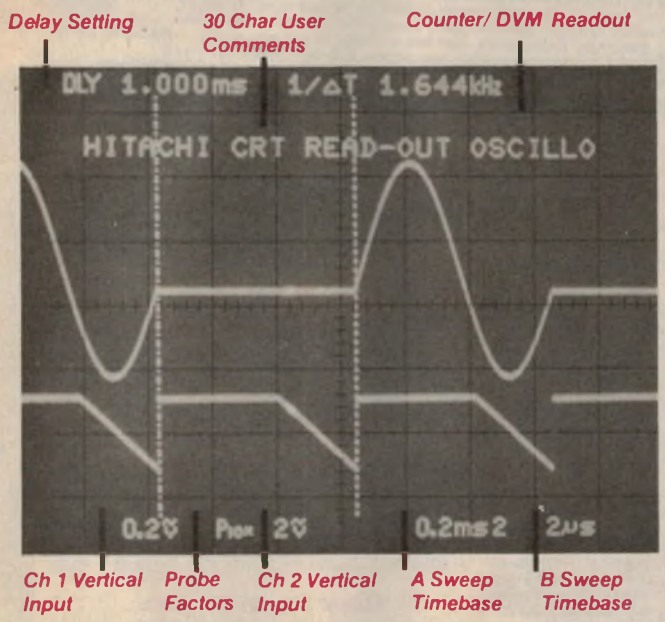

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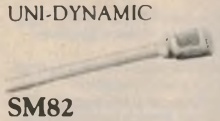

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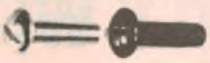

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M 3090	30 + 30
M 3092	35 + 35
M 3100	40 + 40

All **$55ea** 10 Up **$52.50**

Low Cost Multipurpose Power Transformer

240V to 9, 12, 15, 18, 21, 24 volts at 60VA (60W) High grade silicon steel laminions (Sorry we could not do a Toroid at this price!).

Our Multitap 1 amp and 2 amp Transformers have proved so popular we decided to release a big brother. Made right here in Australia. Use of high grade Silicon steel has enabled surprisingly compact dimensions (70mm x 70mm x 58mm High).

M 2165
Outputs
Two Simple Secondaries, each with just one tap, permit an amazing range of outputs i.e.

9V @ 6.6A	12V @ 5A	18V @ 3.3A	24V @ 2.5A

Voltage	Current	Centre Tap
3	6.6A	No
6	6.6A	Yes
9	6.6A	No
12	5A	No
15	4A	No
18	3.3A	Yes
21	2.9A	No
24	2.5A	Yes

An exclusive Altronics Design

Just **$22.50**

Super Versatile Exclusive to Altronics

New PCB Mount Mains Transformers

7/9 Rating. Super Compact, wound on Grain Oriented Steel Core for High efficiency and low temperature rise.

Power Rating:
7VA Load Full voltage +3% -0%
9VA Load Full voltage -6% to 8%

Model Prim/SEC's

M 7012 240/6+6
M 7015 240/7.5 + 7.5
M 7018 240/9+9
M 7024 240/12+12
M 7030 240/15+15

Overall Height 36mm
Length 43mm
Width 36mm

1—9	**$9.80ea**
10—24	**$9.20ea**
25 Plus	**$8.40ea**

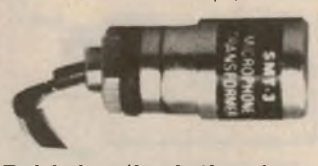
Mu Metal Shielded Microphone and Input Transformers

Microphone Type

Primary: 200 Ohm
Secondary: 50K Ohm

A high quality item eminently suited to mixers, PA amplifiers and where an ultra low "hum" pickup level is desired.

M 0701 **$19.50** 10 up **$18.30**



Bridging/Isolating type

Use for coupling audio modules—prevents earth loops, hum etc. Essential coupling device where DC isolating is required.

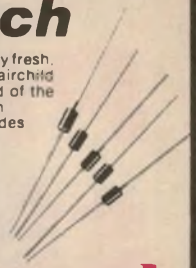
Nominal Impedance Ratio
10K/10K (1:1)

M 0702 **$19.50** 10 up **$18.30**

Million Diode Sellout!

From 1.5¢ each

Altronics have just purchased around 1 Million (yes million) factory fresh, premium quality IN914/IN4148 diodes. These became surplus to Fairchild Australia as the factory supplied bulk, loose pack diodes instead of the tape/reel diodes ordered. So unless you are a manufacturer with automatic component insertion equipment, these fine quality diodes represent the diode bargain of all time!! **Cat. Z 0101**



1-99	**3¢ ea**
100-499	**2.5¢ ea**
500 plus	**1.5¢ ea**

Stereo Mixers at Low Import Price

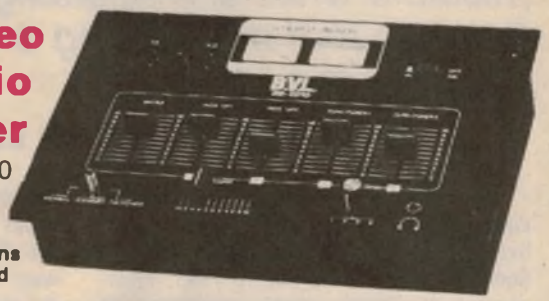
ATTENTION—Social Clubs, Schools, Churchs, Disco Operators, Entertainers, Hotels, Night Clubs and sporting Bodies. With Altronics low prices—here is your opportunity to install one of these outstanding sound control mixers. Both models include microphone "Soundover" facility—making either ideal for live entertainment use.

Stereo Audio Mixer

A 2550

$125

240V Mains Operated

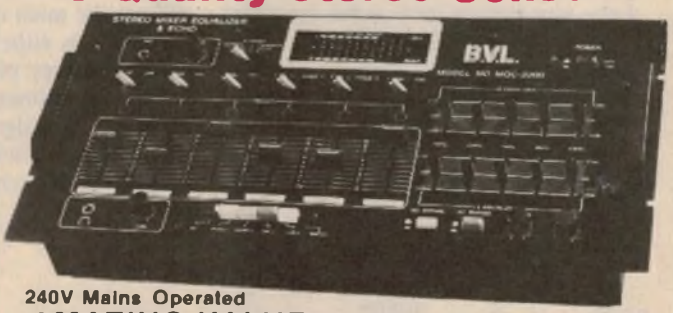


This brilliant little mixing console is absolutely packed with features. Allows blending of Microphone, two Phono inputs and either two Tape or Turner inputs • Right and left VU meters • Separate Bass and Treble controls • 5 slide level controls • Fader control between Phono pickups for professional cueing • Headphone monitor switch • Talkover facility.

SPECIFICATIONS:

• **Input** Mic 0.5mV 600 Ohms Phono 3mV 50K Ohms Tape/Tuner 150mV 100K Ohms • **Output** 250mV • **Frequency Response** 20Hz to 20Hz (plus or minus 1db) • **Tone Control (Treble)** 10KHz (plus or minus 12db) • **Tone Control (Bass)** 100Hz (plus or minus 12db) • **Distortion** Less than 0.07% • **S/N Ratio** More than 60db • **Headphone Impedance** 4—6 Ohms • **Dimensions** 318 (L) x 217 (W) x 85 (H)

Pro-Quality Stereo Console



240V Mains Operated

AMAZING VALUE

A 2570 **$399**

Our sophisticated 'NEW' Audio Mixing Console is ideal for 'live' recording • PA mixing • Fantastic Tape recordings • Even Stereo/Mono VCR recording. A truly professional deck that features separate R/L 5 band graphic equalisers • Echo and Peak LED level indicators • Talkover facility • Separate H/Phone level control • Patch switch bank • Individual microphone, Phono 1 Phone 2, Aux/Line 1, Aux/Line 2, and Master slide level controls. — Blend up to two magnetic or crystal turntables, two tape decks or tuners and two microphones all at once!!

SPECIFICATIONS:

• **Input** Mic 1—0.5mV 600 Ohms Mic 2—0.5mV 600 Ohms (low imp.) 2.5mV 10K Ohms (low imp.) Phono 1 & 2 (Mag) 3mV 50K Ohms Phone 1 & 2 (Cry) 150mV 100K Ohms Tape/Tuner 1 & 2 150mV 100K Ohms • **Equaliser** 5 frequency bands—60Hz, 250Hz, 1KHz, 4KHz, 12KHz—Boost Cut range-plus or minus 12db @ Centre frequency. • **Output** 1.5V/0.775V (Selectable) • **Frequency Response** 20Hz to 20KHz plus or minus 1db • **Distortion** Less than 0.05% • **S/N Ratio** More than 50db

• **Headphone Impedance** 4—16 Ohms • **Echo** B.B.D. System • **Delay Time** 30—200mS • **Echo Repeat Control** • **Delay Time Control** • **Dimensions** 480 (L) x 240 (W) x 110 (H)

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Second article has full circuit details

Playmaster 60/60 stereo amplifier

Following last month's introductory article on our new Playmaster amplifier, we present the full circuit diagram and describe its features. The circuitry has been kept as simple as possible while still including all essential features and maintaining a very high performance standard.

by JOHN CLARKE & LEO SIMPSON

As outlined briefly last month, the circuitry of the new Playmaster Sixty-Sixty is based on that for the Playmaster Series 200 described during 1985. However, it has been greatly simplified by leaving out that amplifier's CMOS signal switching circuitry, the logic circuitry which provided memory of signal selections and the 20Hz rumble filter.

This also enabled the omission of quite a few buffer amplifier stages which were necessary to obtain low distortion figures from the CMOS switching circuitry.

Let's now have a look at the functions of the new amplifier which are illustrated in the block diagram, Fig.1. This has been reproduced from last month's article, for ease of reference.

Fig.1 shows one channel only, for simplicity's sake, so keep in mind that all circuit functions are repeated in the other (unseen) channel. The same goes for the main circuit diagram, by the way, otherwise we would have had to devote two whole pages to it.

Four signal sources are catered for, plus a tape deck. The input selector (S1 on the main circuit diagram) gives a choice of the output of the phono preamplifier or the three line level inputs, CD player, Tuner or Auxiliary. The wiper connection of S1 then feeds the selected signal to the Tape Out connection and to the Tape Monitor switch (S2 on the main circuit diagram).

S2 selects either the chosen input signal or the tape playback signal and then feeds the volume control via a 4.7kΩ resistor. The signal is also fed to the mono/stereo switch which effectively shorts the two channel signals together for the mono mode. Now simply shorting signals together is not good as far as distortion is concerned.

Consider the phono preamplifier, for example. If the two stereo signals from this preamplifier are simply connected together the difference signals (L-R) will tend to be distorted because the left channel output will be severely loaded by the very low impedance of the right channel output. And the same principle applies for the loading of the right channel.

So to avoid this distortion of the difference signals we include the 4.7kΩ resistor(s) just referred to. They cause a slight signal loss (about 10%) but eliminate the distortion.

The signal from the volume control, which can be regarded as a variable voltage divider, is fed to a buffer stage with a gain of about 5.7 times and then to the active tone controls which can be bypassed by the Tone Defeat switch S4.

Balance control

From S4 the signal is fed to the balance control which is a dual ganged potentiometer with an unusual characteristic which is alluded to by its symbolic representation on both the block diagram and circuit diagram. This shows a resistance symbol combined with a solid bar, with the wiper sitting at the junction of the two.

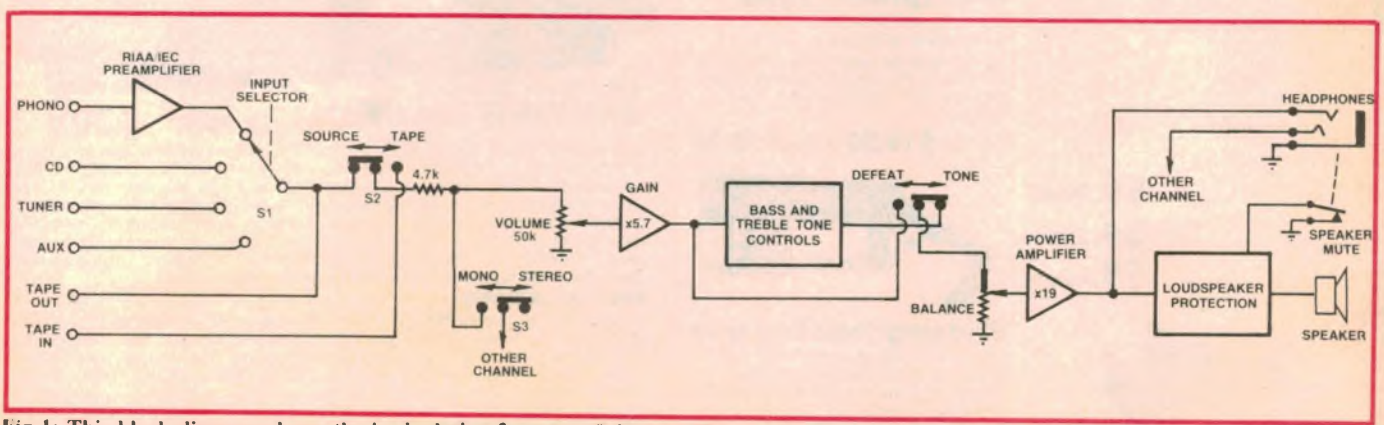
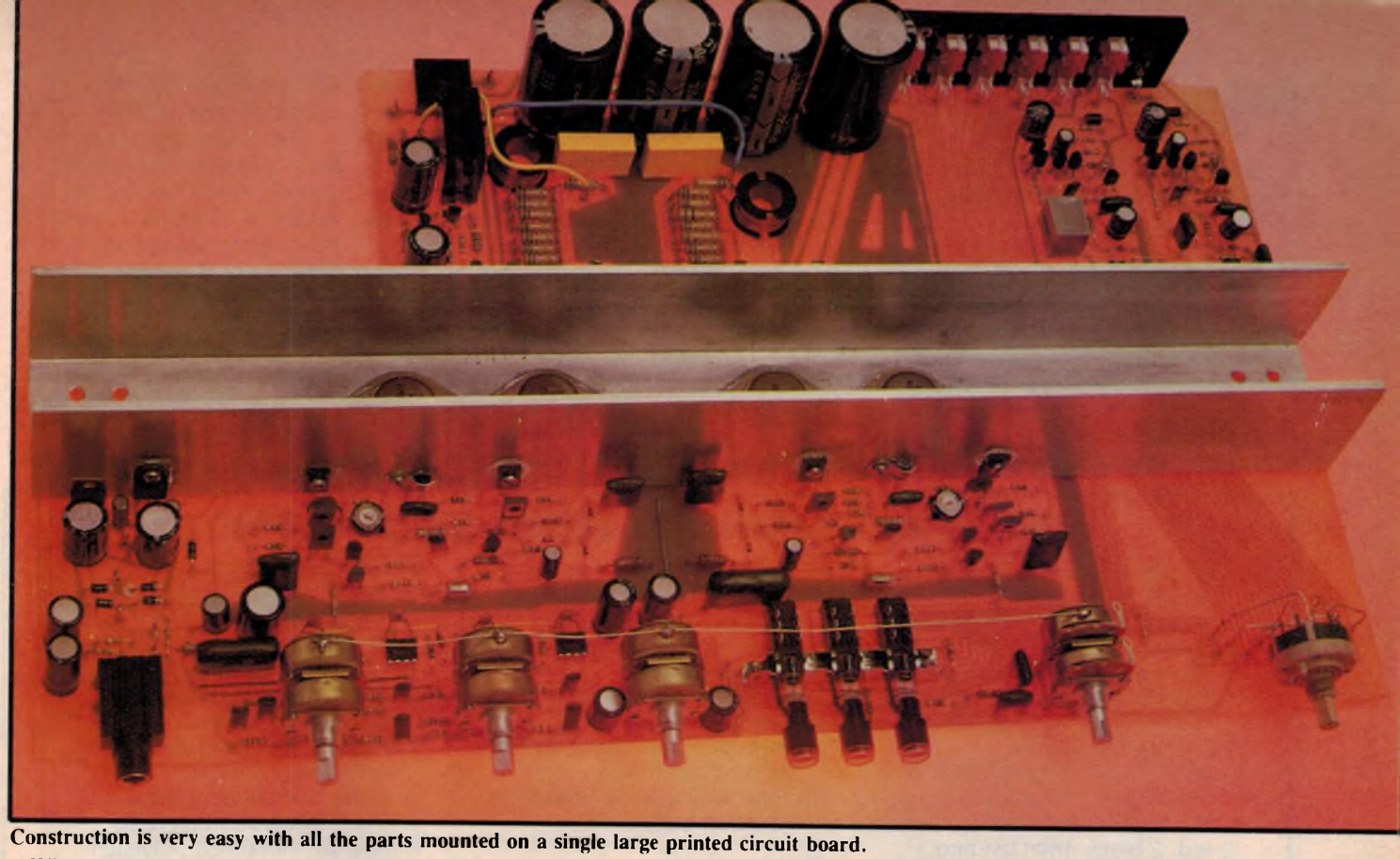


Fig.1: This block diagram shows the basic design features of the new Playmaster Sixty-Sixty stereo amplifier.



Construction is very easy with all the parts mounted on a single large printed circuit board.

What this represents is a resistance element in both sections of the ganged potentiometer which is essentially a short circuit from the centre of the element to one side (and vice versa for the other channel). When the balance control is wound away from the centre setting to favour one channel the other channel's signal is then smoothly reduced towards zero (at the end of travel) while the favoured channel does not increase in level.

This is a subtle refinement on balance controls in earlier stereo amplifiers whereby the favoured channel would increase in gain as the balance control was wound away from the centre setting. You might think this is a small point but when you set the balance control you don't want to make the program sound louder. This is ensured by the specified balance control. It also has a detent position in the centre, for ease of use.

After the balance control, the signal is fed to the power amplifier and then via the protection relay to the loudspeaker. This also incorporates speaker muting when the headphones are plugged in, which obviates the need for a separate loudspeaker switch.

Circuit description

Let us now examine the circuit of the new amplifier in detail, starting with the phono preamplifier. This comprises a low noise operational amplifier, IC1, which is driven by ultra-low-noise transistors connected in a differential pair. To keep noise from this stage to an absolute minimum, we have used paralleled transistors, Q1 and Q3 and Q2 and Q4.

A FET current source in the differential amplifier tail, Q5, sets the collector currents to slightly less than 1mA for each pair. This ensures excellent common mode and supply rejection as well as selecting the operating current for minimum noise.

IC1 has the ability to drive a 600Ω load and this enables the use of a relatively low impedance feedback network to again minimise the noise generated by these components. The feedback components set the RIAA response curve and close tolerance capacitors and resistors (2% and 1% respectively) have been used here for accuracy.

The 39Ω resistor in series with the .018μF capacitor in the feedback is used to limit the amount of negative feedback at very high frequencies and thereby improve the slew rate response.

Note that the 0.22μF capacitor at the output of IC1 provides a degree of rumble filtering (below 20Hz). This curtails the response to the very low frequencies generated by the phono cartridge when playing warped records.

Output from the volume control is capacitively coupled to the input of op amp IC2. This is a low-noise bipolar op amp, type NE5534AN which is largely responsible for the very good noise performance of the amplifier when fed with signals from CD players and other line level sources. The feedback around IC2 is set by the 4.7kΩ and 1kΩ resistors to give a gain of 5.7.

To prevent RF pickup at this point in the circuit, a 1kΩ stopper resistor at the input (pin 3, IC2) has been included. The 18pF compensation capacitor and 470pF capacitor across the 4.7kΩ resistor provide high frequency roll off and ensure stability of this amplifier stage.

IC3 forms the tone control stage which operates by providing variable frequency-dependent negative feedback. When the bass and treble controls are centred, the gain is flat over the audible frequency range.

Winding the bass or treble controls towards the input side of IC3 causes the gain to increase for frequencies above 2kHz and below 300Hz for the treble and bass controls respectively. Similarly, if the controls are wound in the opposite direction, the bass and treble response is reduced.

As noted above, the tone defeat switch, S4, bypasses the tone controls to negate the effect of the tone control settings. The output from the switch is AC-coupled to the Balance potentiometer. This is necessary to prevent any DC offset from IC3 causing DC current

Playmaster amplifier

to pass through the balance pot which would otherwise become noisy to operate.

Power amplifier

Following the balance control is the power amplifier. The input to the amplifier is coupled via a 1μF capacitor and 2.2kΩ resistor. These in conjunction with the 330pF shunt capacitor act as a low-pass filter, to reduce the response to supersonic and radio frequency signals.

Q6 and Q7 form a differential pair with Q8 acting as a constant current tail. It operates as follows: Diodes D1 and D2 set about 1.3V at the base of Q8. Due to the nominal 0.7V across the base-emitter junction of Q8, there is about 0.7V across the 680Ω emitter resistor. The collector current is thus about 1mA which is shared equally by Q6 and Q7.

The inclusion of the constant current source Q8 provides a very high power supply rejection ratio (PSRR) for the amplifier. This means that the amplifier is less likely to respond to variations in the supply rails which may include large ripple signals (ie, hum) and harmonics of the input signal which could lead to higher distortion in the output. Thus Q3 helps improve the distortion and hum performance figures.

Balanced output signals from the 4.7kΩ resistors of Q6 and Q7 are then coupled to a second differential amplifier stage consisting of Q10 and Q11. These have a dynamic collector load

Parts list for the Playmaster 60/60W Stereo Amplifier

1 printed circuit board, code 86sa5, 420 x 249mm with 111 x 111mm corner cutout
1 chassis, 430 x 82 x 254mm (front panel 88 x 482mm)
1 420mm length of 50 x 50mm x 3.5mm U-section aluminium
1 toroidal transformer, 35-0-35VAC, 160VA plus 15-0-15VAC windings (Altronics Cat. M3071)
2 red, 2 black 4mm binding posts
1 6-way PCB mounting stereo RCA socket panel
1 12V DPDT relay, 5A contacts
4 rubber feet
1 6.5mm PCB-mounting insulated headphone socket with changeover contacts
2 plastic coil formers, 20mm OD x 12mm ID x 10mm
2 FX1115 ferrite beads
1 3-pole 4-position rotary switch
1 DPDT pushbutton mains switch
3 PCB mounting push-on/push-off switches (DPDT with 10mm dia pushbuttons, non-interlocked bank with 17.5mm pitch between switches)
4 black knobs, 22mm dia
1 black knob, 40mm dia
8 3AG fuse clips
4 5A 3AG fuses
1 cord clamp mains grommet
1 mains cord and plug
4 earth lugs
26 PC stakes
4 TO-3 mica washers
4 TO-126 mica washers
1 TO-220 mica washer
9 insulated mounting bushes (or 1 bush and 8 insulating sleeves)
2 25mm tapped standoffs
1 500mm length of 6.3mm ID insulating sleeving
1 metre 24/.20 green hookup wire
1 300mm length 24/.20 brown hookup wire
1 200mm length 24/.20 blue hookup wire
2 250mm lengths of 13/. 12 hookup wire
1 metre of single strand 0.8mm tinned copper wire
1 metre of single strand 0.8mm insulated copper wire

Semiconductors

6 NE5534AN op amps
2 MJ15003 NPN transistors
2 MJ15004 PNP transistors
2 MJE340 NPN transistors
2 MJE350 PNP transistors
4 BF469 NPN transistors
2 BF470 PNP transistors
6 BC556 PNP transistors
5 BC547 NPN transistors
1 BC557 PNP transistor
1 BC327 PNP transistor
8 2SC2545 NPN transistors
2 2N5485 N-channel FETs
6 1N914, 1N4148 diodes
6 1N4002 diodes
1 P0-4 6A 400PIV diode bridge
1 7815 three terminal regulator
1 7915 three terminal regulator
2 5.6V 400mW zener diodes
1 3mm green LED

Capacitors

4 2500μF 63VW PC electrolytic
2 1000μF 25VW PC electrolytic
1 1000μF 16VW PC electrolytic
2 220μF 16VW PC electrolytic
5 100μF 16VW PC electrolytic
4 47μF 16VW PC electrolytic
4 47μF 50VW bipolar PC electrolytic
4 22μF 50VW bipolar PC electrolytic
2 10μF 16VW PC electrolytic
2 6.8μF bipolar PC electrolytic
2 1μF metallised polyester (greencap)
8 0.22μF metallised polyester
2 0.15μF 250VAC dual dielectric (Philips MKT-P 2222 330 40154)
7 0.1μF metallised polyester
2 .068μF 2% polystyrene or metallised polyester
2 .018μF 2% polystyrene or metallised polyester
2 .012μF metallised polyester
2 .01μF metallised polyester
4 .0047μF metallised polyester
2 .0033μF metallised polyester
2 470pF ceramic
2 330pF polystyrene
2 100pF polystyrene
2 68pF ceramic
4 18pF ceramic
2 10pF ceramic

Resistors

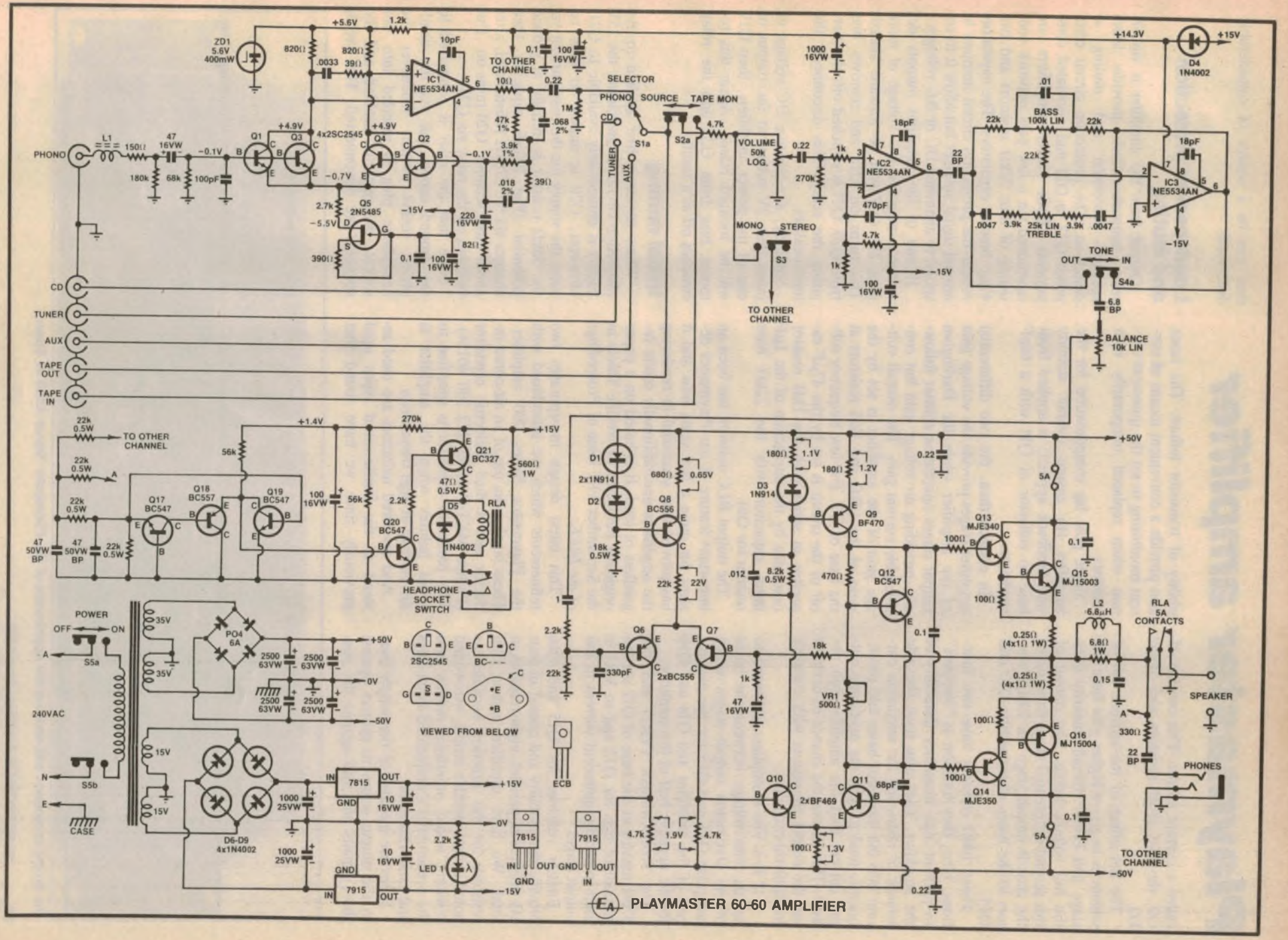
(0.25W, 5% unless stated)
2 x 1MΩ, 3 x 270kΩ, 2 x 180kΩ, 2 x 68kΩ, 2 x 56kΩ, 2 x 47kΩ 1%, 10 x 22kΩ, 4 x 22kΩ/0.5W, 2 x 18kΩ, 2 x 18kΩ/0.5W, 2 x 8.2kΩ/0.5W, 8 x 4.7kΩ, 4 x 3.9kΩ, 2 x 3.9kΩ 1%, 2 x 2.7kΩ, 4 x 2.2kΩ, 2 x 1.2kΩ, 6 x 1kΩ, 4 x 820Ω, 2 x 680Ω, 2 x 560Ω 5W (for setting quiescent current), 1 x 560Ω/1W, 2 x 470Ω, 2 x 390Ω, 2 x 330Ω, 4 x 180Ω, 2 x 150Ω, 10 x 100Ω, 2 x 82Ω, 1 x 47Ω/0.5W, 4 x 39Ω, 2 x 10Ω, 2 x 6.8Ω 1W, 16 x 1Ω/1W.

Potentiometers

2 500Ω miniature vertical trimpots
1 dual gang 100kΩ linear PC-mount pot
1 dual gang 50kΩ log PC-mount pot
1 dual gang 25kΩ linear PC-mount pot
1 dual gang 10kΩ linear PC-mount balance pot

Miscellaneous

Screws, nuts, solder, etc.



PLAYMASTER 60-60 AMPLIFIER

called a current mirror. This consists of Q9, the two 180Ω resistors and diode D3.

The net effect of the current mirror scheme is to give a higher gain from the stage and better overall linearity over the full voltage swing. The output of this second differential stage then drives the class-B output stage via 100Ω resistors to the bases of transistors Q13 and Q14.

These 100Ω resistors have two functions. First, they function as "stoppers" to prevent high frequency instability of the amplifier. They also have the side benefit of restricting the maximum current into the transistor bases and consequently tend to limit the maximum output current that the amplifier can deliver. This lessens the chance of destroying the output transistors with complex loads or short circuits.

Q12 is a Vbe multiplier. It is used to set the bias voltage between the bases of the Darlington output stages which comprise Q13 and Q15 for the positive half of the amplifier and Q14 and Q16 for the negative half of the amplifier.

The 500Ω trimpot (VR1) and the 470Ω resistor at the base of Q12 set the amount of bias for Q12 and so VR1 is used to set the quiescent current in the output stage.

Emitter resistors for Q15 and Q16 provide bias stability and consist of four 1Ω resistors in parallel, eight resistors in total. We have specified carbon film resistors for this function because, as noted in last month's article, wirewound resistors would otherwise radiate into the preamplifier's unshielded input lines and cause distortion.

Fuses are included in the supply lines to the output stages to protect against short-circuits and also against the possibility of transistor failure. The fuses also provide a convenient means of current monitoring to set the quiescent current when replaced temporarily with resistors.

Single pole lag compensation for the amplifier (to ensure overall stability with feedback applied) is applied from base to collector of Q11 with a 68pF capacitor.

In essence then, the two differential amplifier stages provide the voltage gain of the amplifier while the Darlington output stages operate as emitter followers, providing no voltage gain but considerable current gain. The overall voltage gain of the amplifier is set by the ratio of the 18kΩ and 1kΩ resistors at the base of Q7. The low frequency roll-off of the circuit is set by the 47μF capacitor in series with the 1kΩ resistor (and also by the interaction of the 1μF input capacitor with the 22kΩ base resistor for Q6).

The output RLC network has been an important feature of our Playmaster designs for quite a few years now and it has proved very successful in rendering the amplifiers unconditionally stable regardless of load. It is based on a paper originally published by Neville Thiele in the September 1975 issue of *Proceedings of the IREE.*

This latest design incorporates two refinements which we introduced with the Playmaster Series 200 amplifier. These involve the use of an air-cored inductor and a dual dielectric capacitor (Philips MKT-P series 222 330 40154). This particular capacitor is specified to avoid failures when the amplifier is driven hard at high frequencies.

And air-cored inductors are used instead of the ferrite-cored types used previously since we have found that they can be a source of considerable distortion.

Loudspeaker protection and muting

Output from the amplifier is via 5A relay contacts which provide loudspeaker protection and muting at switch-on. The protection circuit comprises Q17 to Q21 and associated components. Both power amplifiers are monitored via a low pass network consisting of four 22kΩ resistors and two 47μF bipolar capacitors. The capacitors render the protection circuit immune to normal signal voltages but allow it to respond to abnormal DC or AC voltages.

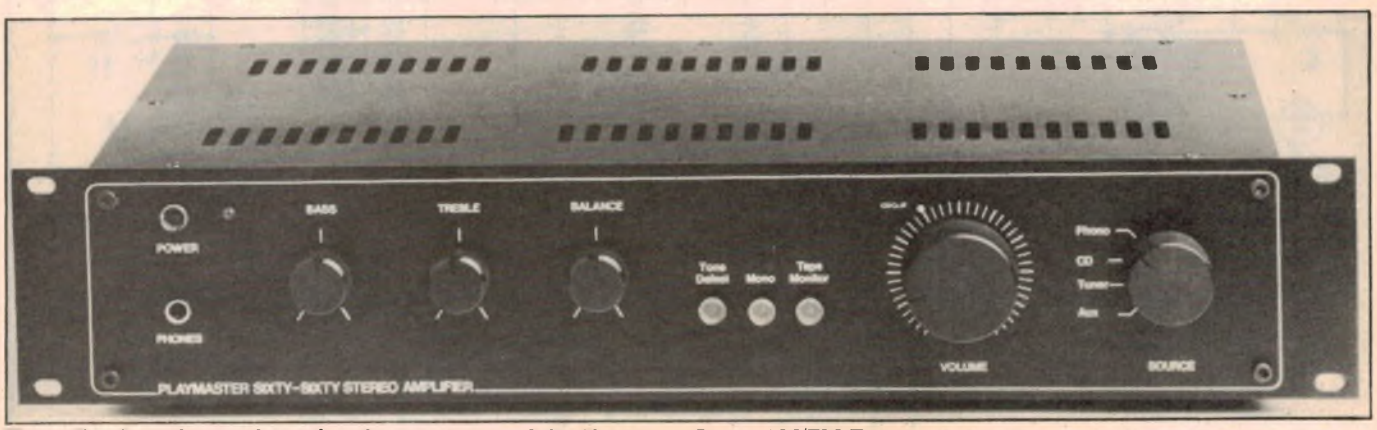
If one of the amplifier outputs develops a negative DC voltage of more than 2V, Q17 will be forward biased. This turns on Q18 and removes bias from Q20. Q21 is switched off, de-energising the relay. This disconnects the loudspeakers.

Similarly, if a positive DC voltage of more than 2V occurs at the output of one of the power amplifiers, then Q19 will be forward biased. Again this removes bias from Q20 and the relay switches off as a result.

Initial muting

When power is first applied to the protection circuit, at switch-on, the 15V supply is immediately available to Q21. However, Q20 is unable to turn on since the supply for the base current via the 56kΩ resistor is initially at ground potential. The 100μF capacitor then charges via the 270kΩ resistor and, after about three seconds, Q20 turns on. This switches on the relay via Q21.

Note that the relay is connected to the ground supply rail via the headphone socket switch. Whenever the headphone plug is inserted into this socket, the relay is disabled and the speakers are disconnected. This avoids



The styling is modern and matches the appearance of the Playmaster Stereo AM/FM Tuner.

the need for a separate switch to disconnect the speakers.

The second contact of the changeover switch then connects a 560Ω 1W resistor across the +15V supply. This resistor is used to load the +15V supply rail when the relay is not connected and thus gives the same rate of discharge of the supply rail after switch-off. This is important to avoid switch-off thumps.

Headphone protection

The headphone circuit itself is permanently connected to the amplifier outputs and so the headphones are ostensibly not protected from large DC faults. However, they are effectively protected from overdrive or DC faults by virtue of the series 330Ω resistor and 22μF bipolar capacitor.

The positive supply to the op amps is isolated from the +15V rail using diode D4 and a 1000μF capacitor. This capacitor maintains the positive op amp supply voltage after the power is switched off so that the positive and negative rails to the op amps fall at the same rate.

This is done so that the op amps maintain control of their outputs until the balanced supply rails fall almost to zero. If one of the supply rails falls much faster than the other, the op amps effectively stop working early and "latch up", delivering a large DC pulse to the following stages. The result of this is an audible thump as the amplifier is turned off.

Power supply

As noted last month, the key to the power supply is the 160VA toroidal power transformer which has very low hum radiation. The transformer feeds a centre tapped 70VAC to a bridge rectifier and two 5000μF (2 x 2500μF) filter capacitors. This gives unregulated supplies of ±50V which feed the power amplifiers.

Separate 15VAC windings on the transformer are full wave rectified with bridge-connected 1N4002 diodes and filtered with two 1000μF capacitors to give unregulated supplies of about ±21V. Separate positive and negative three terminal regulators produce the necessary ±15V DC supplies. The 10μF capacitors at the output of the regulators ensure stability and provide improved ripple rejection.

A 2.2kΩ resistor in series with the power on LED connects across the negative 15V supply.

That completes the circuit description. Next month we will describe construction.

"With my HP CAD sail a boat that

Ask Ben Lexcen what his most valuable design tool is and he'll tell you it's his Hewlett-Packard Computer Aided Design system. Here he talks about his experience with the HP system and offers some salient advice to the new generation of designers who will follow in his wake.

Have you always felt at ease working with computers?

"No way! Really I was a latecomer to computers because I didn't have any formal training and I was frightened of them. In fact, I used to dream up some wonderful excuses to avoid getting involved with them.

"But, of course, I realise now that if you're going to be a leader in any field, not just design, you've got to utilise the leading technology. And really this HP stuff is so easy to use, I'm not sure what I was frightened of."

Which parts of a boat do you design with the help of the computer?

"Virtually the whole lot, with the exception of tiny mechanical things. But we use it to design the shape and structure of the boat, and the sails.

"We use it to do all the hydro-dynamic considerations such as the total drag of the hull unit. Plus we use the computer to test different hull shapes."

What aspect of your involvement with Hewlett-Packard strikes you as being particularly beneficial?

"Well, once you become involved with HP, you'll soon realise that apart from their technical excellence and innovation, one of their major strengths is that they have the people to help you get the best results from CAD.

"Because HP supply the hardware and the software, you've got a terrific advantage over the guy who tries to work with a lot of different suppliers. I mean it counts for a lot when the person who writes the software understands the workings of the processor.

"If you've got questions or problems, you can get answers and solutions from the one place. And believe me, that can save a lot of time and worry."

How has the HP equipment assisted in the day-to-day running of your office?

"Well, it's staggering how much faster we can get things done since we plugged into HP. This is mainly due to the fact that the computer does so much of the calculation which we used to labour over manually.

system I can virtually doesn't exist."

"For instance, now I can create the basic shape of a boat in a matter of hours whereas it used to take about a month. It might take me about ten minutes to do a keel whereas before it might have taken a week."

Does saving so much time mean that you have to compromise on quality or accuracy?

"Absolutely not. The equipment is dead accurate and I can do a more thorough job for far fewer man-hours.

"In fact, we are so confident in the HP equipment that when we've settled on the design of the boat to defend the America's Cup, we won't tank test it in Holland, we'll test it here in the computer. And when you're talking about a million dollar boat, you've got to be damn sure you've got the right equipment to do it."

What of CAD in the future?

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Build this low cost project and . . .

Control appliances by telephone

Ring-a-ding! Ting-a-ling, ding-a-ling! This "Phone Controller" lets you dial your home number and switch a mains appliance on or off without paying for the phone call. You can use it to turn on outside lights, a spa or an electric blanket.

by JOHN CLARKE

How often have you been caught out at night and worried that your house was in total darkness? An unlit house is burglar bait, but it's not always convenient, or deemed necessary, to leave a light on when we go out.

Wouldn't it be nice if you could turn on a living-room light or the outside lights simply by dialling your home number? With this nifty little project, you can do just that.

Alternatively, you can use your Phone Controller to turn on any other appliance, so long as its rating does not exceed 2400W. There's simply no need to go home to an unlit house, a cold bed, or a non-bubbling spa.

So how does the Phone Controller work? The concept is really quite straightforward — the device is simply triggered by a preset number of phone rings and switches a relay to turn on the appliance. What's more, the phone call costs nothing since the device only counts the number of phone rings and does not answer the phone.

The accompanying photographs show the neat appearance of the prototype. The circuitry is all housed in a low profile plastic case which can sit under the telephone. At the rear of the unit is a mains outlet socket, while the front panel carries a power switch, a power on indicator LED, and an appliance indicator LED.

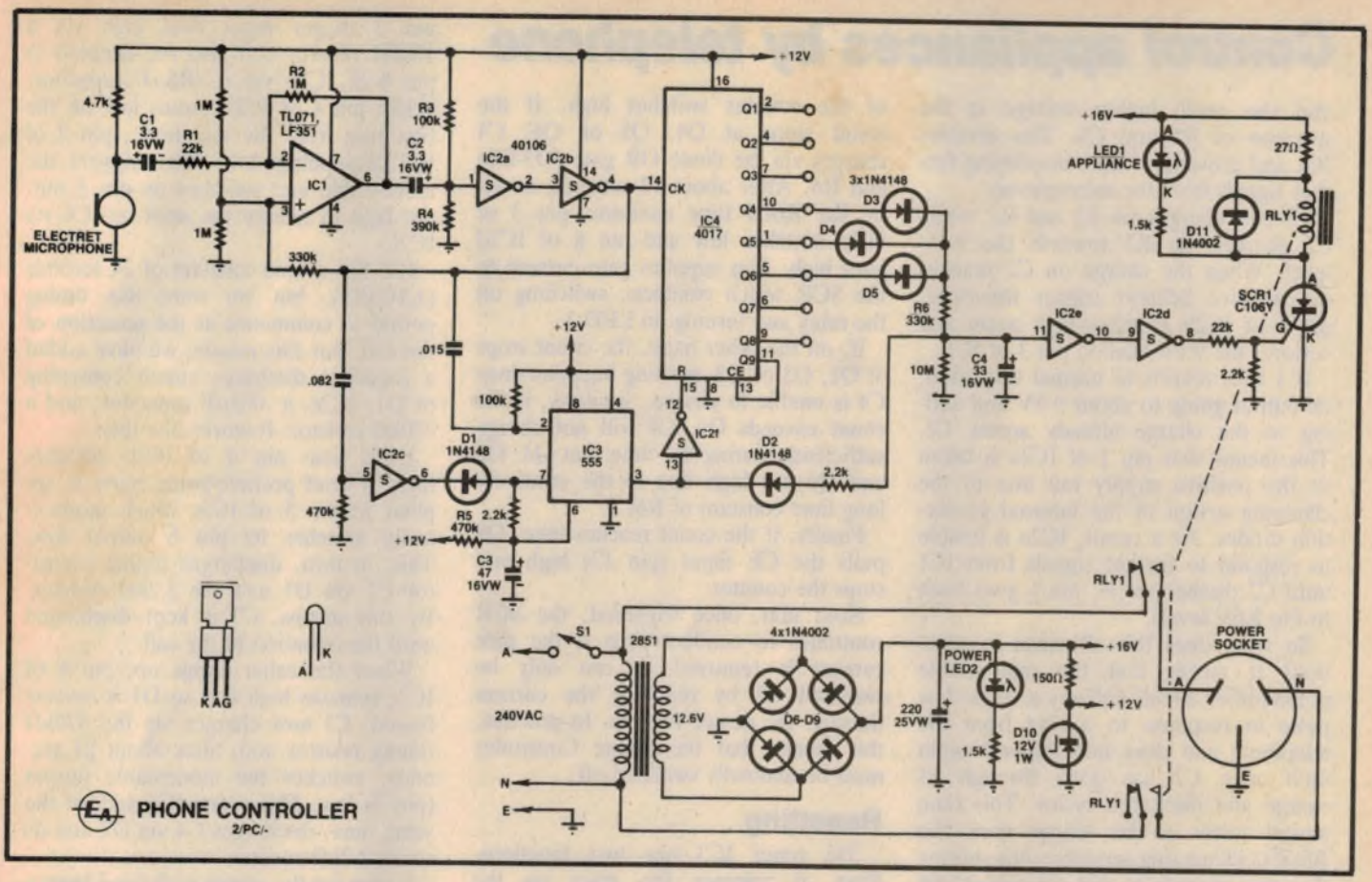
In operation, the appliance is plugged into the rear socket while the Phone Controller is plugged into the mains. An internal microphone listens to the telephone and passes the received ring signal onto a counter circuit. When the correct number of rings is detected, the appliance is switched on.

The Phone Controller is designed to sit underneath the telephone.

However, if the caller hangs up before the unit has counted the correct number of rings, or if the number of rings exceeds the preset number, the call will be ignored. This is to prevent the unit from being false-triggered by other callers.

Design features

It is here that we came to the first problem in designing such a unit. What number of rings should be selected to provide maximum security against false triggering? After much discussion, it was decided that five rings is the optimum number. It is sufficiently long to guard against a wrong number or spurious rings due to crossed lines etc, but



low enough to ensure that a legitimate caller will ring for longer.

As a final refinement, we have designed a plus and minus one ring error into the circuit to ensure reliable triggering. Thus the circuit will trigger on either four rings, five rings or six rings. If readers disagree with our optimum number, the circuit can easily be altered to trigger on another sequence of three numbers between one and eight.

In practice, the Phone Controller provides only low-level security against false triggering. This means that it should only be used with appliances where the repercussions of false triggering are not serious.

Note that the unit is designed to switch an appliance once only. Once the appliance has been switched on, it can only be switched off manually. Alternatively, the Phone Controller can be wired to switch the appliance off instead of on.

How it works

Fig.1 shows the Telecom specification for a telephone ring sequence. It consists of a 400ms long ring pulse, followed by a 200ms pause, another 400ms ring pulse, then a 2s pause, and so on indefinitely. For each 400ms ring pulse, the current is modulated by a 15-27.5Hz tone. It is this current that activates the bell striker within the telephone.

The internal circuitry of the Phone Controller processes the signal picked up by the microphone and produces a single pulse for each 400/200/400ms ring sequence. The resultant pulse train is then fed to a counter circuit. When the correct number of pulses is received, the output of the counter circuit remains high and activates the relay circuit.

Let's take a look at the circuit. It uses four ICs: a TL071 op amp, a 40106 hex Schmitt trigger, a 555 timer and a 4017 decade counter.

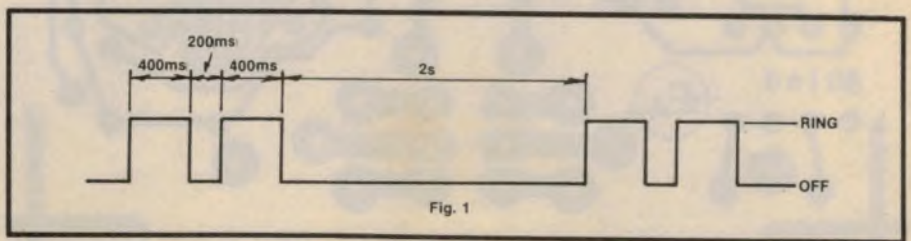
IC1, together with Schmitt triggers IC2a and IC2b, forms the microphone preamplifier. The signal picked up by the microphone is AC coupled to IC1 which is an inverting amplifier with a gain of about 45. Bias for the non-inverting input (pin 3) of IC1 is provided by two 1MΩ resistors and a 330kΩ feedback resistor from the output of IC2b.

The way in which the circuit works is rather devious. Here's what happens:

Initially, under no signal conditions, the output of IC2b is high and this biases pin 3 of IC1 to about 9.6V as set by the 330kΩ feedback resistor and the two 1MΩ resistors. Thus, pin 6 of IC1 will also be at 9.6V, as will the voltage on pin 1 of IC2a due to R3 and R4. Thus, C2 is initially discharged.

When a ring signal is subsequently received, the output of IC1 pulses low and this low signal is coupled, via C2, to pin 1 of IC2a. Pin 2 of IC2a thus switches high, while pin 4 of IC2b switches low and pulls pin 3 of IC1 to about 3V.

The output of IC1 now goes to ground due to the low voltage at pin 3



This timing diagram shows the standard telephone ring sequence.

Control appliances by telephone

and the much higher voltage at the junction of R1 and C1. This disables IC1 and prevents it from amplifying further signals from the microphone.

C1 now charges via R1 and R2, while C2 charges via R3 towards the 9.6V level. When the charge on C2 reaches the positive Schmitt trigger threshold, pin 4 of IC2b switches high again and restores the 9.6V bias on pin 3 of IC1.

IC1 thus reverts to normal operation, its output going to about 9.6V and adding to the charge already across C2. This means that pin 1 of IC2a is taken to the positive supply rail due to the clamping action of the internal protection diodes. As a result, IC2a is unable to respond to further signals from IC1 until C2 discharges (ie, pin 1 goes back to the 9.6V level).

So what does this all mean in practice? It means that the microphone preamplifier circuit delivers a single low pulse in response to a ring from the telephone and does not respond again until after C2 has gone through its charge and discharge cycles. This time period needs to be longer than the 400/200/400ms ring sequence but shorter than two seconds so that the circuit can respond to the next ring sequence.

We have set this time to about 1.2 seconds.

The output of IC2b clocks decade counter IC4. As each positive going clock signal is received, the next output of the counter switches high. If the count stops at Q4, Q5 or Q6, C4 charges via the diode OR gate (D3-D5) and R6. After about 12 seconds, as set by the R6C4 time constant, pin 3 of IC2e switches low and pin 8 of IC2d goes high. This supplies gate current to the SCR which conducts, switching on the relay and turning on LED 1.

If, on the other hand, the count stops at Q1, Q2 or Q3, nothing happens since C4 is unable to charge. Similarly, if the count exceeds Q6, C4 will not charge sufficiently during the time that Q4, Q5 and Q6 are high due to the relatively long time constant of R6C4.

Finally, if the count reaches nine, Q9 pulls the CE input (pin 13) high and stops the counter.

Note that, once triggered, the SCR continues to conduct even if the gate current is removed. It can only be switched off by reducing the current through the device to zero. In practice, this means that the Phone Controller must be manually switched off.

Resetting

555 timer IC3 has two functions. First, it releases the reset on the counter when the first ring is detected so that it can begin counting. Second, it rearms the circuit some 24 seconds after the last phone call so that it cannot be disabled by other callers.

IC3 is wired as a monostable with its pin 2 trigger input held high via a 100kΩ resistor and also AC-coupled to pin 4 of IC2b via a .015μF capacitor. When pin 4 of IC2b pulses low on the first ring from the telephone, pin 2 of IC3 also pulses low. This triggers the monostable and switches its pin 3 output high to release the reset on IC4 via IC2f.

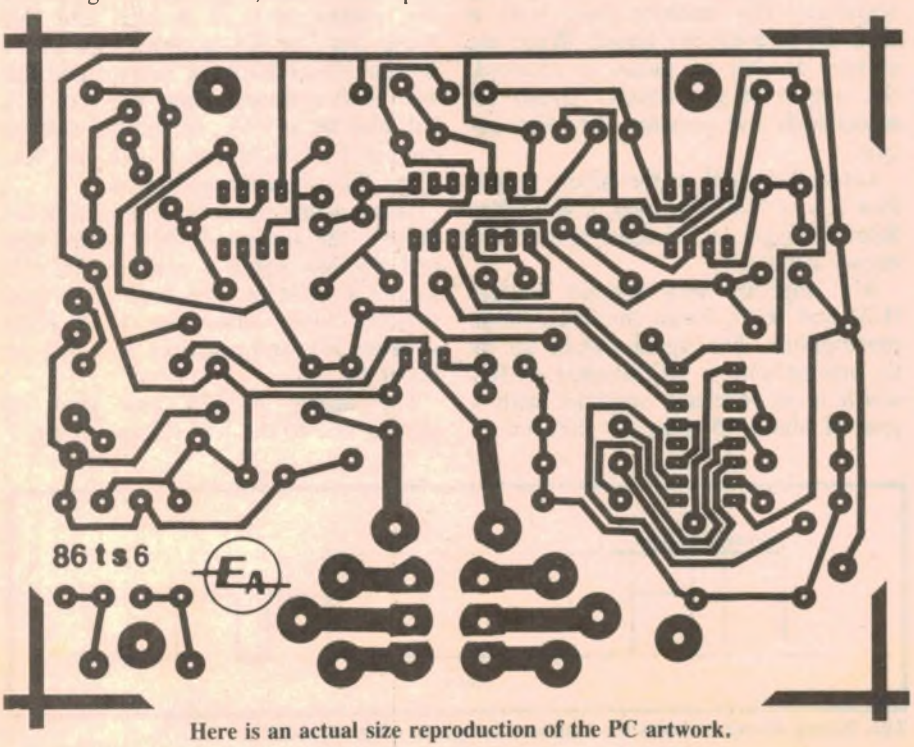
IC3 has a time constant of 24 seconds (1.1C3R5), but we want this timing period to commence at the cessation of the call. For this reason, we have added a capacitor discharge circuit consisting of D1, IC2c, a .082μF capacitor, and a 470kΩ resistor. It works like this:

Each time pin 4 of IC2b switches high, a brief positive-going pulse is applied to pin 5 of IC2c which momentarily switches its pin 6 output low. This, in turn, discharges timing capacitor C3 via D1 and the 2.2kΩ resistor. By this means, C3 is kept discharged until the cessation of the call.

When the caller hangs up, pin 6 of IC2c remains high and so D1 is reverse biased. C3 now charges via the 470kΩ timing resistor and, after about 24 seconds, switches the monostable output (pin 3) low. This resets IC4 and, at the same time, discharges C4 via D2 and its series 2.2kΩ resistor.

Power for the circuit is derived from a small mains transformer which drives a bridge rectifier circuit (D6-D9) and a 220μF filter capacitor. This produces an unregulated supply rail of about +16V which is used to power the SCR and relay circuitry.

Zener diode D10 is used to derive a +12V regulated rail to power the ICs. This is necessary to ensure that the maximum voltage rating of the ICs (16V) is not exceeded. LED 2 and its associated 1.5kΩ current limiting resistor provide power-on indication, while two-pole relay RLY1 switches the active and neutral lines to the mains socket.



Here is an actual size reproduction of the PC artwork.

Construction

Most of the parts are accommodated on a small PCB coded 86ts6 and measuring 110 x 87mm. This is housed in a UB11 plastic case measuring 185 x 125 x 50 mm and distributed by Arista Electronics Pty Ltd. A Scotchcal adhesive label was used to give the completed project a professional appearance.

Begin assembly of the PCB by installing PC stakes at all external wiring points, except for the four mains connections adjacent to the relay. This done, the remaining parts can be installed on the PCB according to the wiring diagram. No special procedure need

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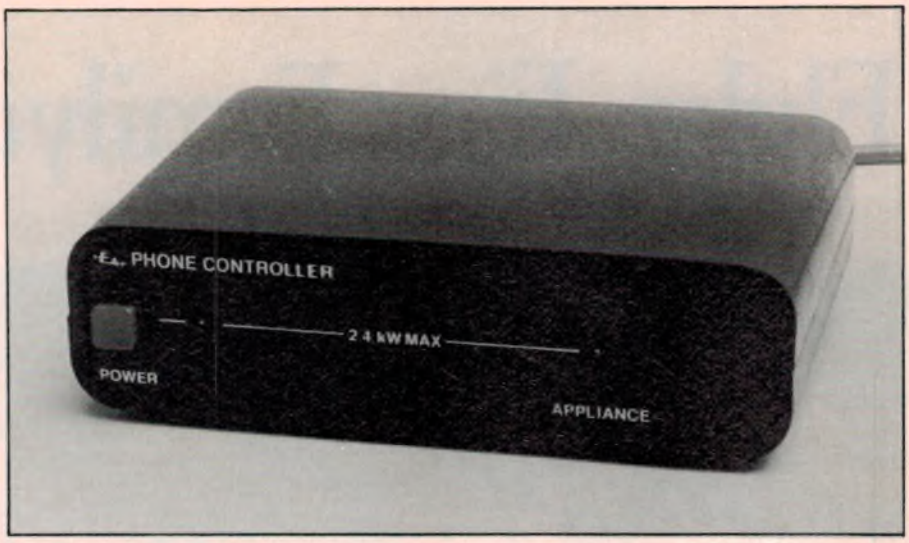


The Phone Controller can switch appliances rated up to 2.4kW.

Control appliances by telephone

be followed here although we suggest that the smaller parts be installed first.

Note carefully the orientation of the diodes, ICs, SCR and electrolytic capacitors when they are being installed. We installed D3, D4 and D5 at the Q4, Q5 and Q6 outputs of IC4, but readers can install these in other positions if they wish.

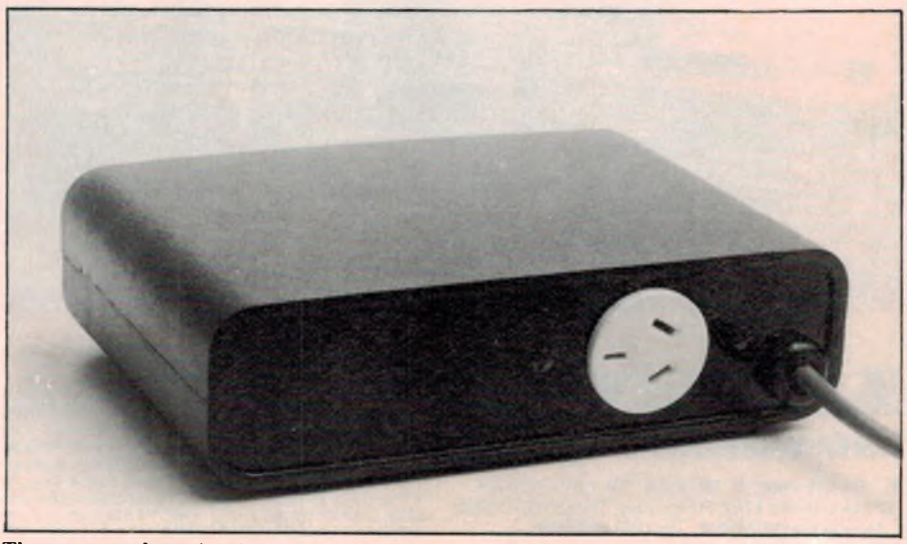
For example, you may decide that seven rings is the number that best suits your particular application. In this case, D3, D4 and D5 should be installed at the Q6, Q7 and Q8 outputs respectively of IC4. There are additional holes on the PCB to provide for this.

The electret microphone is supported on the PCB using two PC stakes. Note that it must be correctly oriented. The earth pin is the one that is connected to the case.

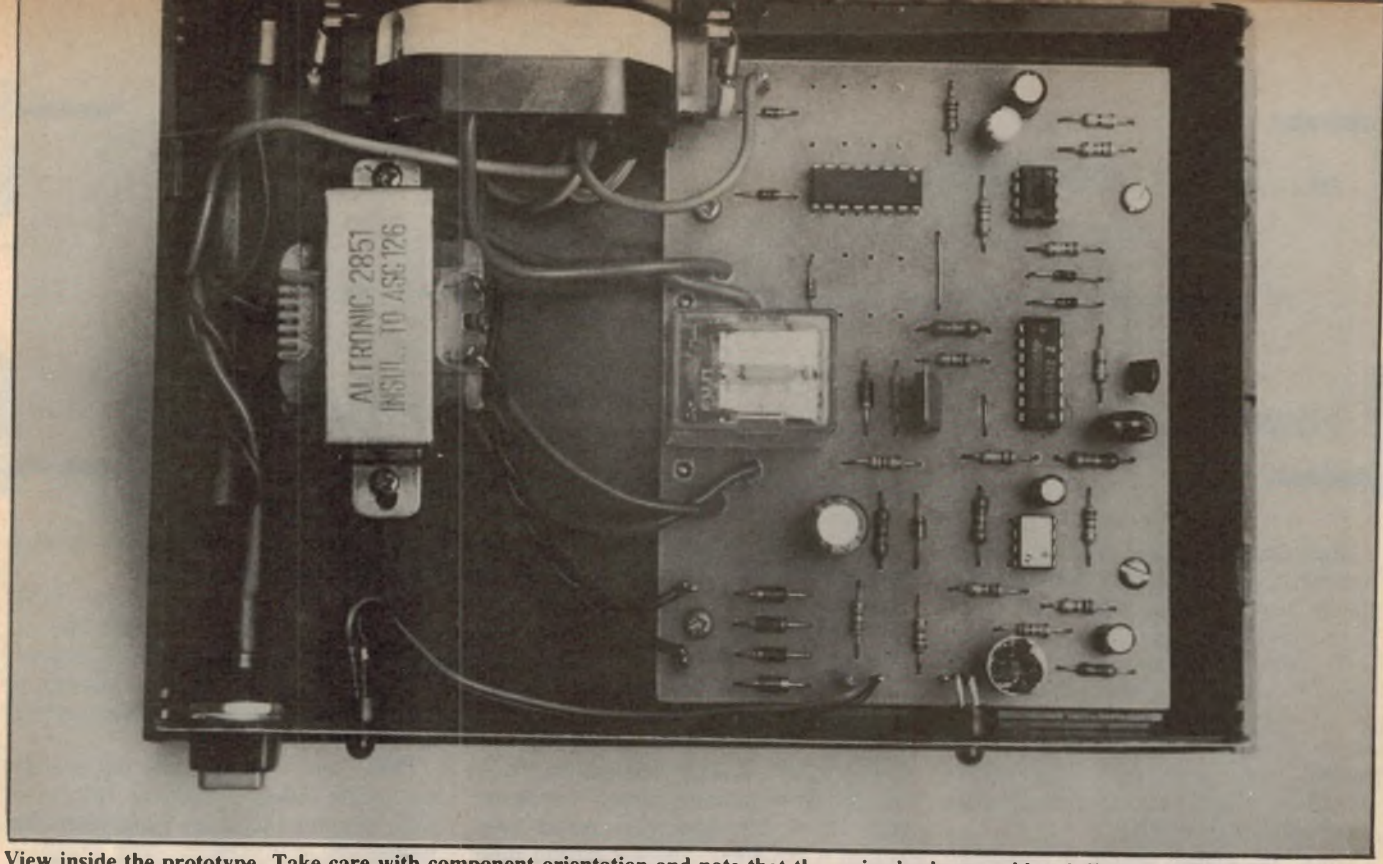
When the PCB has been completed, attention can be turned to the plastic case. Temporarily position the PCB in the case, then mark out and drill holes for the cord clamp grommet and mains outlet socket. The large hole for the mains outlet socket can be made by drilling a series of smaller holes around the inside perimeter of the marked circle, and then filing the cutout to a smooth shape.

The Scotchcal label can now be carefully affixed to the front panel and used as a drilling template. You will have to drill three holes in this panel — one each for the power and indicator LEDs, and one for the power switch.

This done, the various items of hardware can be installed in the case and



The rear panel carries the mains outlet socket and cord clamp grommet.



View inside the prototype. Take care with component orientation and note that the mains leads are soldered directly to the PCB.

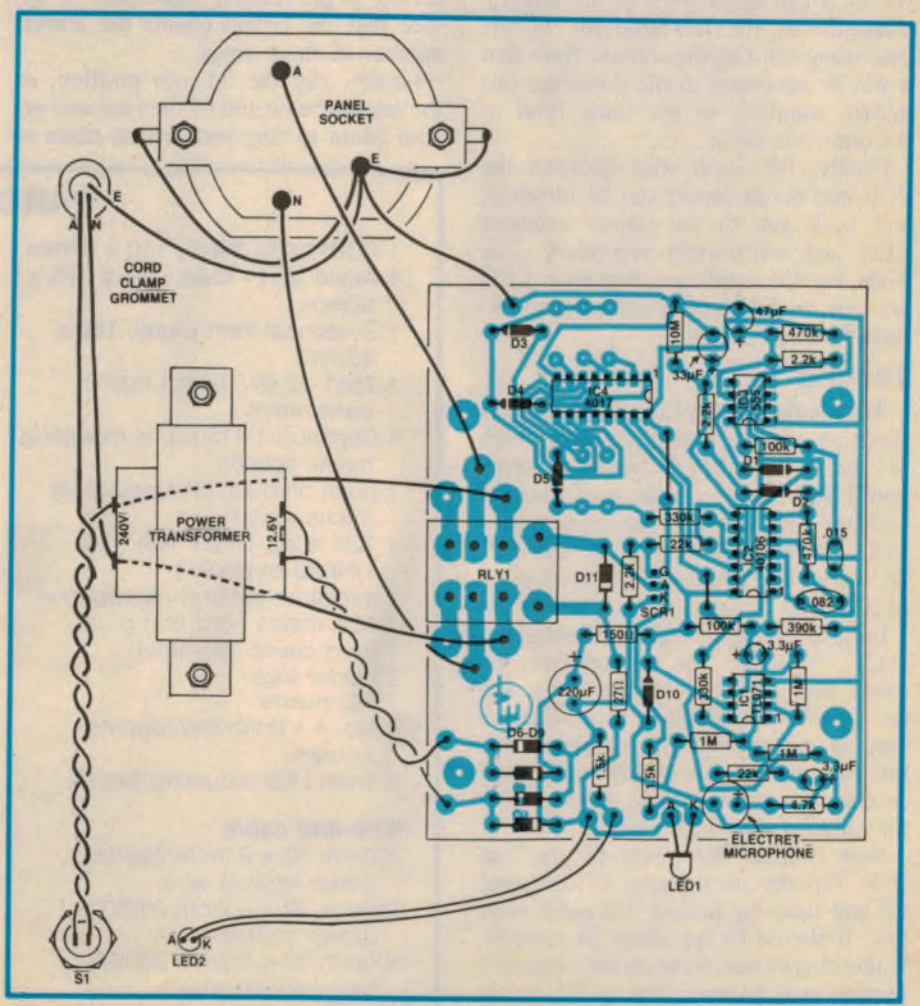
the two LEDs installed using LED mounting bezels. The transformer is mounted on two integral plastic stand-offs and secured using self-tapping screws.

All that remains now is to complete the wiring. Note that mains-rated cable must be used for all wiring, except for the wiring to the power LED and to the transformer secondary.

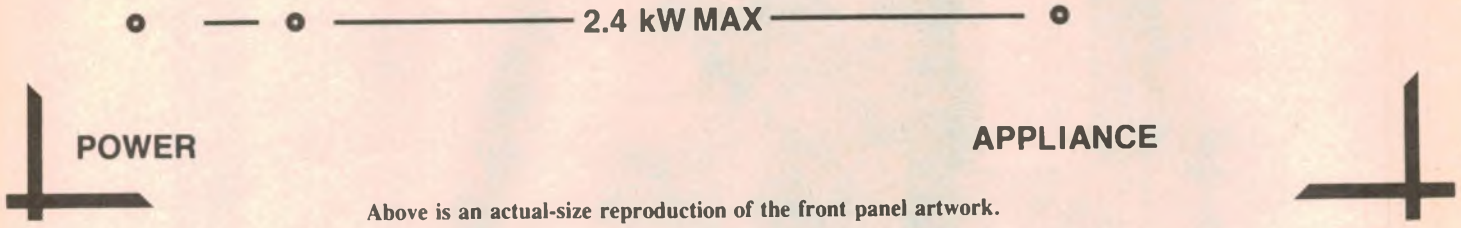
Strip back the outer insulation on the mains cord so that the individual wires are long enough to reach the mains switch from the rear panel, then secure the mains cord using the cord clamp grommet. Solder the active (brown) lead to the mains switch and the neutral (blue) lead to one side of the transformer primary. The earth lead (green/yellow) goes directly to the earth terminal on the mains outlet socket.

Leave the earth lead longer than necessary to ensure that, if the cord does slip out of the grommet, it is the active lead to the mains switch that comes adrift first. It is a good idea to insulate the terminals on the mains switch to prevent accidental contact with the mains.

We also suggest that you earth the mounting screws for the mains socket, as it is possible for these to come in contact with a loose mains wire. Install an earth lug under each of the mounting screws and run the leads from them to the earth terminal on the mains socket.



Above: parts layout and wiring diagram for the Phone Controller.



Above is an actual-size reproduction of the front panel artwork.

Note that the mains wires from the transformer and mains outlet socket should be soldered directly to the PCB. Do not use PC stakes.

The wiring diagram shows how the circuit is wired to switch an appliance on. If you want to use the circuit to switch an appliance off, the active and neutral leads from the outlet socket should be transferred to the adjacent spare pads on the PCB.

Once the mains wiring is complete, the PCB can be secured to the integral standoffs on the left-hand-side of the case using self-tapping screws. Note that it will be necessary to file down the two middle standoffs to the same level as the outer standoffs.

Finally, the earth wire between the PCB and mains socket can be installed, and leads run to the power indicator LED and transformer secondary. The leads for the appliance indicator LED are bent at right angles and soldered directly to two PC stakes.

Testing

Testing the Phone Controller involves checking out the time periods for each of the time related circuits. Apply power and check that the power supply voltages are correct. Assuming all is well, set your multimeter to the 20V DC range and connect it between pin 4 of IC2b and ground.

Initially, the meter should read about +12V. Now tap the microphone and check that the pin 4 output goes low (ie, to 0V) for about a second. Keep tapping the microphone to check that the output does not go low again until another 1.2 seconds have elapsed after the output swings high again.

Now connect the meter to pin 3 of IC3. Tap the microphone to discharge C3 and time the period that pin 3 stays low. It should be for about 24 seconds. If this checks out, temporarily connect a jumper lead between the +12V supply and the D3, D4 and D5 (cathode) side of R6. Measure the time it takes for the relay to pull in — it should be longer than nine seconds but less than the IC3 time period (preferably about 12 seconds).

Don't forget to remove the jumper lead after this step.

If any of the above time periods are too short or too long, change the value of the corresponding timing capacitor (C2, C3 or C4) until the correct time period is obtained. The 1.2 second time period is particularly important to ensure that the circuit counts the correct number of phone rings.

Finally, clip the lid into position, sit the telephone on top of the case and get your Mum to ring you several times so that you can check the circuit operation for various numbers of rings.

Alternatively, if you want to be really smart, dial 199 and hang up. The exchange will then ring you back automatically. You can control the number of rings simply by picking up the receiver at the appropriate time.

Make sure that you pick the receiver up quietly though, otherwise the circuit will interpret the noise as another ring pulse.

Finally, note that the circuit may not respond correctly unless the bell volume is turned up to somewhere near maximum. The bell volume is adjusted by means of a small knurled knob located on the underside of the receiver.

PARTS LIST

1 PCB, code 86ts6, 110 x 87mm
1 Arista UB11 case, 185 x 125 x 50mm
1 Scotchcal front panel, 180 x 45mm
1 2851 12.6V 150mA mains transformer
1 Clipsal S/1/415 panel mounting mains socket
1 push on/push off single pole mains switch
1 12V relay, DPDT 10A (Fuji HH62B or equiv.)
1 miniature electret microphone
1 10A mains cord and plug
1 cord clamp grommet
2 solder lugs
7 PC stakes
6 No. 4 x 6mm self-tapping screws
2 5mm LED mounting bezels

Wire and cable

300mm 32 x 0.2mm 250VAC green hookup wire
300mm 32 x 0.2mm 250VAC brown hookup wire
300mm 32 x 0.2mm 250VAC blue hookup wire
500mm 12 x 0.12mm hookup wire
50mm 0.5mm tinned copper wire

Semiconductors

1 TL071, LF351 JFET input op amp
1 555 timer
1 4017 decade counter
1 40106 hex Schmitt trigger
1 C106Y SCR
5 IN4002 1A diodes
5 IN4148, IN914 diodes
1 12V 1W zener diode
1 5mm red LED
1 5mm green LED

Capacitors

1 220μF 25VW PC electrolytic
1 47μF 16VW PC electrolytic
1 33μF 16VW PC electrolytic
2 3.3μF 16VW PC electrolytics
1 .082μF metallised polyester
1 .015μF metallised polyester

Resistors (1/4W, 5%)

1 x 10MΩ, 3 x 1MΩ, 2 x 470kΩ, 1 x 390kΩ, 2 x 330kΩ, 2 x 100kΩ, 2 x 22kΩ, 1 x 4.7kΩ, 3 x 2.2kΩ, 2 x 1.5kΩ, 1 x 150Ω, 1 x 27Ω.

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NEW FOR '86

$699

Suitable for use with longwire or backstay antennae etc. for maximum range

Say goodbye to all those antenna matching hassles, once and for all! The Stingray Antenna Matching Unit can match your transceiver to any antenna without fuss or bother. Why waste time adjusting equipment when you can be out there having a good time?

You'll get maximum performance from your transceiver. Operates over the 2-30MHz range. Get the most from your transceiver — your safety depends on it! Cat D-1412

Stingray Noise Blanker/Mute Card

Accessory for Stingray HF Marine radio. Effectively reduces annoying background noise. Easily plugs into transceiver. Cat D-1414

$199

See DSE for all your Amateur Radio, Marine and Communication needs.

Stingray Loaded Whip Antenna

2182KHz loaded whip that puts a 'sting' into marine communications. Operates on the international marine distress frequency. Cat D-1418

IDEAL BACKUP ANTENNA

$199

Yaesu FRG9600 VHF/UHF Receiver

The FRG-9600 is a scanning receiver capable of covering the **complete** 60 to 905MHz VHF/UHF spectrum. But even more than that, the FRG-9600 is **all mode** — FM, AM, CW, SSB... the lot. At the touch of a button, it opens up an exciting world of communication. Tune into FM-Wide for standard FM and TV station sound transmissions. FM-Narrow is your passport to the arena of two way communication — emergency services, business, military and amateur radio. Other amateur bands plus aircraft bands are accessible through the AM & SSB modes. (SSB covers up to 460MHz). And if that's not enough, the FRG-9600 even covers the new ASCB mode which is becoming increasingly used by the military and looks like becoming firmly established in VHF/UHF as well.

$849

Cat D-2825

AM/FM/CB/SW/VHF

Top value for the avid radio listener — or the boat owner who wants to know just where he is! This quality radio receiver has a built-in radio direction finder to pinpoint your position against AM radio stations. Plus you get 6 bands including all 40 CB channels plus shortwave AND VHF! Can even double as a PA amplifier with optional microphone!

Cat D-2832

$129

'Sangean' Multiband Radio

Sangean is a respected name amongst enthusiasts. And when you see its ATS-803, you'll understand why! It's a great combination of listening excitement : local AM/FM plus LW/MW/SW. And it boasts state of the art features.

150kHz to 30MHz in 12 bands.

Cat D-2831

$349

Sangean 10 Band Radio

Here's a great little 10 band portable at a fantastic value for money price! At 160 × 76 × 28mm it's small enough to carry with you to the beach, football, work — anywhere! With AM/FM, 8 shortwave bands, built-in antenna, carry cord, slide band selectors and much more!

$79

Cat D-2834

Air Band VHF Radio & AM/FM!

You've probably wondered what goes on, what pilots and air traffic controllers talk to each other about... Wonder no more! This budget aircraft band radio tunes the entire band, so you don't miss a thing.

Cat D-2836

$29.50

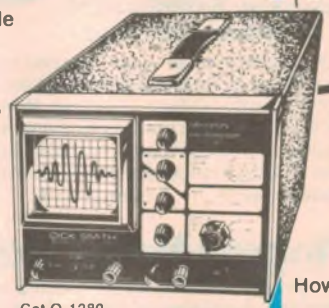
DICK SMITH ELECTRONICS HAS THE MOST COMPREHENSIVE RANGE OF TEST EQUIPMENT TO SUIT EVERYONE'S NEEDS

LAST YEAR'S PRICES ON TEST EQUIPMENT!!

6.5MHz HOBBYIST'S CRO

Every hobbyist knows how valuable a good oscilloscope is: probably the most useful piece of test gear you can own. At last, we've been able to obtain a new 6.5MHz CRO, at a bargain price.
Here's what it offers:

- **Retrace blanking for a much clearer display**
- **10mV per division verticle sensitivity**
- **500mV per division horizontal sensitivity**
- **10Hz to 100kHz timebase (in 4 ranges)**
- **Internal or external sync**
- **And a usable response to beyond 6.5MHz**



Cat Q-1280 **$299**

Power SWR/Meter	Q-1340	**$139.00**
Battery lamp and fuse tester	Q-1525	**$13.75**
PWR/SWR Meter 27MHz	Q-1350	**$24.75**
IC test clip leads	W-4509	**$3.95**
4mm plug test lead sets	W-4508	**$2.95**
1.5mm plug test lead set	W-4504	**$2.50**
Mini alligator clips (red/black)	W-4550/2	**.30**

NEW PRODUCTS FOR '86

Personal LCD with auto ranging DMM	Q-1555	**$49.95**
3.5 digit with memory DMM	Q-1515	**$89.50**
Bench Meter VDC	Q-2140	**$29.95**
Bench Meter ADC	Q-2130	**$29.95**
Digital LUX Meter	Q-1400	**$149.00**
Universal test lead set	W-4523	**$4.95**

Double Power Point

Replace old single outlets with a double: much more convenient! Cat P-5560

$8.95

Double Adaptor

Standard 3 pin AC plug into 2AC sockets enabling you to use 2 appliances on one outlet. Cat P-5440

$2.75

DICK SMITH ELECTRONICS PTY LTD

"LOONEY

Digital Blood Pressure Meter

(Sphygmomanometer)

Medical authorities will tell you that blood pressure is one of the first indications of a problem (notice how the doc always takes your blood pressure?) Now keeping a check of your own blood pressure is as easy as checking your weight — and you don't have to be a medico whiz to work it all out! Measures both blood pressure and pulse (ie checks to see if you're still alive!) with ranges of 20-280mm Hg (pressure) and 40-200 per minute (pulse). Cat Y-5010

$99

Digital SHARP Thermometer

Take temperatures the modern way with a quality Sharp thermometer. The kids won't mind having their temperatures taken and the 3.5 digit display provides a more accurate reading at a glance. Features automatic battery cut-off when inadvertently left on. Comes with its own clear protective case and full instructions. Cat Y-5000

BARGAIN! $16.95

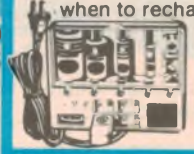
Walk-A-Jog Meter

How far do you go? Now you'll know! The Walk-A-Jog tells you how far you've walked or jogged. This compact device clips to your belt and measures your footsteps. Now you can plan your health program accurately! Set yourself a limit and you'll know when you can sit down to rest. Cat Y-5020

$29.95

NiCad Battery Charger

You'll never go flat again! Or your batteries either. Universal design for all popular battery sizes. PLUS it checks battery strength so you know when to recharge before you run down. Cat M-9518



ONLY $29.50

Charger Plug Pack

What a great idea! Two part charger consists of plug pack and separate snap-on battery holder. Charges four penlight 'AA' NiCads easily and simply. Cat M-9520

VALUE $10.95

New Tools for 1986. Dick Smith

Mini 15W Soldering Iron

$14.95

The perfect iron for hobbyists and enthusiasts... at an ideal price! Miniature size and ligtweight. Suits soldering jobs involving semis and delicate work. Cat T-1333

Desoldering Iron

$69

A 'must' for any serviceman's or hobbyist's took kit! A self-contained, fully portable 240V, 30W desoldering tool that operates quickly and efficiently. Cat T-1340

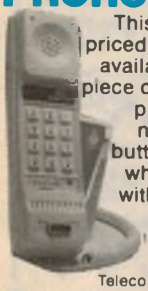
JUNE" CRAZY MID YEAR BARGAINS!

Cordless Phone

Cordless phones are practical and convenient! Take the remote handset with you, indoor and out, ready for any call: effective up to 100m. Handset features modern push button dialling, redial, mute and volume control. Built-in NiCad batteries automatically re-charge themselves while the handset rests on the base-station cradle. The base-station itself simply plugs into any power point and existing phone connection. Features 'power on' and 'in use' LED indicators, full duplex system for interference free conversations and programmable security to prevent unauthorized handset use. Cat F-5816
Telecom Australia Authorisation No. C85/35/109

VALUE $249

DSE Economy Phone



This is probably the lowest priced, feature packed phone available. The attractive one piece design features modern push button dialling, last number redial and mute button for absolute privacy when discussing a matter with someone in the same room.

$19.95 Cat F-5185

Telecom Authorisation No. C82/30/5

Deluxe Slim Line Clock/ Phone

NEW FOR '86

Due Soon!

Cat F-5175

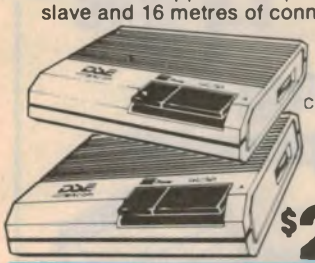
This superb phone features last number redial and mute privacy buttons plus a ringer on/off switch. The full featured alarm clock boasts 24 hour alarm setting, snooze button, night back light plus all time/alarm setting controls.

Telecom Authorisation No. C82/30/25

$44.95

Two Station Intercom

A highly efficient 2 station intercom that is fully transistorised and can be used over any distance up to 160 metres. Master unit has volume control and is supplied complete with slave and 16 metres of connecting cable.



Cat F-1025

$24.95

3 Ch. Wireless FM Intercom

Superb 2 station intercom — capable of receiving up to 6 stations — uses modern FM technology for simple power point operation: no messy wiring problems! Ideal for office, factory and home... Cat F-1013

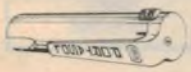
$79.95

Electronics, The Constructors Friend.

Refillable 'Butane' Soldering Iron

Variable 10W-60W

Uses refillable 'butane' — the type used in ordinary cigarette lighters. Provides an amazing 60 minutes continuous use at a full 60 watts.



$69.50

Economy Stainless Steel Tools

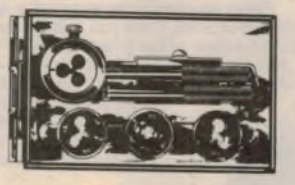
Curved Needle Pliers	T-3251	$9.95
Straight Needle Pliers	T-3252	$9.95
Flat Nose Pliers	T-3253	$9.95
Flush Cutters	T-3254	$9.95

LAST YEAR'S PRICES ON KITS • KITS • KITS

VCR Sound Processor	K-3422	$49.95
Glass RTTY for VZ200/300	K-6318	$69.50
70cm Amateur Transceiver	K-6300	$199.00
Microwave Leakage Detector	K-3095	$14.95
Video Modulator	K-6043	$9.95
Reflector	K-6016	$5.50
TV Patter Generator (lower than '85)	K-3472	$29.95
Playmaster Mosfet Amplifier	K-3515	$199.00
LED Level Meter	K-3370	$16.50
20 Watt Amp	K-3445	$14.50

• TOOLS • TOOLS • AT LAST YEAR'S PRICES

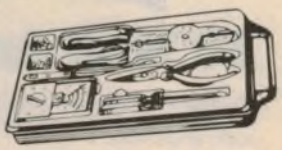
Die set	T-4905	$29.50
Tap set	T-4910	$17.95
High speed mini drill kit	T-4751	$26.95
PVC tape	N-1362	$1.00



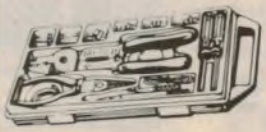
38 Piece Deluxe Repair Kit

Everything for quick and easy wiring repairs — with no soldering! Ideal for automotive and hobby use. Includes multimeter.

Cat T-4832 $34.95



68 Piece Multipurpose Repair Kit



Already own a multimeter? This set has everything else — and then some! Auto electric checker (6-12-24V), heavy duty pliers, crimp terminal set...with 60 assorted crimp lugs, insulation tape, even connecting wire!

$19.95 Cat T-4834

DICK SMITH ELECTRONICS PTY LTD

"LOONEY JUNE"

Mosfet Amp Kit

Build-it-yourself and save $$$! Respectable 45W per channel output delivers mind blowing sound. All components are on a single PC board. Features sturdy chassis, heatsinking PLUS integral speaker protection. Frequency response: 30-20KHz/1dB RIAA. Sensitivity: 2mV phono, 190mV high level. THD: 0.2% full power, 0.05% normal.

Features:
- LED input indicator
- loudness control
- muting control
- speaker switching
- stereo/mono switch
- tape monitor switch

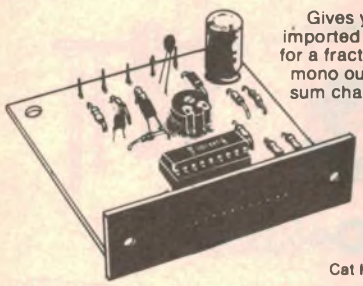
As described in EA
Cat K-3515

LAST YEAR'S PRICE

WHILE STOCKS LAST

$199

LED Level Meter



Gives your amp the expensive look of imported units... but you build it yourself for a fraction of the price! Displays either mono output, one stereo channel or the sum channel outputs. Or build two for a true stereo level meter.
- 10 green LED displays
- 2 red LEDS for max. power and overload indication.

Cat K-3370

$16.50

20 Watt Amp

Handy general purpose amp. Use it for virtually any project or for learning how audio amps work.

- Input impedance: 100K ohm
- Output impedance: max 4 ohms
- Signal to noise: +58dB/1W
- Frequency response: -3dB at 45Hz and 68KHz
- Supply voltage (power): 20V (6.6W), 30V (12W), 35V (19W)

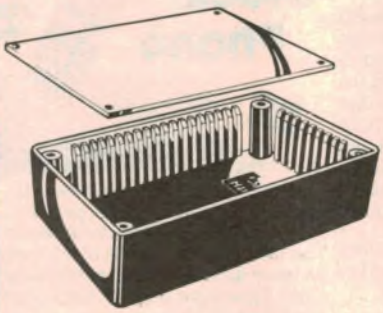
Cat K-3445

$14.50

DSE Zippy Boxes

There is only one genuine 'Zippy' box — the one with the all round deep ribbing. Don't be fooled by inferior copies — this is the one used by the major electronics magazines because of its versatility. Insist on the one and only — genuine — Zippy Box which comes complete with both aluminium and plastic lids.

More projects are built in genuine DSE 'Zippy Boxes' than any other case. And the reason is simple: they're so versatile! From the tough moulded case with its deep ribbed sides, to the close fitting aluminium lid with screws supplied — for ease of use and versatility you cannot beat a genuine Zippy box. The ribbed sides are ideal for mounting PCB's without worrying about screws — and the PCB can be mounted either lengthwise or across the box. These are the boxes used by beginners in the Funway into Electronics projects — and thousands of other projects.



Small - UB5 (28 x 54 x 83mm) Cat H-2855
$1.95 (10 up **$1.75**)

Medium - UB3 (41 x 68 x 130mm) Cat H-2853
$2.75 (10 up **$2.45**)

Large - UB1 (50 x 90 x 150mm) Cat H-2851
$3.25 (10 up **$2.90**)

Giant - UB2 (60 x 113 x 196mm) Cat H-2852
$4.50 (10 up **$4.10**)

Bread Board

Ideal work bench companion for prototyping, experiments and temporary circuits. Features 128 groups of 5 TIE points 8 BUS of 25 TIE points and 3-pc.. binding posts. Nickel reduces oxidization. Measures 122x195x22mm, weighs 275g.

Cat P-4617

$18.95

Plus we're holding the price on these popular hobbyists lines...

Diecast Aluminium Boxes

Affordable precision-made boxes with channeled walls for easy PCB mounting. Ideal for RF circuits too! And nothing better withstands heat: up to 600 degrees C. Two sizes:

150x50x80mm. **$10.50** Cat H-2206

100x25x50mm. **$5.50** Cat H-2221

Aluminium Boxes

Ideal for those weekend projects. Two piece sliding box comes with holding screws.

127x102x76mm. **$4.25** Cat H-2320

133x76x54mm. **$3.75** Cat H-2325

DICK SMITH ELECTRONICS PTY LTD

B 178/BB

"LOONEY JUNE"

FT757GX "The Radio"

Cat D-2940

$1495

...'without modesty, the best transceiver'

That's what Amateur Radio Action magazine said about the FT757GX when it was released. When you look at the outstanding specifications of the FT757GX, then look at its size, you'll wonder how Yaesu managed to pack it all into the case. Here's what it offers you:

• All mode AND all WARC HF bands built-in (nothing extra to buy) • 100 watts continuous output power (SSB/CW/FM) • Two VFO's, 8 memories, with complete control • Triple conversion receiver covering full 0.5 to 30MHz • 0.25uV sensitivity (SSB) • Yaesu's famous IF shift/width passband control system • Duct flow forced air cooling • 4-bit microprocessor built-in • IAMBIC electronic keyer circuit built-in.

Yaesu's 2m/70cm FT-2700RH

Cat D-3515

The FT-2700RH is a suberbly designed unit with a host of impressive features. Enjoy Yaesu's renowned programmable memory scan. 10 memory channels. Priority scan. Dual independant front ends, local synthesizers, IFs and transmitter RF stages. Full duplex crossbanding — it's child's play. More and more amateurs are adopting the adage: that 'two bands are better than one'! And with the superb FT-2700RH the enthusiast can enjoy the old favourite 2m and the large, uncrowded 70cm bands.

• 25 watts continuous on both bands
• Two 4-bit CPUs for complete control
• Wide anlge LCD display
• Includes scanning microphone and mobile mounting bracket

$1095

2m Mobile FT-270RH

Not just one, but two microprocessors to do everything for you except make coffee (they're working on that one!) That's the new FT-270RH mobile 2m. Absolutely the latest word in flexibility and performance — including 45 watts output! With 10 memories, dual VFO's and incredible scanning facilities, you're ready to take on the two metre pile-up: and win! And this is packed into just 140 x 162 x 40mm: small enough to go anywhere! Features high/low power output (45/5W) so it's just right for the city or the bush!

Cat D-3517

$879

Push button 70cm FT-709R

Absolutely everything that the serious UHF'er could ever want — all in a hand-held! For a start, 10 memories to remember all your favourite repeaters and sked frequencies (covers the full 10MHz 430-440MHz band) with selective scan, priority scan, skip scan, busy or clear scan... band scanning — either full or within (your set) limits... Yaesu's unique Power Saver System: programmable receiver activation to check a selected channel.

Cat D-3509

$399

Tri Band Beam

While stocks last

$399

Cat D-4303

Mini-Multi's MSC33 offers top performance on 10, 15 & 20 metres and its compact design make it ideal where space is a limiting factor. Durable and lightweight for tower installations.

Hi Mound Morse Key

$44.50

Double ball pivot rollers and full adjustment for superb quality code. Contacts for break-in keying included.

Cat D-7104

Universal Mic

Designed especially for AM & SSB transceivers. This economical mic is supplied with a 5-wire (4 lead plus shield) 2 metre lead that can be adapted to any transceiver.

Cat C-1102

$15.95

Deluxe Gutter Mount

At last! A gutter grip that will grip anywhere! If you have a difficult mounting problem, try this one.

Cat D-5100

$13.50

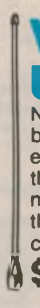
HF Linear Amplifier

Now you can have power and performance without breaking the bank! Our superb broad-band, bi-linear amplifier delivers over 100W with only 4W input. Ideal for mobile or fixed use with three level RF power selection. Includes over-voltage and over-drive protection. Advanced semiconductors and specially wound ferrite transformers permit operation over the full HF band (2-30MHz) without re-tuning.

$499 Cat D-2547

VHF/UHF Antenna Kit

No more wondering 'which one to buy?': this one does the lot! And everything you need is suppplied. All this makes the perfect solution to your mobile antenna problems, whether they're amateur, UHF CB or commercial radio. A complete kit.



$29.95 Cat D-4025

HF Mobile Whips

All are approx. 6 feet (2m) loaded whips with adjustable tuning (no cutting!) and features a heavy duty stainless steel stud mount, RG58C/U coax and PL259 connector.

80 metre. Cat D-4307
40 metre. Cat D-4308
20 metre. Cat D-4309

All **$59.95**

DICK SMITH ELECTRONICS PTY LTD

New for '86 — Improve your Library

Design of PLL circuits with experiments

A fascinating introduction to PLL circuits: the theory, design and practical applications. Includes experiments to test your newly acquired knowledge. Cat B-1249

$20.95

Active — filter cookbook

From how to build an active filter, the many different types available, and the one to suit your needs, etc... all of practical interest to hobbyists and technicians. Cat B-1250

$22.95

Laser experiments

Wow! The future is yours today. This amazing book is a comprehensive guide to building your own laser. It takes you from basic physics, through to actual laser experiments. Cat B-1860

$19.95

Fibreoptics

Everything you wanted to know about fibreoptics. If you're one of the many people entering the exciting field of fibreoptics — this book is for you! An easy to read book detailing hardware, applications and projects. Cat B-1865

$26.50

Electronics projects for the photographer

With this exceptional guide, you'll enter a whole new world of photography. Amateurs will learn new facets of the art they never thought of and even professionals can pick up a trick or two. Cat B-1740

$28.95

Alternative energy projects.

A fascinating guide to designing and constructing alternative power generators... concentrating on 'circuits'. A wide range of topics extends to computerised priority power distribution. Cat B-1775

$22.95

STORE LOCATIONS

NSW

Swift & Young Sts.	**Albury**	**21 8399**
T55 Terrace Level	**Bankstown Sq**	**707 4888**
Shop 1, 65-75 Main St	**Blacktown**	**671 7722**
613 Princess Hwy	**Blakehurst**	**546 7744**
Oxford & Adelaide Sts	**Bondi Junction**	**387 1444**
531 Pittwater Rd	**Brookvale**	**93 0441**
Campbelltown Mall Queen St	**Campbelltown**	**27 2199**
Shop 235, Archer St Entrance	**Chatswood Chase**	**411 1955**
147 Hume Hwy	**Chullora**	**642 8922**
164 Pacific Hwy	**Gore Hill**	**439 5311**
315 Mann St	**Gosford**	**25 0235**
4 Florence St	**Hornsby**	**477 6633**
Elizabeth Dr & Bathurst St	**Liverpool**	**600 9888**
450 High Street	**Maitland**	**33 7866**
621-627 The Kingsway	**Miranda**	**TBA**
173 Maitland Rd, Tighes Hill	**Newcastle**	**61 1896**
Lane Cove & Waterloo Rds	**North Ryde**	**88 3855**
George & Smith Sts	**Parramatta**	**689 2188**
The Gateway High & Henry Sts	**Penrith**	**32 3400**
818 George St	**Railway Square**	**211 3777**
125 York St	**Sydney City**	**267 9111**
Treloar's Bldg, Brisbane St	**Tamworth**	**66 1711**
263 Keira St	**Wollongong**	**28 3800**

ACT

96 Gladstone St	**Fyshwick**	**80 4944**

VIC

Creswick Rd & Webster St	**Ballarat**	**31 5433**
145 McCrae St	**Bendigo**	**43 0388**
Shop 46,Box Hill Central,Main St	**Box Hill**	**890 0699**
Hawthorn Rd & Nepean Hwy	**East Brighton**	**592 2366**
260 Sydney Rd	**Coburg**	**383 4455**
1150 Mt Alexander Rd	**Essendon**	**379 7444**
Nepean Hwy & Ross Smith Ave	**Frankston**	**783 9144**
Shop 9 110, High St	**Geelong**	**43 8522**
291-293 Elizabeth St	**Melbourne City**	**67 9834**
Bridge Rd & The Boulevarde	**Richmond**	**428 1614**
Springvale & Dandenong Rds	**Springvale**	**547 0522**

QLD

157-159 Elizabeth St	**Brisbane City**	**229 9377**
166 Logan Rd	**Buranda**	**391 6233**
Gympie & Hamilton Rds	**Chermside**	**359 6255**
Queen Elizabeth Dr & Bernard St	**Rockhampton**	**27 9644**
2nd Level Western Entrance		
Redbank Shopping Plaza	**Redbank**	**288 5599**
Gold Coast Hwy & Welch St	**Southport**	**32 9863**
Bowen & Ruthven Sts	**Toowoomba**	**38 4300**
Kings Rd & Woolcock St	**Townsville**	**72 5722**
Cnr Pacific Hwy & Kingston Rd	**Underwood**	**341 0844**

SA

Wright & Market Sts	**Adelaide**	**212 1962**
Main South & Flagstaff Rds	**Darlington**	**298 8977**
Main North Rd & Darlington St	**Enfield**	**260 6088**
24 Park Terrace	**Salisbury**	**281 1593**

WA

Wharf St & Albany Hwy	**Cannington**	**451 8888**
66 Adelaide St	**Fremantle**	**335 9733**
William St & Robinson Ave	**North Perth**	**328 6944**
Raine Square, 125 William St	**Perth City**	**481 3281**

TAS

25 Barrack St	**Hobart**	**31 0800**

NT

17 Stuart Hwy	**Stuart Park**	**81 1977**

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days, or unforseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!) Please don't blame the store manager or staff: they cannot solve a dock strike on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first ... just in case!

Thanks. Dick Smith Electronics.

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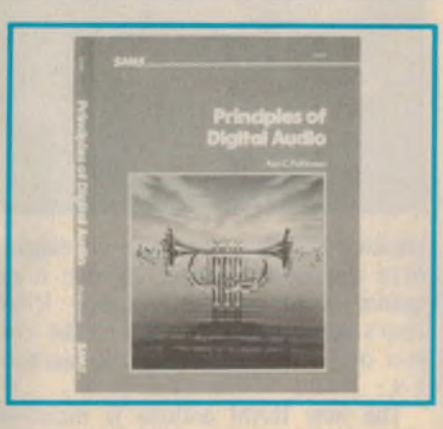
Books & Literature

Digital Audio

Principles of Digital Audio by Ken C. Pohlmann. Published 1985 by Howard W. Sams & Co, Inc. Soft covers, 187 x 248mm, 285 pages, illustrated with many diagrams. ISBN 0-672-22388-0. Recommended retail price $39.95.



In view of the radical developments in audio technology in the last few years there have been very few textbooks to illuminate the subject of digital audio. Now there is an excellent book on the subject written by the ideal author, a highly qualified engineer and academic who also happens to be a prolific contributor to US audio magazines.

Using his undoubted journalistic skills, Ken C. Pohlmann has written a text which is sure to become acknowledged as "the reference" on the subject of digital audio. It is written for an audience who could be assumed to be familiar with audio and high fidelity but with little familiarity with digital circuitry. As such, it is aimed at the keen enthusiasts, technicians and engineers.

There are eight chapters in all, with the first chapter giving an easy introduction to the characteristics of sound and the concepts of analog and digital recording. The second chapter then gets right into the subject and talks in detail about sampling, aliasing and quantisation. It also contains the best explanation of the use of dither that I have come across in any article.

Chapter three talks about pulse code modulation, dither generation, input filter design, sample and hold design, record and modulation processing and analog-to-digital conversion. Each of these topics is treated in considerable detail without becoming tedious.

Chapter four talks about the corollary of the previous chapter, digital audio reproduction: demodulation, processing, digital-to-analog conversion, and alternative digitisation methods such as floating point systems, non linear systems (now used in the Sony Video-8 PCM recording system) and delta modulation.

Chapter five is on digital audio media and is mainly devoted to digital magnetic tape although there are sections on optical storage and satellite transmission. Chapter six is on error correction. It talks first about the various types of error that can occur, and the ways in which they are detected, corrected or concealed.

Finally, in chapter seven, the compact disc is discussed in detail and there is also a section on the CD-ROM. Chapter eight concludes with a short essay on the problems and opportunities presented by the introduction of digital audio technology.

In summary, a very well written text which is a must for anyone who wants to have a solid background in the subject. Highly recommended. (L.D.S.)

Optical fibres explained

FIBEROPTICS; Everything you need to know on fundamentals, hardware and applications, PLUS actual projects you can build! by John A. Kuecken. Published 1980 by TAB Books Inc. Soft covers, 363 pages. Illustrated with diagrams, circuits, equations and tables. ISBN 0-8306-9709-8. Retail price $22.95.

Not only does this book have information on fibre optics, but it also includes some very important and interesting facts on light. These include the nature of light, wave mechanisms, polarisation and wave interference, refraction and reflection and lenses.

The background information on light theory is of course very useful when using fibre optics. The two types of optical fibres, stepped index and the graded index fibres are discussed in later separate chapters. Following these are chapters on coupling losses and the Quantum theory of light.

Photodetectors are discussed from the atom to the P and N-type semiconductors to the reversed biased PN junction, PIN diode and phototransistor. The light sources include the LED and injection laser diode.

Remaining chapters involve practical aspects such as feeding of light sources, receiver design, noise degradation, accessories and practical applications. Finally a low-cost transmitter and receiver project is described.

In all, an interesting book which starts from the basics and then brings the reader op to date on usage of fibre optics. Our review copy came from Dick Smith Electronics. (J.C.)

Scientific tricks and experiments

333 SCIENCE TRICKS & EXPERIMENTS: by Robert J. Brown. Published 1984 by TAB Books Inc. Soft covers, 131 x 210mm, 199 pages, illustrated with drawings and photographs. ISBN 0-8306-1825-2. Retail price $15.95.

333 MORE SCIENCE TRICKS & EXPERIMENTS: by Robert J. Brown. Published 1984 by TAB Books Inc. Soft covers, 228 pages. Illustrated with drawings and photographs. ISBN 0-8306-0835-4. Retail price $16.95.

Although these books are written for primary science students, they have some useful experiments for all ages. Readers will find them excellent practical instruction references for physics experiments. Young children will be delighted to demonstrate the experiments to their parents and friends.

The experiments cover many topics such as inertia and momentum, sound and vibrations, tricks, biology and psychology, water and surface tension, gravity and centrifugal force, electricity and magnetism, air and gases, heat, light, chemistry and mechanics.

Each experiment lists the items needed, the experiment procedure and the reason why the experiment works in simple language. Common household devices and materials are used for the experiments.

If you have children keen on science (or you'd like to make them so) these are ideal books. Take a look at them at Dick Smith Electronics' stores. (J.C.)

Circuit & Design Ideas

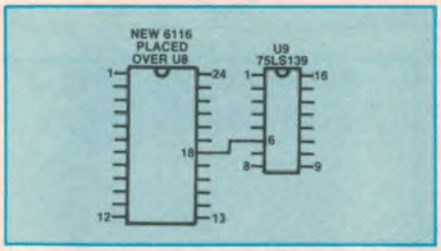
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Microprofessor memory expansion

This modification provides an extra 2K of RAM for the Microprofessor 1B system. The requirements are simply an extra 6116 RAM chip and a short length of wire.

The modification takes advantage of the fact that memory addresses 1000-17FF are decided by U9 but not used in the circuit. This range is a convenient 2K block, so it can be mapped onto a 6116 RAM chip.

Access to the correct data, address and control lines is provided by simply



stacking the new chip onto an existing 6116 chip in the circuit. All that is required is to connect the new RAM chip's select input (pin 18) to the correct output of the decoder, ie pin 6 of U9.

The new RAM address is therefore 1000-17FF as before. This area can then be accessed and used as for other RAM areas, while the ROM monitor will set the default PC to 1000.

To add the extra memory, pin 18 of the 6116 is bent out sideways and the chip placed firmly over U8 which is the existing system RAM chip. If the pins are bent slightly inwards, they will partially enter the socket for U8 and the new RAM chip will not require soldering. A wire is then used to connect pin 18 of the new 6116 to pin 6 of the adjacent 74LS139 decoder chip (U9).

I. Hogan,
Glen Waverley, Vic. **$15**

Sound effects for toy guns

These two circuits were originally designed to provide electronic sound effects for toy guns.

The first, Fig.1, produces both single shot and machine gun sounds. It is based on NPN transistor Q1 which is wired as a blocking oscillator. Feedback between collector and base is applied via the primary of T1, the 3.3kΩ resistor, and the 0.1μF capacitor.

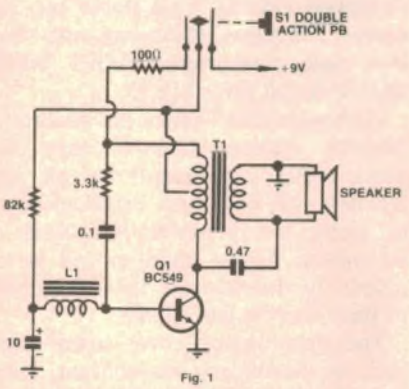


Fig. 1

When the pushbutton switch is initially pressed, the circuit produces a single "shot". Further pressure on the switch (trigger) will then result in an automatic firing mode.

T1 can be a miniature audio transformer (eg Jaycar Cat. No. MM-2532) with a 1kΩ centre-tapped primary and 8Ω secondary. L1 can be the primary winding of another 1kΩ centre-tapped transformer.

The second circuit, Fig.2, uses a multivibrator circuit based on Q1 and Q2 to modulate a blocking oscillator based on Q3. This produces a "sonic laser" sound for a space gun. Both circuits can be powered from a small 9V battery.

Lok Man Loong,
Shaukiwan, Hong Kong. **$20**

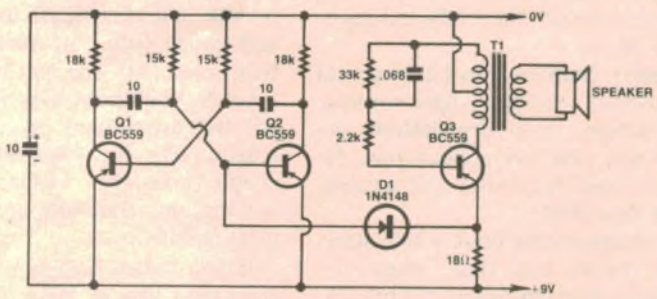
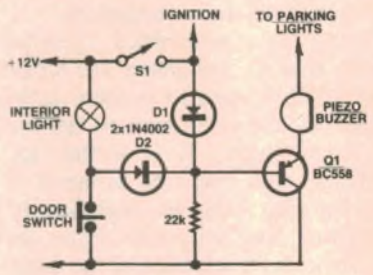


Fig. 2



Lights on reminder for cars

There's nothing worse than returning to your car only to discover that you've left the parking lights on and flattened the battery. By fitting this simple circuit, you'll never leave your parking lights on again.

The circuit is adapted from one submitted by M. Cameron in EA July, 1984. It uses a couple of diodes, a PNP transistor and a 12V buzzer.

D1 and D2 form an OR gate which monitors the ignition and door courtesy light switches. While ever the ignition is on, the base of Q1 is pulled high via D1 and the buzzer will be off. However, if the ignition is turned off and a door opened while the parking lights are still on, Q1 will be forward biased and the buzzer will sound.

The circuit can be disabled simply by turning off the headlights. Note that the buzzer should be a piezoelectric type with an inbuilt oscillator.

P. Reid,
Papakura, NZ. **$10**

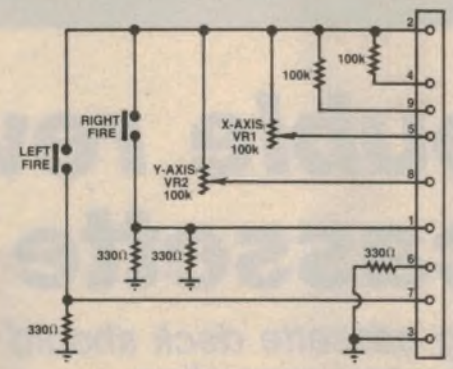
A mouse for the Cat

Many graphics production programs for the Dick Smith Cat computer require a joystick to draw the graphical representation on the screen. Often, this is difficult to control and so this 'mouse' circuit was designed. It allows the operator to accurately plot a point on the screen.

Basically, the joystick operates via two potentiometers, one for moving along the x-axis and the other for moving along the y-axis on the screen. These are mechanically linked to the joystick handle, thus allowing movement in all directions.

In this circuit, the individual potentiometers are separated to permit individual movement along the x and y axes. The operator can therefore fix a point along the x-axis and vary the position along the y-axis and vice versa.

The two pots are 100kΩ linear and



the knobs can be fitted with vernier dials to give accurate points on the screen. The dials on the prototype were calibrated 0-100 and featured a 10:1 ratio.

The fire buttons (left and right) are single pole momentary pushbutton switches. These are wired up exactly the same as the normal joystick switches.

The connection to the computer is via rainbow cable and a 9-pin D-type plug. Note that the Cat computer has provision for dual joysticks. For this reason, 100kΩ resistors are connected to pins 4 and 9 to simulate the other joystick's potentiometers.

Here are the pin configurations for the plug:

Pin 1 ..... Right fire buttons
Pin 2 ..... +5V
Pin 3 ..... Ground
Pin 4 ..... Joystick 2 left/right control
Pin 5 ..... Joystick 1 left/right control
Pin 6 ..... Left fire button for joystick 2
Pin 7 ..... Left fire button for joystick 1
Pin 8 ..... Joystick 1 up/down control
Pin 9 ..... Joystick 2 up/down control

Finally, an LED can be connected to pin 2 via a 180Ω resistor to indicate when the unit is on.

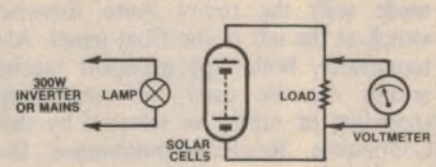
A. Fong,
Carlingford, NSW. **$25**

Setting the output of the 300W inverter

This simple scheme will allow accurate setting of the output voltage from the EA 300VA inverter published in September 1985. It uses a 100W light bulb and a solar cell.

First, the solar cell output is connected to a voltmeter and a suitable load resistor. This load resistor should be selected so that the current drain from the cell is about half its maximum rating. A value of 470Ω will do quite nicely with a 12V 40mA solar panel.

The light bulb is then connected to the mains and moved towards the solar cell until the voltmeter reading is about 75% of the maximum available output voltage. The exact voltage reading should then be noted.



Next, the light bulb is plugged into the inverter output. This must be done without moving the bulb itself, otherwise the method will be inaccurate. The inverter's voltage regulator is then adjusted until the output from the solar cell matches the previous reading.

This method works because the light output is proportional to the RMS voltage. Thus, the RMS voltage from the inverter will be the same as the mains RMS voltage.

J. Hunter,
Northbridge, NSW. **$15**

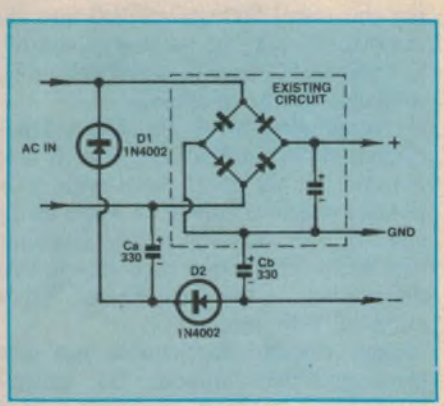
Low-cost technique for diagnostic training

Teaching the techniques of fault tracing in electronics can be an expensive and time consuming business. Faults must generally be created in otherwise working PCBs and, in the process, damage can result through repeated soldering and de-soldering.

One way around this is to wire a dual in line (DIL) switch into different circuit nodes. The switch can be glued to the reverse side of the PCB with its legs suitably flattened and flying leads connected to the circuit. Nodes can be chosen from the circuit to provide realistic simulations of open circuit, short circuit and no power.

In the case of digital circuits, the nodes can be connected directly to the supply rails or to ground. Note, however, that analog signals should be routed through current limiting resistors.

J. Hanson,
Broadmeadows, Vic. **$10**



Negative rail from bridge power supplies

This simple circuit provides a low current negative rail for power supplies which use a bridge rectifier.

Diodes D1 and D2, together with capacitors Ca and Cb, act as a modified voltage doubler. This produces a voltage which is negative with respect to ground. On the first half cycle, Ca charges to the peak AC voltage. On the second half cycle, Cb is charged by Ca.

Note that only a small amount of current is capable of being drawn. The output impedance is determined by the capacitors and suitable values should be chosen by experiment. A typical application is a negative rail for op amps.

Wen Liang Soong,
Fullarton, SA. **$10**

Teac double reversing stereo cassette deck

Teac's double reversing cassette deck should create a lot of interest among recording enthusiasts. It allows high speed copying between tapes plus the facility for continuous recording and playback together with Dolby B, C and dbx noise reduction.

The W-880RX Stereo Double Reverse Cassette Deck is an impressive unit with its array of controls and two vertical cassette mechanisms. Considering the many features packed into the machine though, the number of controls are reasonably few. It is certainly not a difficult machine to operate.

Overall dimensions are 435 x 116 x 290mm. It has a black finish with gold lettering on the front panel with additional touches of colour on some of the controls and on some of the labelling. This helps lift the overall styling so that the machine is not just another "black monolith" hifi product.

Each cassette mechanism has two heads and two capstans. The integral record/playback head and erase head is rotatable so that it is oriented correctly for the direction of tape travel. Separate pinch rollers correspondingly are pushed against the capstan for tape drive in the requisite direction.

Tapes can be selected to play or record on one side only, to automatically play the next side or to continuously play both sides. This selection is made with the rotary Auto Reverse switch at the left of the front panel. Alternatively, both tape transport mechanisms can be used for continuous recording or replay as selected by the Continuous Rec/Play pushbutton located between the two cassette mechanisms.

Controls for the tape mechanism are arranged on a narrow sloping panel beneath the cassette loading drawers. The slope enables easy visibility even if the unit is below eye level, as it normally would be. Each mechanism has a stop, fast forward and reverse, a forward and reverse plus record pushbuttons. The "record mute" and "pause" pushbuttons control both tape mechanisms.

Located to the right of the tape transport mechanisms are the audio controls. There is a five band graphic equaliser, recording level sliders, noise reduction selector, a tape counter and finally the level meters.

The graphic equaliser has slider controls giving ±10dB boost and cut for frequencies centred on 100Hz, 350Hz, 1kHz, 3.5kHz and 10kHz. It is an unusual graphic equaliser in that an extra switch allows the centre frequencies to be doubled so that the equaliser operates at 200Hz, 700Hz, 2kHz, 7kHz and 20kHz. This is necessary for equalisation when dubbing between tapes at double speed. The equaliser can also be switched out of circuit completely, to ensure that it will not have any effect on the recording chain.

Selection of noise reduction systems is via five interlocked pushbutton switches for dbx, Dolby B and Dolby C. The appropriate logo for each noise reduction system is backlit when selected.

Dubbing

During dubbing an interesting Decode Copy selection can be made. Either the noise reduction on the tape to be copied can be decoded and the second tape then recorded without noise reduction or the tape can be dubbed through without decoding the noise reduction. The second choice means that the copy tape will have noise reduction

Teac's double reverse cassette deck has three forms of noise reduction available: Dolby B and C plus dbx.

on it. The first course would be selected if the tape was to be used on a machine without the particular noise reduction system.

The signal level meters are eleven segment bar graphs with the segments lighting up in sets of two from minus infinity up to +6dB, and with the minus infinity bar permanently lit. The critical −5dB up to +6dB range occupies most of the display.

Some elegant playback programming features are available for the number one tape mechanism. These are Computomatic Program Search (CPS), Computomatic Direct Selection (CDS) and Programmed Music Search (PGM). To facilitate this, a single digit display can select up to 19 separate tracks on the tape. For numbers above 9, a dot in the top left hand side of the digit lights up to indicate the "tens" digit.

CPS allows playback of up to 19 tracks beyond or before the currently played track on either side of the cassette. To distinguish between tracks, it detects blank four second spaces between tracks. These blanks can be inserted when recording by using the Rec Mute facility which records a four second blank before pausing the tape.

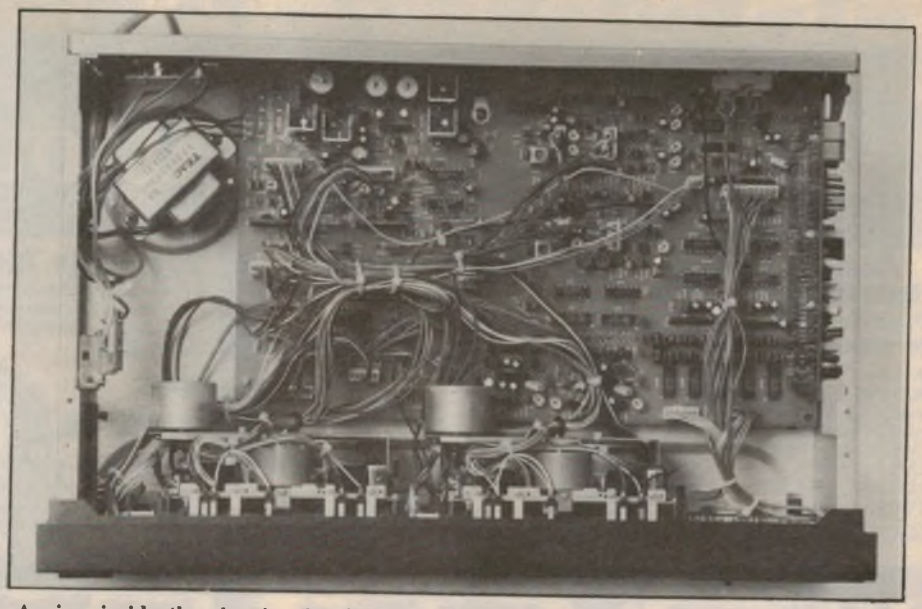
CDS and PGM involve search, programming and playback of desired tracks. The search of one track is CDS, while programming of up to 19 tracks in any order is PGM. To facilitate programming, there is an Intro Check function. This plays the first 15 seconds of each track to introduce it with fast forwarding between tracks.

Another interesting feature of the W-880RX is the Blank Scan. This can be used on both decks one and two. Basically when this button is pressed, and a blank portion of tape occurs for longer than ten seconds, the tape will be fast forwarded to the beginning of the next track.

Recording

Recording facilities on the W-880RX include dubbing and timer recordings using an external timer unit. Recording can be performed on tape 1 and tape 2 either consecutively or concurrently. When dubbing, either the normal speed tape-to-tape transfer can be made or you can use the Hi-speed Dubbing facility which dubs at twice normal playing speed.

Normal (ferric), CrO2 (chrome) and metal tapes can be used. Correct equalisation is selected automatically by sensors which detect the tape identification holes in the cassette body.



A view inside the chassis, showing the two tape transports, each having two motors.

Chassis Features

Each transport mechanism of the W-880RX is powered by two separate motors, with two solenoids employed for changing the transport mode.

One motor is for the capstan while the second is for the reel drive. Two flywheels, one for each capstan are both driven via a belt from the capstan motor pulley.

A large PCB incorporates most of the circuitry while cables make the connections between the front panel switches, tape mechanism, display and equaliser.

A smaller vertical PCB houses the noise reduction circuitry and incorporates a single dbx IC and a single Dolby IC.

The machine is fitted with a standard three pin mains plug and three-core power flex and the chassis is earthed which goes against the trend of double-insulated hifi gear. While we are happy to see the earthed chassis on the Teac the exposed mains wiring in the chassis should be insulated to prevent the possibility of shock when the unit is being serviced.

Performance

We tested the Teac W-880RX Deck using the three types of tapes. These were Metal, TDK MA-60; Chrome (CrO2), TDK SA-C90 and ferric tape, PD Magnetics C-60.

As expected, the best results were obtained with metal tape. Frequency response measured without noise reduction at a level of −20VU proved to be within ±3dB from 30Hz to 18.5kHz. With Dolby B, the upper −3dB frequency response point was reduced to 16kHz and for Dolby C, 17kHz.

At −10VU without Dolby, the frequency response was almost identical to the −20VU response. This is a very good result since most machines will exhibit an earlier upper rolloff frequency when recording at this higher level.

Signal-to-noise ratio was measured at 47dB without noise reduction, 68dB with dbx, 57dB with Dolby B and 60dB with Dolby C. These are unweighted figures with respect to 0VU recording level. THD at 1kHz and at 0VU level was 1.7%.

Chrome

Frequency response for chrome tape without noise reduction at −20VU was measured at ±3dB from 30 to 18kHz. With Dolby B the upper frequency response (−3dB) was reduced to 17kHz and for Dolby C, 16kHz. At −10VU without Dolby, the upper −3dB frequency response was 16kHz. With Dolby B this reduced to 15kHz and for Dolby C, 16kHz.

Unweighted signal-to-noise ratio was measured at 52dB without noise reduction, 66dB with dbx, 57dB with Dolby B and 61dB with Dolby C. THD at 1kHz and 0VU was 2%.

Frequency response for normal ferric tape without noise reduction at the −20VU level was ±3dB from 30 to 15kHz. With Dolby B, the upper −3dB point was reduced to 10kHz and for Dolby C, 9kHz.

Continued on page 118.

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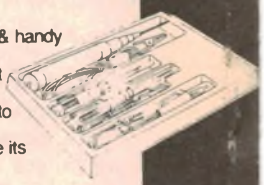

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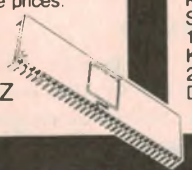

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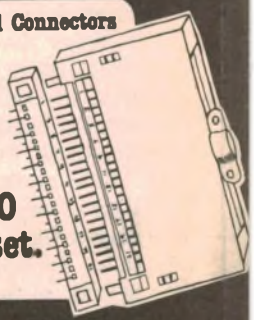

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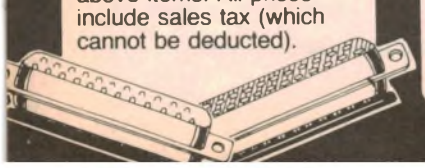

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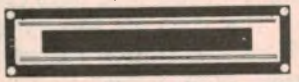

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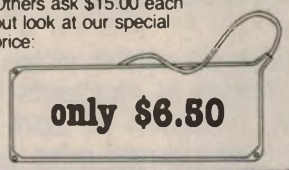

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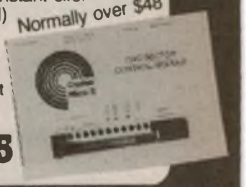

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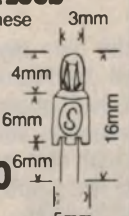

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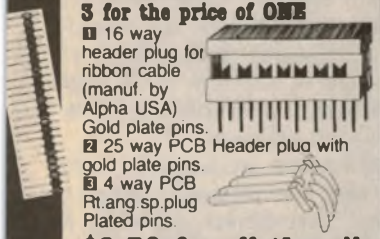

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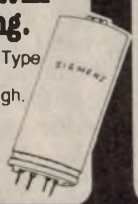

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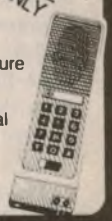

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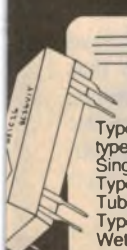

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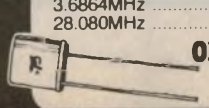

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The Serviceman

Don't force it — hit it with a hammer!

One of the disturbing features of the video recorder scene is the relatively high percentage of incidents involving mechanical butchery — and not, I hasten to add, by the owners of these machines, but by servicemen who present themselves to an unsuspecting public as "experts" in this field. Little wonder that the video recorder is still regarded with suspicion by sections of the public.

The story I am about to relate is just one of several examples I have encountered of supposedly reputable servicemen who, without having bothered to acquire any formal training, attempt to get by with a "twist and fiddle" approach. There is also evidence that some adopt a "don't-force-it, hit-it-with-a-hammer" approach.

I realise that comments like this may not be welcomed by sections of the industry, fearing that it may worsen the video recorder image in the eyes of the public. Well, maybe it will, but I feel that things like this need to be brought into the open if the credibility of the industry is to be established in the long term.

Having said that, let's get down to this particular story. The recorder in question was a Beta format Sanyo VTC-5000. It was brought to me by one of my regular, long standing customers, who dropped it into the shop late one evening just as I was about to close the door. In the ensuing brief discussion I learned that it was producing a "streaky" picture, but that was all. Nothing of its history was mentioned.

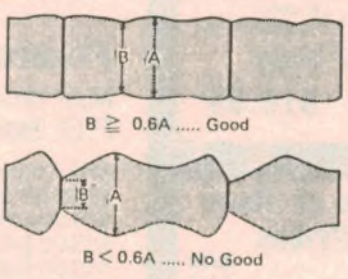
When I finally came to check it I found that the word "streaky" was not strictly accurate. "Noisy" would have been a more accurate term, though it is easy to understand why a layman would not use such a term. This symptom suggested worn or dirty heads, but it wasn't the only fault. Across the top of the picture was a band of colour, mainly greenish. I tipped that this would most probably be a tracking problem.

At this stage I was in two minds whether to tackle the job myself or pack it off to the local distributors. The truth was I had not had much to do with this brand of recorder, and absolutely no experience with this model. I had no manual for it, the nearest thing being for the Sanyo VTC-9300.

On the other hand I was anxious to do the best I could for a valued customer. If the job turned out to be straightforward, I could save him a possible long wait and some of the handling costs which would otherwise be involved. In addition, I would have the opportunity to gain some experience on another model machine, which is always valuable.

I finally opted to tackle the job myself. With the benefit of hindsight, I'm glad I did. I could easily have been blamed for something I didn't do.

In making this decision I was hoping that the manual I had would prove adequate, in spite of the different model numbers. While recorders change their appearance with monotonous regularity,



The test pattern at TP-3 (good, top; poor, bottom).

and change their electronics and "features" nearly as often, the mechanical side is much less prone to change. I was banking on this and, in fact, the hunch was justified.

I pulled the covers off and had a good look over the drum, guide pins etc. There was no doubt that the machine had had a good deal of use and the first thing I did was to give it a routine clean — heads, drum, guides, etc. This presented no great problem in itself.

Who's been fiddling?

In the process, however, I became aware that someone had been there before me — not in regard to the components being cleaned, but in regard to the various tape guide adjustments.

What really intrigued me was very visible evidence that someone had already had a go at adjusting these. I have no idea what kind of screwdriver he used, or how much force he employed, but he had certainly left his mark.

These adjustments are supposed to be made with what the manual describes as an "eccentric" screwdriver, but which is perhaps more accurately described as a slotted screwdriver; ie, one in which the centre of the blade is cut away to enable the blade to straddle a collar or bearing and engage screwdriver slots on either side of it.

I can only surmise that the previous operator had lacked such an instrument and had endeavoured to make do with a standard blade; a tricky operation and one most likely to leave evidence around the slots. Also, judging from the end result, I would guess that he had proceeded on a twist and fiddle basis, rather than the routine set out in the manual.

So it looked as though I would have to start from scratch, with the hope that no serious damage had been done to the adjustments. The procedure as set out in the manual calls for a suitable CRO, a test tape, the aforementioned screwdriver, and a dentist's mirror.

Tracking adjustment

The CRO has to be connected to a designated test point (TP-3 for the VCT-9300), and a test tape, carrying a blank red raster, run through the machine. The result should be a CRO pattern similar to that shown in the accompanying diagram (taken from the manual) and, ideally, as above the "good" caption. If, on the other hand, it is more like the "no good" pattern, a prescribed tracking adjustment routine should be followed.

Finding the equivalent of TP-3 was the first hurdle, because this was where the VCT-9300 manual differed markedly from the VCT-5000 model on the bench. So I had to trace it out for myself. Such test points are invariably at some point in the video chain after the outputs from the two heads have been mixed and amplified to a suitable level.

The best place to start is to trace the two shielded leads from the heads to the associated board. Once there, obvious test points can be tried until the appropriate one is found. In this case, the shielded cables lead to a small metal box adjacent to the drum. Associated with it were some six or seven obvious test points, and I checked each one with the CRO.

Murphy put his oar in of course, ensuring that I had to check them all before I found the right one. It was, in fact, one of three pins in the form of a miniature three-pin, in-line plug, such as is often used for inter-board connections, except that there was no matching socket in this case.

Test tape

That much established, I was ready to run a test tape. Test tapes are readily available, in either format, but they are likely to cost a couple of hundred dollars. As I may have remarked in these notes before, I have not felt that I could justify this outlay for the relatively small amount of use I would have for it at the present time.

Instead I have compromised by making my own tapes from the colour bar generator and, so far, they have proved quite good enough for what I have had to do. I made them by taking the video directly out of the generator and into the video input of the recorder. I also took the precaution of waiting until I had access to what were virtually new machines in each format.

Running the test tape produced a pattern which was nothing like either of the published ones, suggesting that the whole set-up was in a pretty bad shape. There are four adjustable guides involved in this procedure, designated (a), (b), (c), and (d). Guides (a) and (b) are associated with the erase head near the supply reel, while (c) and (d) are associated with the audio and control heads near the capstan and pinch roller.

Each one is adjusted in turn until the closest approximation to the "good" pattern is obtained. In fact, the first thing I had to do was to produce something approaching the "no good" pattern, which at least indicated that I was on the right track. After that, a lot of careful adjustment eventually produced something, approaching the "good" pattern.

I say "approaching" because it fell somewhat short of the ideal, although it would have satisfied the numerical values shown on the diagram. Going by the data in the manual I concluded that this failure to reach the ideal was most likely due to head wear.

The next step was to play a known good tape, and this produced a very satisfactory picture, certainly nothing like the horrible image I had first observed. Then I made a recording on the machine and played it back. Again the results were quite good. There was a suggestion of noise — if one looked for it — on some scenes but I felt sure that the customer would be quite happy with it.

Summing it all up I concluded that the heads were showing some signs of wear, but hardly enough to justify the expense of new heads at this stage. Naturally, I would advise the customer of the situation, and leave the decision to him, but I felt sure he would be happy to live with the machine for the present.

In theory, this should have been the end of the story but I was intrigued as to just how the situation had come about in the first place. I knew the customer well enough to feel quite confident that he would never have ventured to even take the cover off, let alone fiddle with anything inside. On the other hand, he was such a good customer that I couldn't imagine why he would have sought someone else's help when the machine gave trouble.

Thus prompted, I phoned the customer in the hope of clarifying the situation. The phone was answered by a voice I didn't recognise and, when I asked for the customer, and explained what it was about, the other party explained that the recorder was really his. It transpired that he was a relative of my customer and was visiting on holidays.

That much clarified, I began probing. He told me that the set had originally given trouble — of the type I had observed — while he was in Canberra and he had taken it to a local service organisation, who purported to be video specialists. Unfortunately, the results didn't support their claim because, according to the owner, it was little better when they returned it than when he gave it to them.

Feeling thoroughly browned off, he brought the machine with him in the hope that his relatives could recommend someone to have another go at it. Which was how it landed on my bench. And, in answer to my question, he assured me that neither he nor anyone else had ever tampered with the machine.

With those points clarified I was happy to inform him that the machine was now performing satisfactorily, and that he could pick it up whenever he liked. It so happens that my customer's house is not far away, so he elected to come round immediately. I left the machine set up so that I could demonstrate it to him and he was delighted with the performance. As he put it, "It hasn't performed like that for a long time."

That was not that

And that, I hoped, was that. But it wasn't. A couple of days later the owner was on the phone with a tale of woe. "I'm afraid that recorder's no good; it's still playing up." My heart sank. Had all my effort been for nothing? Fortunately, I had nothing urgent on hand so I suggested that he bring the machine around immediately and let me check it.

Thus it was that the machine was back on my bench within a few minutes, together with one of the tapes he had been trying to play. I set everything up as before, inserted his tape, and set things going. To my immense relief the tape played perfectly, even though I couldn't account for the situation right then.

The owner was equally puzzled. "It won't play like that at home. It goes all funny." It was the word "funny" that alerted me.

"What do you mean, 'funny'?"

"Aw well, it shakes around up at the top of the picture."

The penny dropped. Flag waving. And flag waving suggested a fault in the receiver; probably a model set which needed to be modified but which hadn't been.

"What make of set are you using?"

"I'm not sure; I think its a Philips."

Well that made sense. It was probably a K9; a model which definitely requires modifying for use with video recorders (Serviceman, May 1984). It so happened that I had an unmodified K9 on the bench, waiting for its owner to pick it up. It took only a few moments to hook it up to the video recorder and display a picture from the tape. It was a beautiful demonstration; the top of the picture waved like a bunch of school kids during a Royal walkabout.

"That's it — that's it," exclaimed the customer. "It's just like that."

"OK," I replied, "the fault is nothing to do with the recorder; it's the set which needs attention."

Fortunately, I had nothing urgent on hand, and decided that now was as good a time as any to cure the problem once and for all.

The house was within easy walking distance, so I grabbed the tool kit, locked up the shop, and we set out. On arrival I had to explain to the owner of the set — my original customer — the nature of the problem and what needed to be done, since some people don't take too kindly to their sets being modified when, as far as they are concerned, there is nothing wrong with them.

But there were no such problems and the actual modification for the K9 — which it turned out to be — is quite simple; just a couple of bridges across some module pins. That done, we tried the recorder again, and this time it turned in a first class picture, all signs of flag waving having vanished.

So we finally had a happy ending to what started out as a rather dicey situation; a machine that had been fiddled with on the one hand, and a serviceman — yours truly — who had never tackled that particular model before. Little wonder that I heaved a sigh of relief.

Hammers and chisels

But the real point of the story is the butchery, twist and fiddle type of approach which is all too common in the industry. And this is not an isolated incident; I am constantly encountering evidence of so-called servicemen who are tackling video recorder repairs for which they are in no way qualified. Nor do they consult the appropriate service manuals, or even service departments. They simply wade in, sledge hammers and cold chisels flying.

An exaggeration? Well, maybe. But, at a seminar held some time ago, by a well known distributor, one of the service department personnel showed me a video head drum which some character had tried to remove. Finding it a trifle stiff he had tapped the blade of a screwdriver into the small gap between the drum and the supporting plate and endeavoured to lever it off. The marks on the drum and base plate were clear for all to see. Needless to say, the drum was a write-off.

Another heavy handed approach which they showed me involved the angle of the two guides which extract the tape from the cassette and wrap it around the drum. These were normally offset at a slight angle, something which this character couldn't understand. So he proceeded to "straighten" them with a pair of bull nosed pliers.

As I intimated at the beginning, none of this presents a very desirable image of the video industry; in fact, some may resent what I have said.

But can the industry ignore it, in the hope that it will go away?

Pink ears

And while I am in this kind of mood, a word in the pink ear of those whose job it is to promote video recorders. I'm talking about both national advertising of particular brand names, and the more restricted advertising by distributors, discount stores, and retail outlets.

Not to put too fine a point on it, you're doing a lousy job.

The simple fact is that the average John Citizen knows virtually nothing about video recorders, apart from what is implied by the name. They have little idea what facilities they offer and, therefore, to what extent that may add to their home entertainment. And the publicity I just mentioned does virtually nothing to correct that state of affairs.

Because I do not sell such devices, customers who may be vaguely interested in a recorder often seek my advice in the hope that they may receive an unbiased opinion. In this regard I do my best; discussing features to look for, options typically available, compatibility with friends' or relatives' formats, and so on.

But that's not really the point. In every such discussion, I invariably point out one very important fact about a video recorder; that it can be used to record one program while a completely different one is being watched on the TV set.

I have lost count of the number of times that this statement has been greeted with incredulity and disbelief. In fact, some people take a lot of convincing. They are obviously conditioned to the audio recorder scene, where a separate receiver is normally needed to record a program off air. And so they imagine that the TV set has to provide the signal for the recorder to put on tape.

No one has ever bothered to explain that a video recorder contains its own TV set — or at least as much of it as is necessary to put signals on tape. At times I have had to cite extreme examples in order to convince them; such as pointing out that their TV set could be in my workshop for repairs and that they could still record their favourite program for replay when the set returns.

But once they are convinced their whole attitude changes completely. This is something they never thought possible, and disposes of a limitation which they subconsciously took for granted. I am convinced that I have been responsible for changing many a lukewarm attitude to one of enthusiasm — and an ultimate purchase.

Of course, I can anticipate the kind of answer likely to be levelled at this criticism: "Don't be silly; everyone knows that a video recorder can do that." You're wrong mate. Maybe everyone in your circle knows it, and people who already own machines know it, but these are not the people that matter from a sales point of view.

The people who matter are the average members of the public, such as those who come to me for advice. And you're not reaching them. I'll wager a proper advertising campaign would lift recorder sales significantly and benefit the whole industry.

Junk tapes

Still on the video theme, here is another story about an abused machine, this time by the owner. Most owners are at least moderately fussy about the kind of tapes they put in their machines. Some are very particular, using nothing but the most expensive top brand tapes, while the majority adopt a middle-of-the-road approach, selecting well known brands at moderate prices. But a few don't worry at all.

In this case the customer was one of my regulars and he phoned up to report a double problem. Over the weekend a relatively new video recorder had packed up, followed a few hours later by the TV set itself. (From the way he spoke I'm sure he believed that the two faults were connected.)

The TV set fault proved to be a perfectly routine one which I was able to track down and fix in a few minutes, but the recorder was a different matter. Running a known good tape through it produced sound, but no picture — nothing but a pattern of noise. All the indications were that the heads were gummed up with muck, but I was at a loss to equate this with the fact that the machine was only about three months old.

In any case, it was a job for the workshop, so I loaded it into the van, promising to return it next day if nothing more serious was discovered. On the bench I removed the covers and examined the whole transport and drum assembly. What a mess! The heads were gummed up with oxide, there were oxide patches on the drum and guides, and piles of oxide on the baseplate, particularly in the vicinity of the guides.

I couldn't imagine how all this had come about in only a few months, but I went ahead and cleaned it all up, paying particular attention to the heads. As far as I could see they had not suffered any permanent damage and, when I finally played a tape, the machine produced a first class picture. On that basis I returned it to the customer.

But I was still puzzled as to how this condition had come about. The most likely explanation seemed to be that there was a bodgie tape somewhere in the system, so I quizzed the owner and his wife as to just what tapes had been used. Initially this produced nothing startling; a couple of tapes on hire from the local video shop, some pre-recorded tapes they had bought, and a selection of blank tapes in a well known brand.

Nevertheless, I was not convinced. At the risk of labouring the point I insisted that there just had to be some other tape, or tapes, which they had played and which were faulty. Suddenly daylight seemed to dawn. There was another tape; one that had been given to their teenage son by a friend. It was a pre-recorded tape of some sporting event, and their son played it quite often.

At my suggestion the tape was produced. Superficially it appeared to be good quality pre-recorded tape such as one might hire or purchase from a video store, with no suspicion of trouble. But flicking back the cover to reveal the tape told a different story. Right at the beginning of the tape there were numerous patches of missing oxide, and spot checks at several points throughout its length revealed the same situation — only worse in places.

Having roundly condemned the tape and advised them never to play it again, I naturally wanted to know from whence it had come. And so the whole sorry story emerged. (You're not going to believe this!)

It transpired that a family friend is in the habit of scavenging at the local garbage tip and this tape was one of a whole batch he had uncovered while

rumaging through the rubbish. They were almost certainly tapes which had been discarded by the local video shop, for the obvious reason that they had reached the end of their useful life.

And, I gathered, he had distributed these tapes among his various friends, selecting the one he had given this family on the basis of the subject matter which he knew would interest their son. So, somewhere out there in videoland there are a couple of dozen more such tapes waiting their chance to gum up, or even chew up, some precious video heads. (I wonder if I'll get the job!)

All of which adds up to a pretty grim story, particularly when one appreciates that these tapes, apart from being worn out in the first place, had been "stored" in anything but an ideal environment. I can only hope that my customer's experience will flow onto the scavenger and that he may make some attempt to recall his gifts.

On a completely different theme, here is a reaction to my story in the December 1985 issue about a General GC145 36cm colour TV set, and problems with the 12V inverter. It is from Mr D.P. of Mudgee, NSW and is a real tale of woe. Here's how he tells it.

It was with interest that I read your comments in the December EA about a General GC145. I purchased one of these sets with the plan to run it off a 12V solar system.

In this system the panels and batteries are located about 50m from the house in order to obtain sunlight for the panels, the house having been built to obtain early summer shade. The house is supplied by two 10mm circuits, one for the fridge and the other supplying the offending TV set, radio cassette, and seven high efficiency, 16W, fluorescent lights.

When I first attempted to run the TV set it would run for about two minutes, then cut out. On contacting the distributors I was informed that there was a cut-out circuit which removed the EHT section when the supply dropped below 11.5V. I was told that, by replacing a 1.2kΩ resistor (R693) with a 1kΩ, the cut-out level would be reduced to 10.5V. The problem was that this would void the warranty.

After changing the resistor partial success was obtained; the set now operated for five minutes before the cut-out removed the picture. Now even connecting the set directly to a battery made no difference, it still cuts out at 12V after five minutes, and I was left without a warranty.

The problem was eventually solved by running a 12V-240V inverter, 300VA that EA published recently. This enables us to obtain a satisfactory picture until the supply drops to 8V, and has been doing so since early October.

The battery capacity is 200Ah and the voltage measured at the house, on fully charged batteries, with the TV only operating, is 11V. Voltage measured at the house, using the TV set and one light, varies from 10.5V at 6pm to 8V at 11pm.

I write this because someone purchasing a TV set for 12V operation may be better advised to purchase a set and inverter independently, rather than pay extra for an inverter built into the TV set.

Well, all that takes a bit of digesting. Incidentally, I have abbreviated D.P.'s letter in places without, I hope, altering the sense of it.

My first reaction to the story is that the set is almost certainly faulty, and probably had been from the start. The key to this conclusion is the statement ". . . even connecting the set directly to the battery made no difference, it still cuts out at 12V after five minutes."

Behaviour of this kind suggests a thermal fault, probably around Q684 and Q685 in the protector circuit. And, in spite of the routine warning concerning the warranty, I feel it would be worthwhile approaching the agents on the basis that the set has what appears to be a manufacturing fault, which has nothing to do with changing the resistor value. Also, it should be noted that this change is a recommended modification, all later models being fitted with a 1kΩ resistor.

So, assuming the set is still within the warranty period, and that the board was not butchered in the process of changing the resistor — not very likely — the agents may still take a reasonable view of the situation. The final decision is, of course, up to them, but I suggest it would be worth a try.

My other reaction to the letter is one of confusion regarding the behaviour of the electrical system versus its description. Apparently, with a fully charged battery — say at least 12V to be conservative — there is a 1V loss in the line when the TV set only is operating. According to the GC145 manual, and confirmed on my own bench, this set would typically draw about 5A. A loss of 1V at 5A means a resistance of 0.2Ω in the line.

Now D.P. describes the line as "10mm", but I wonder what this really means. A 10mm conductor is a pretty hefty cable, and would also be fairly expensive on the scale described. More importantly, by my calculations, it could not have anything like this resistance; more like .02Ω. So I back-tracked through the wire tables looking for a gauge which would provide this order of resistance at 100m. And strangely enough this comes out at 10SWG.

So, did D.P. make a slip of the pen and write "10mm" instead of "10SWG"? In any case, it does appear that the losses in the system are fairly high and I am prompted to ask whether the location of the batteries is the best one. While no figures have been given it is a fair bet that the charging current would be considerably less than the peak discharge current. On this basis, would the batteries be better located at the house?

I have devoted rather more space to this letter than is normally available, but I feel that the unusual nature of the problem justifies it. I have done my share of country servicing and it is an experience which makes one realise just how readily we take the 240V mains for granted — and how helpless one feels when they are no longer there.

So I'm the first to award full marks to those who, by hard work, ingenuity, and expense attempt to bring some city comforts to their isolated areas. If any of my comments have provided some help or food for thought for D.P. — or any other readers in similar circumstances — then they will have been more than justified.

TETIA Fault of the Month

Hitachi CPT2065

Symptom: No vertical scan. The vertical oscillator is running and some kind of drive is being delivered to the vertical output module. The transistors and diodes on the module test OK.

Cure: Replace the HM6251 module. The fault lies in the printed resistors on the ceramic base and these cannot be repaired or replaced.

This information is supplied by courtesy of the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contributions should be sent to J. Lawler, 16 Adina St, Geilston Bay 7015.

FANS

		1-9	10+	100+
Cat. T12461	240V 4½"	10.50	10.00	8.00
Cat. T12465	240V 3½"	10.50	10.00	9.00
Cat. T12463	115V 4½"	10.50	10.00	8.00
Cat. T12467	115V 3½"	10.50	10.00	9.00

(Fan guards to suit also available)
Plus 20% tax where applicable

ECONOMY TOGGLE SWITCHES

Unbelievable Value!

	10-99	100+
S11010 (SPDT)	0.70	0.60
S11020 (DPDT)	0.90	0.80

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QUALITY MOMENTARY (RED BODY)

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SPDT Cat. S11050	1.00	.90

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ENCLOSED ROTARY SWITCHES AT SPECIAL PRICES!!

		1-9	10+	100+
S13021	SW ROT 1P 12Pos	1.00	.80	.70
S13022	SW ROT 2P 6Pos	1.00	.80	.70
S13033	SW ROT 4P 3Pos	1.00	.80	.70
S13035	SW ROT 3P 4Pos	1.00	.80	.70

Plus 20% Sales Tax where applicable

CANNON TYPE ADUIO CONNECTORS

We've sold 1000's because of their great value!

	1-9	10+
3 Pin Line male Cat. P10960	1.80	1.60
3 Pin Chas male Cat. P10962	1.90	1.70
3 Pin line female Cat. P10964	2.50	2.20
3 Pin Chas FMle Cat. P10966	2.90	2.50

Plus 20% Sales Tax where applicable

DIP SWITCHES

	10+	100+	1000+
S13402 2 Way	.70	.65	.60
S13404 4 Way	.80	.75	.70
S13405 5 Way	.90	.85	.80
S13407 7 Way	1.10	1.00	.95
S13408 8 Way	1.20	1.10	1.00

20% Sales tax where applicable

ELECTROLYTICS

Cat No.	Desc.	10+	100+
R1415	1uF 63V PCB RB	0.05	0.04
R15461	10uF 16V PCB RB	0.05	0.04
R15462	10uF 25V PCB RB	0.05	0.04
R15482	22uF 25V PCB RB	0.06	0.05
R15521	47uF 16V PCB RB	0.07	0.06
R15522	47uF 25V PCB RB	0.08	0.07
R15581	1000uF 16V PCB RB	0.21	0.20
R15582	1000uF 25V PCB RB	0.28	0.25
R15591	2200uF 16V PCB RB	0.39	0.33
R15592	2200uF 25V PCB RB	0.55	0.50
R15904	2200uF 50V AXIAL	1.50	1.00

Plus 30% tax where applicable

HOOK UP WIRE

Cat. No.	Description
W11251	13/.12 TND BLK
W11252	13/.12 TLD BROWN
W11253	13/.12 TLD ORANGE
W11254	13/.12 TLD YELLOW
W11255	13/.12 TLD GREEN
W11256	13/.12 TLD BLUE
W11257	13/.12 TLD WHITE

PRICES PER 100 METRE ROLL

1-9	10+
$3.50	$3.00

Plus 20% tax where applicable

W11260 14/.20 RED
W11261 14/.20 BLACK
W11265 14/.20 BLUE
W11268 14/.20 WHITE

PRICES PER 100 METRE ROLL

1-9	10+
$9.00	$7.00

Plus 20% tax where applicable

W11270 24/.20 RED
W11272 24/.20 BLACK
W11274 24/.20 GREEN

PRICES PER 100 METRE ROLL

1-9	10+
$11.00	$10.00

Plus 20% tax where applicable

W11280 32/.2 BROWN
W11282 32/.2 BLUE

PRICES PER 100 METRE ROLL

1-9	10+
$12.00	$11.00

Plus 20% tax where applicable

75 OHM COAX CABLE IN 100M ROLLS

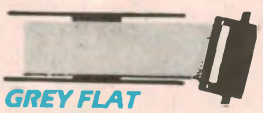
Cat No.	1-4 rolls	5+ rolls	10+ rolls
W11222 3C2V	18.00	17.00	16.00
W11224 5C2V	27.00	25.00	24.00

(5C2V WHITE OR BLACK)
LINE LOSS PER 100 FEET (33M 200MHz)
W11222 3C2V 6.2dB (Approx.)
W11224 5C2V 3.9dB (Approx.)
Plus 20% tax where applicable

RAINBOW CABLE

Cat.No.	Description	1-29 mtr	30+ mtr
W12714	28AWG 14W per metre	$0.90	$0.70
W12716	28AWG 16W per metre	$0.90	$0.70
W12720	28AWG 20W per metre	$1.20	$1.10
W12726	28AWG 26W per metre	$1.60	$1.50
W12734	28AWG 34W per metre	$1.90	$1.80
W12740	28AWG 40W per metre	$2.20	$2.00

Plus 20% tax where applicable



GREY FLAT RIBBON CABLE

			PER 100 FT ROLL			
Cat No.	Desc.	Per Mtr	1-3	4-9	10-99	100+
W12614	14 Way	1.29	19.50	18.50	18.00	14.00
W12616	16 Way	1.90	21.50	19.50	19.00	16.00
W12620	20 Way	2.20	29.50	28.00	26.50	20.00
W12625	25 Way	2.50	32.50	29.00	28.50	25.00
W12626	26 Way	2.60	34.00	32.00	29.00	26.00
W12634	34 Way	2.80	44.00	42.00	39.00	34.00
W12636	36 Way	3.00	49.00	47.00	42.50	36.00
W12640	40 Way	3.20	55.00	52.50	49.50	40.00
W12650	50 Way	3.75	62.00	59.50	58.50	50.00

EX STOCK
LARGER QUANTITIES NEGOTIABLE
Plus 20% tax where applicable

TELEPHONE CABLE (200 METRE ROLLS)

		1-9	10+
W11302	2 Pair	24.00	23.00
W11303	3 Pair	36.00	34.00
W11310	10 Pair	120.00	115.00

Per 200m Roll
20% Sales tax where applicable

RCA INSULATING SOCKETS

Cat No.	Desc.	1-99	100+
P10232	2 Way	0.25	0.21
P10234	4 Way	0.45	0.40
P10236	6 Way	0.75	0.60

Plus 30% tax where applicable

RCA CHASSIS MOUNT METAL

Cat No.	1-99	100+
P10231	0.16	0.13

Plus 30% tax where applicable

ELECTROLYTIC SINGLE ENDED PCB MOUNT

Cat. No.	Descr.	10+	100+	1,000+
R15405	0.47uF 63V	$0.07	$0.06	$0.05
R15415	1uF 63V	$0.07	$0.06	$0.05
R15422	2.2uF 25V	$0.07	$0.06	$0.05
R15424	2.2uF 50V	$0.06	$0.05	$0.04
R15425	2.2uF 63V	$0.07	$0.06	$0.05
R15432	3.3uF 25V	$0.07	$0.06	$0.05
R15435	3.3uF 63V	$0.07	$0.06	$0.05
R15442	4.7uF 25V	$0.07	$0.06	$0.05
R15443	4.7uF 35V	$0.08	$0.07	$0.06
R15445	4.7uF 63V	$0.07	$0.06	$0.05
R15461	10uF 16V	$0.07	$0.06	$0.05
R15462	10uF 25V	$0.07	$0.06	$0.05
R15463	10uF 35V	$0.07	$0.06	$0.05
R15465	10uF 63V	$0.07	$0.06	$0.05
R15481	22uF 16V	$0.07	$0.06	$0.05
R15482	22uF 25V	$0.08	$0.06	$0.05
R15483	22uF 35V	$0.08	$0.07	$0.06
R15484	22uF 50V	$0.09	$0.08	$0.07
R15502	25uF 25V	$0.07	$0.06	$0.05
R15505	25uF 63V	$0.10	$0.08	$0.07
R15512	33uF 25V	$0.08	$0.07	$0.06
R15521	47uF 16V	$0.09	$0.08	$0.07
R15522	47uF 25V	$0.09	$0.08	$0.07
R15525	47uF 63V	$0.10	$0.09	$0.08
R15531	100uF 16V	$0.10	$0.09	$0.09
R15532	100uF 25V	$0.08	$0.07	$0.06
R15533	100uF 35V	$0.15	$0.12	$0.11
R15535	100uF 63V	$0.24	$0.22	$0.20
R15541	220uF 16V	$0.09	$0.08	$0.07
R15542	220uF 25V	$0.14	$0.12	$0.11
R15543	220uF 35V	$0.25	$0.23	$0.20
R15545	220uF 63V	$0.26	$0.24	$0.22
R15552	330uF 25V	$0.15	$0.13	$0.12
R15555	330uF 63V	$0.34	$0.30	$0.28
R15561	470uF 16V	$0.16	$0.13	$0.12
R15562	470uF 25V	$0.23	$0.20	$0.18
R15563	470uF 35V	$0.30	$0.28	$0.26
R15564	470uF 50V	$0.00	$0.00	$0.00
R15565	470uF 63V	$0.44	$0.39	$0.36
R15581	1000uF 16V	$0.25	$0.22	$0.20
R15582	1000uF 25V	$0.35	$0.30	$0.28
R15583	1000uF 35V	$0.45	$0.40	$0.36
R15591	2200uF 16V	$0.45	$0.40	$0.36
R15592	2200uF 25V	$0.65	$0.60	$0.50
R15593	2200uF 35V	$1.20	$0.91	$0.75
R15601	2500uF 16V	$0.45	$0.40	$0.36
R15602	2500uF 25V	$0.65	$0.60	$0.55

Plus 10% tax where applicable

BRIDGES

	10+	100+	1000+	10K+
6A 400V	1.00	0.80	0.75	0.69
W02	0.24	0.23	0.20	0.18
W04	0.25	0.24	0.21	0.19

NEW MDA3504 BRIDGE!

35A 400V	3.50	2.90	2.75	2.50

Plus 20% tax where applicable

AXIAL ELECTROLYTICS (DOUBLE ENDED)

Cat. No.	Description	10+	100+	1,000+
R15705	0.47uF 63V	$0.12	$0.10	$0.09
R15715	1uF 63V	$0.12	$0.10	$0.09
R15725	2.2uF 63V	$0.12	$0.10	$0.09
R15742	4.7uF 25V	$0.11	$0.09	$0.08
R15745	4.7uF 63V	$0.11	$0.09	$0.08
R15761	10uF 16V	$0.12	$0.10	$0.09
R15762	10uF 25V	$0.13	$0.12	$0.11
R15765	10uF 63V	$0.15	$0.14	$0.13
R15792	22uF 25V	$0.13	$0.12	$0.11
R15794	22uF 50V	$0.17	$0.15	$0.13
R15812	25uF 25V	$0.13	$0.12	$0.11
R15815	25uF 63V	$0.17	$0.15	$0.13
R15831	47uF 16V	$0.16	$0.13	$0.12
R15832	47uF 25V	$0.16	$0.13	$0.12
R15835	47uF 63V	$0.22	$0.19	$0.17
R15841	100uF 16V	$0.18	$0.16	$0.15
R15842	100uF 25V	$0.18	$0.16	$0.15
R15845	100uF 63V	$0.27	$0.24	$0.22
R15851	220uF 16V	$0.17	$0.15	$0.14
R15852	220uF 25V	$0.21	$0.18	$0.17
R15855	220uF 63V	$0.50	$0.46	$0.40
R15871	470uF 16V	$0.27	$0.24	$0.22
R15872	470uF 25V	$0.29	$0.27	$0.25
R15873	470uF 35V	$0.75	$0.70	$0.60
R15875	470uF 63V	$0.75	$0.70	$0.65
R15885	1000uF 63V	$0.60	$0.58	$0.55
R15891	1000uF 16V	$0.39	$0.35	$0.30
R15892	1000uF 25V	$0.45	$0.40	$0.38
R15893	1000uF 35V	$0.70	$0.65	$0.55
R15894	1000uF 50V	$0.00	$0.00	$0.00
R15903	2200uF 35V	$1.20	$1.10	$0.90
R15904	2500uF 50V	$1.30	$1.20	$1.00
R15911	2500uF 16V	$0.59	$0.50	$0.40
R15912	2500uF 25V	$0.95	$0.90	$0.80
R15913	2500uF 35V	$1.10	$1.00	$0.90
R15914	2500uF 50V	$1.30	$1.20	$1.00
R15932	4700uF 25V	$1.90	$1.80	$1.60
R15933	4700uF 35V	$2.40	$2.15	$1.90

Plus 30% tax where applicable

SOLDERING IRON STANDS

Cat No.	1-99	100+
T113023	3.75	3.50

Plus 10% tax where applicable

HORN SPEAKERS

Cat No.		1-99	100+
C12010	5" Plastic 10W Max	4.80	4.70
C12015	5" Metal 10W Max	4.70	4.60
C12012	12V Siren	8.50	8.00

Plus 20% tax where applicable

MINIATURE BUZZER

5-15V White or black
Cat. C15062 10-99 100+ 0.90 0.80
Plus 20% tax where applicable

POLYESTER 100V "GREENCAP" TYPE

Cat No.		1-99	100+	1000+
R15131	.001uF	0.06	0.04	.036
R15137	.0012uF	0.06	0.04	.036
R15138	.0015uF	0.06	0.04	.036
R15140	.0022uF	0.06	0.04	.036
R15142	.0033uF	0.06	0.04	.036
R15143	.0039uF	0.06	0.04	.036
R15145	.0047uF	0.06	0.04	.036
R15146	.0056uF	0.06	0.04	.036
R15147	.0082uF	0.06	0.04	.036
R15148	.01uF	0.07	0.05	.045
R15150	.015uF	0.07	0.05	.045
R15152	.022uF	0.07	0.05	.045
R15154	.033uF	0.07	0.05	.048
R15155	.039uF	0.07	0.05	.045
R15156	.047uF	0.08	0.06	.055
R15157	.056uF	0.08	0.06	.055
R15158	.068uF	0.08	0.06	.055
R15159	.082uF	0.08	0.07	.055
R15160	.1uF	0.09	0.08	.07
R15162	.15uF	0.11	0.10	.09
R15164	.22uF	0.15	0.14	.13
R15165	.27uF	0.16	0.15	.14
R15172	1uF	0.70	0.55	0.50
R15176	2.2u	1.20	1.10	1.00
R15178	3.3uF	1.50	1.20	

Plus 30% tax where applicable

VOLTAGE REGULATORS

	10+	100+	1000+
7805uC	.45	.44	.43
7805KC	1.50	1.40	1.20
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PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.10	.08
PN3642	.10	.08	PN3643	.10	.08
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.16	.14
PN4356	.16	.14	MPSA42	.23	.20
MPSA43	.23	.20	MPSA55	.15	.14
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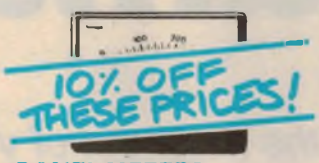

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8237A	35.00	31.00		
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P10902	DB25 Cover	.80	.65	.55
P12210	Centronics Solder	3.50	3.15	2.50
P12200	Centronics Crimp	6.00	5.50	5.00
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Socket	1.40	1.30	1.00
P10882	DB9 Cover	0.60	0.55	0.50
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Socket	1.40	1.30	1.00
P10892	DB15 Cover	0.65	0.55	0.50

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VHF wattmeter for amateurs

Are you getting the most out of your VHF rig? This VHF wattmeter measures RF power to 150W in both forward and reverse directions so that you can calculate SWR and check the efficiency of your antenna system. It's available as a complete kit and can be built for less than $50.

by GREG SWAIN

Sooner or later, every amateur wants to measure transmitter power and transmission line SWR. Power measurements are particularly important when checking or servicing a transmitter to ensure that the unit is capable of delivering its rated power.

But it is not enough to simply adjust the transmitter for maximum power output. It is also necessary to ensure that as much power as possible is radiated by the antenna. For this to occur, the antenna must be arranged to present the correct impedance match to the transmission line.

In amateur installations, the most commonly used form of transmission line is 50Ω coaxial cable. So, in order to match the cable, the input impedance of the antenna must also be 50Ω. Assuming that the antenna is also resonant at the transmitter frequency, it will appear as a purely resistive load and will accept all of the RF energy arriving via the transmission line.

Now consider a situation where the antenna impedance does not match the transmission line — that is, we have an impedance mismatch. This could be due to the antenna not being resonant at the frequency of interest or due to mismatch at the feedpoint.

Depending upon the degree of mismatch, part of the RF energy will now be reflected by the antenna and will travel back down the line towards the transmitter. Thus, only part of the transmitted RF energy will be transferred to the antenna and subsequently radiated.

This is an undesirable situation because the reflected power tends to be dissipated in the cable, even if it is subsequently reflected back up the line by the transmitter. In cases of severe mismatch, damage may even occur to the output stage of the transmitter. And the greater the degree of impedance mismatch, the greater the reflected power and the greater the risk of damage.

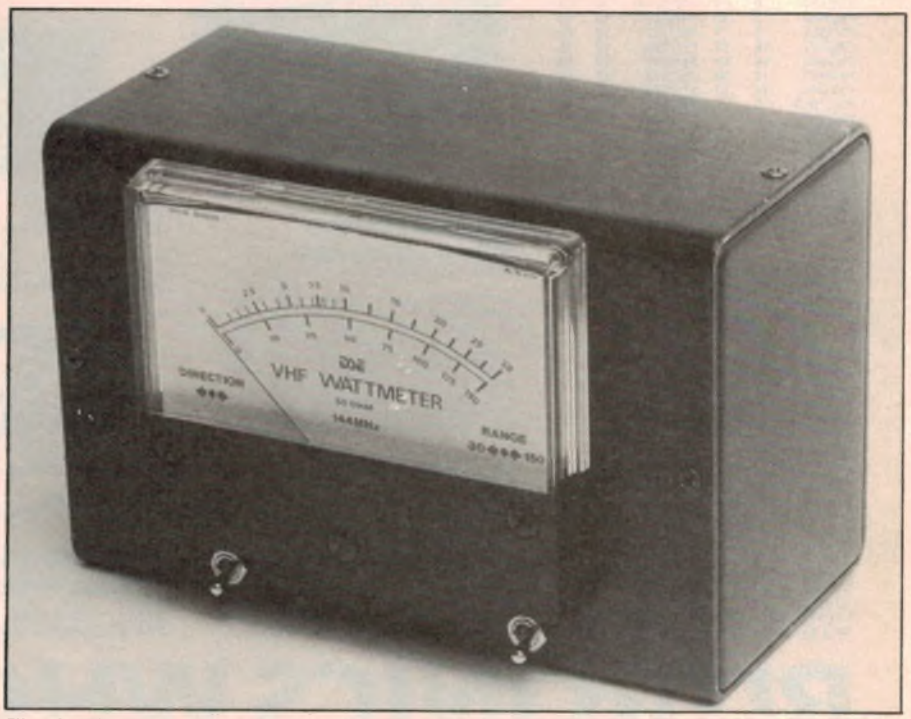
Standing waves

Between them, the forward and reflected power components create standing waves in the transmission line. By measuring the forward and reflected power components, we can calculate the standing wave ratio (SWR) from the following equation:

(1). $SWR = (\sqrt{Pf} + \sqrt{Pr})/(\sqrt{Pf} - \sqrt{Pr})$

where Pf and Pr are the forward and reflected powers respectively.

What does this mean in practice? Just this — in an ideal situation, the reflected power is zero and thus the SWR is equal to 1. This, in turn, means that the antenna is correctly matched to the



The VHF Wattmeter can measure RF power to 150W in both forward and reverse directions.

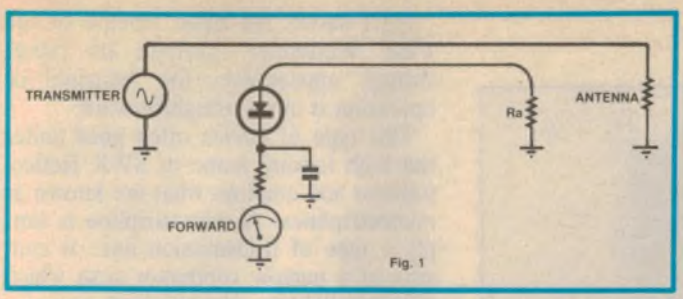


Fig.1: basic scheme for an SWR reflectometer.

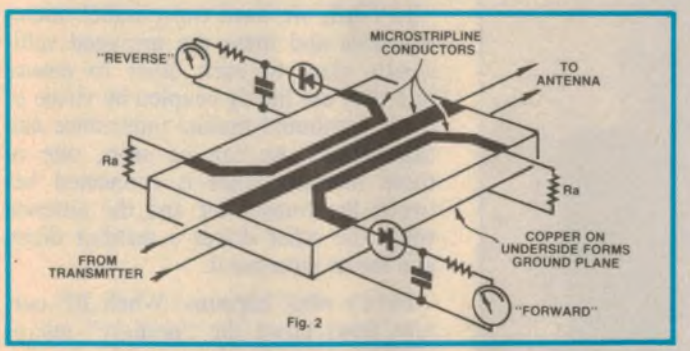


Fig.2: two secondary striplines are required to measure power in both forward and reverse directions.

Specifications

Usable frequency range	144-148MHz
Maximum power	150W
Ranges	0-30W; 0-150W
Accuracy	±10%
Impedance	50Ω
Directivity	>20dB
Insertion loss	<0.1dB

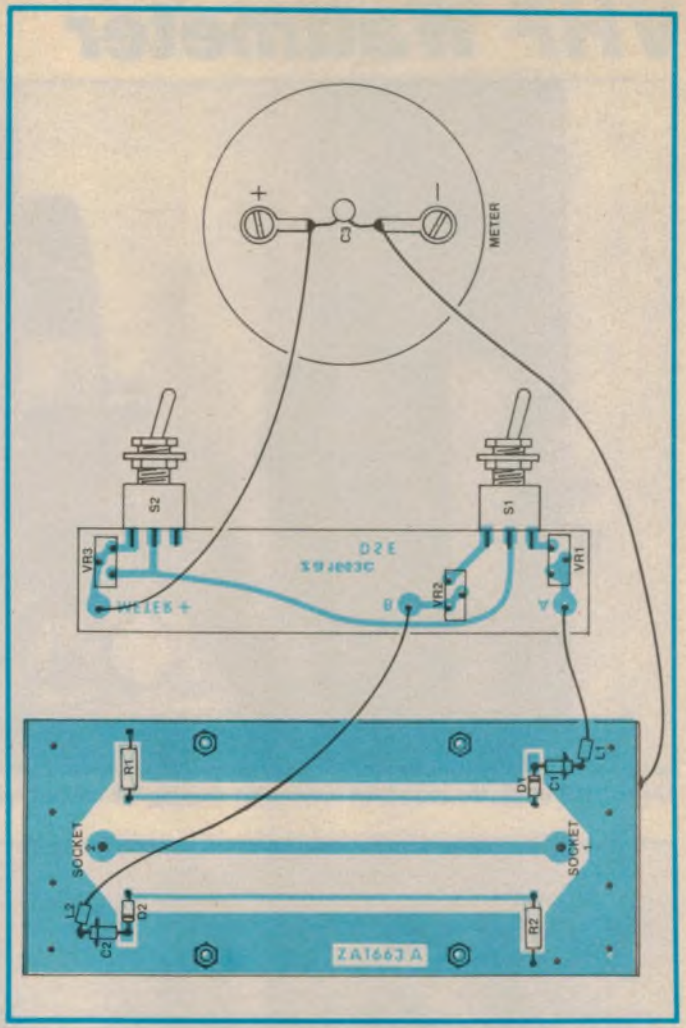


Fig.4: parts layout and wiring diagram for the VHF Wattmeter.

transmission line and that the antenna system is operating at maximum efficiency.

In practice, the ideal situation is never achieved. Instead the aim is to tune the antenna for an SWR as close to 1 as possible. For a small amount of mismatch, the SWR will be around 1.1 or 1.2, increasing for a serious mismatch to 3 or beyond.

What the figures mean

In order to get some feel for the figures involved, let's take a look at a practical situation. Let's suppose that we have an SWR of 3 and that we're shooting 100W "up the stick". By substituting in equation 1, the reflected power turns out to be a quite substantial 25W.

From there, the situation deteriorates quite rapidly. For an SWR of 4, the reflected power is 36W, while for an SWR of 10, the reflected power rises to a massive 67W. Of course, some of this power will be reflected back to the antenna at the transmitter end but, by the time cable losses are taken into consideration, it adds up to a very serious loss indeed.

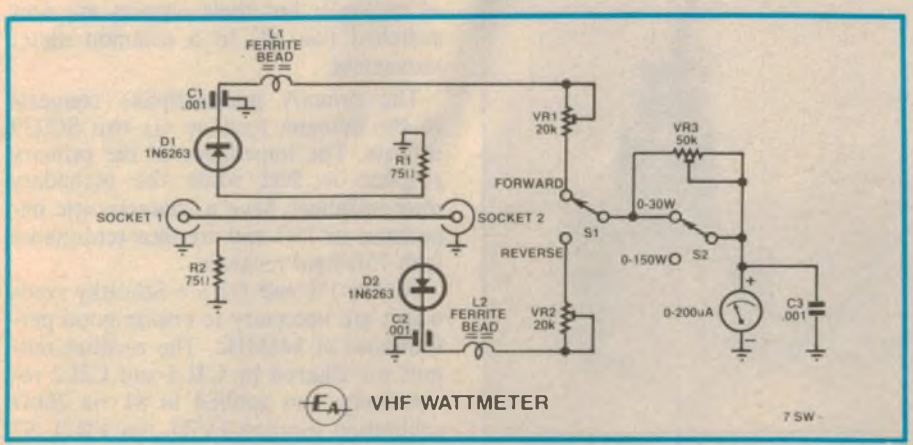


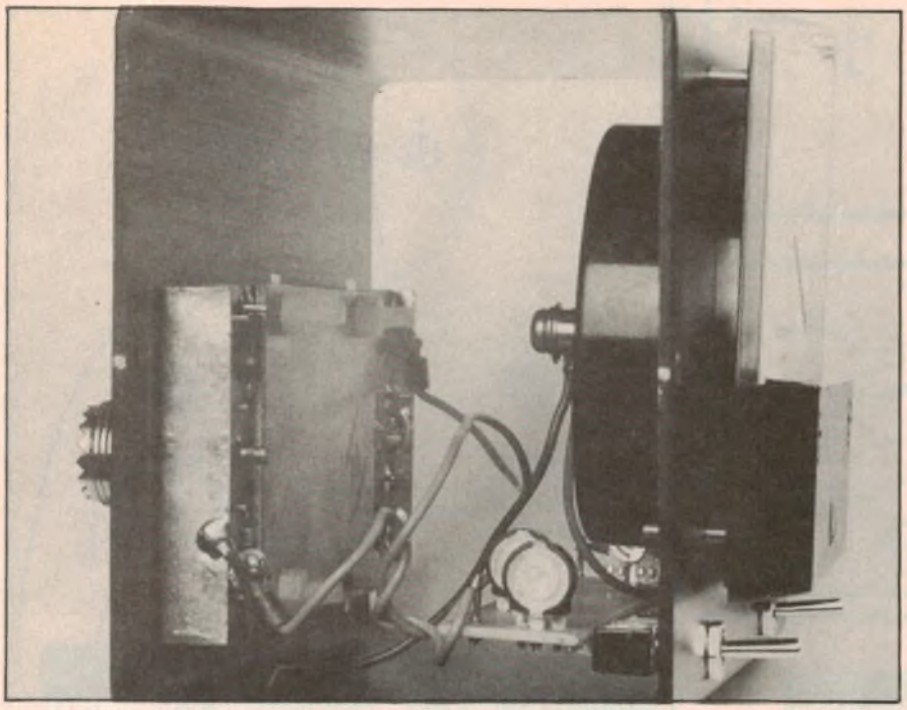
Fig.3: the forward and reverse microstriplines are switched to a common meter.

How it works

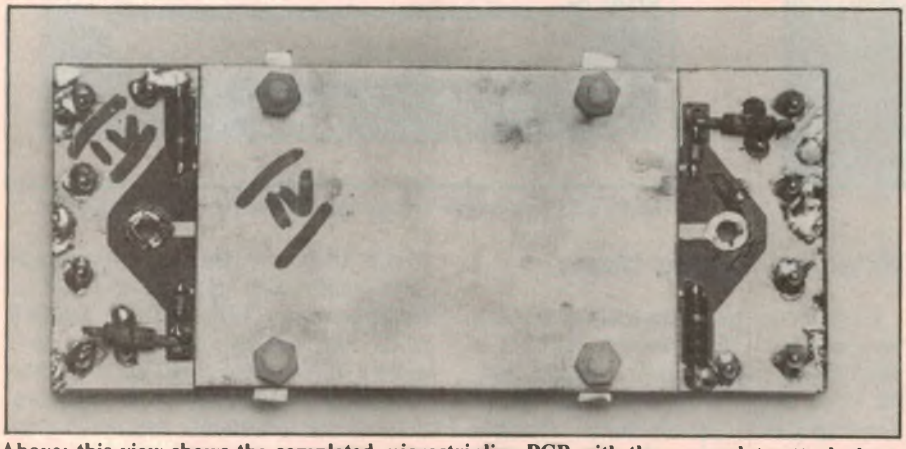
The VHF Wattmeter described here was developed by Gil McPherson, VK2ZGE for Dick Smith Electronics. Basically, it is an insertion type RF wattmeter capable of measuring power in both forward and reverse directions into a 50Ω load. These measurements are then used to calculate SWR, thus doing away with the fiddly controls and complex scales normally required on an SWR meter.

In fact, there are only two scales on the Dick Smith VHF Wattmeter: 0-30W and 0-150W. A forward/reverse switch selects the required power range.

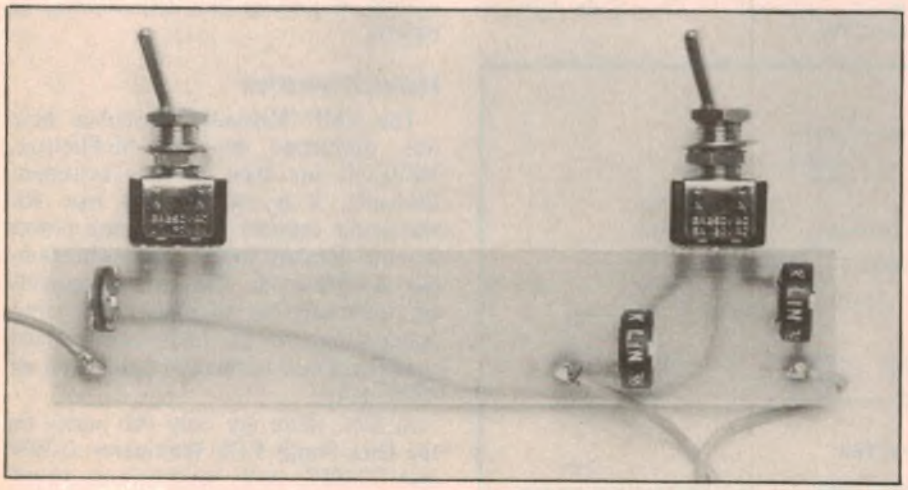
VHF Wattmeter



Above: view inside the completed instrument showing the microstripline assembly.



Above: this view shows the completed microstripline PCB with the cover plate attached.



The two front panel switches are soldered directly to the underside of the trimpot PCB.

Fig.1 shows the basic scheme of the VHF Wattmeter. Despite its rather strange appearance, the principle of operation is quite straightforward.

This type of device often goes under the high falutin' name of SWR Reflectometer and employs what are known as microstriplines. A microstripline is simply a type of transmission line. It consists of a narrow conductor strip which runs parallel to a ground plane.

In Fig.1, we have two parallel microstriplines and these are arranged sufficiently close to each other to ensure that they are lightly coupled by virtue of their distributed mutual inductance and capacitance. As can be seen, one of these microstriplines is connected between the transmitter and the antenna while the other drives a rectifier diode and meter movement.

Here's what happens: When RF current flows down the "primary" microstripline towards the antenna, an induced RF current flows in the opposite direction in the secondary stripline. This current is then rectified and used to drive the forward meter movement.

Note, however, that current flowing in the secondary due to any reflected power is blocked by the diode and so does not affect the meter. Instead, the power is dissipated in load resistor Ra which is matched to the characteristic impedance of the secondary line.

To monitor the reflected power, we need to add a complementary secondary microstripline. Fig.2 shows the basic physical arrangement. The microstriplines themselves consist of strips of copper etched on one side of a small PCB, while the unetched copper laminate on the other side of the board forms the ground plane.

It's now only a short step to the final circuit shown in Fig.3. Both the forward and reverse microstriplines are present as in Fig.2, but their outputs are now switched (via S1) to a common meter movement.

The primary microstripline connects to the antenna feedline via two SO239 sockets. The impedance of the primary stripline is 50Ω while the secondary microstriplines have a characteristic impedance of 75Ω and are thus terminated with 75Ω load resistors.

Diodes D1 and D2 are Schottky types which are necessary to ensure good performance at 144MHz. The rectifier outputs are filtered by C1L1 and C2L2 respectively, and applied to S1 via 20kΩ calibration trimpots (VR1 and VR2). S2 selects either the 0-30W or 0-150W

ranges while VR3 provides calibration of the 150W range.

Construction

Three small printed circuit boards are used in the VHF Wattmeter assembly. The microstriplines are etched onto a PCB coded ZA1663A (120 x 50mm) and this board also holds the 75Ω resistors, feedthrough capacitors and Schottky diodes. A second board coded ZA1663C (100 x 20mm) accommodates the trimpots and switches.

The third board is coded ZA1663B and measures 74 x 50mm. It consists of a piece of single-sided unetched PCB laminate and serves as a cover plate for the microstripline PCB (ZA1663A).

Begin assembly by installing the resistors and diodes. Note that the bodies of these components fit into four cutout areas and that the leads must be soldered on the top (microstripline side) of the PCB. This done, the two feedthrough capacitors can be mounted.

One lead of each capacitor is soldered directly to the cathode of its corresponding diode while the earth disc is soldered direct to the top of the PCB. The remaining (looped) lead is subsequently used to terminate flying leads.

The next step is to fit ten PC stakes (five at either end) through unused holes in the earth pattern of the PCB (see wiring diagram). These stakes should be soldered to both sides of the board using generous amounts of solder. This step is designed to provide a low-impedance path between the earth pattern on the top of the PCB and the groundplane on the other side.

Construction of the microstripline PCB assembly can now be completed by installing the cover plate PCB. The two boards are fastened together using four 12mm nylon screws and nuts. Note that the copper laminate on the plate PCB faces outwards and that the two boards must be separated slightly by installing a 0.3mm-thick shim washer at each screw location (see Fig.5).

Do not leave out the shim washers otherwise the stripline impedances will be incorrect.

Once the microstripline assembly has been completed, attention can be turned to the remaining board. Install PC stakes at the two external wiring points, then mount the trimpots and switches. Note that the switches are soldered directly to the underside of the PCB.

The remaining component, capacitor C3 (.001μF), is soldered directly across the meter terminals. Install the capacitor as shown in Fig.4, together with two 70mm-long flying leads.

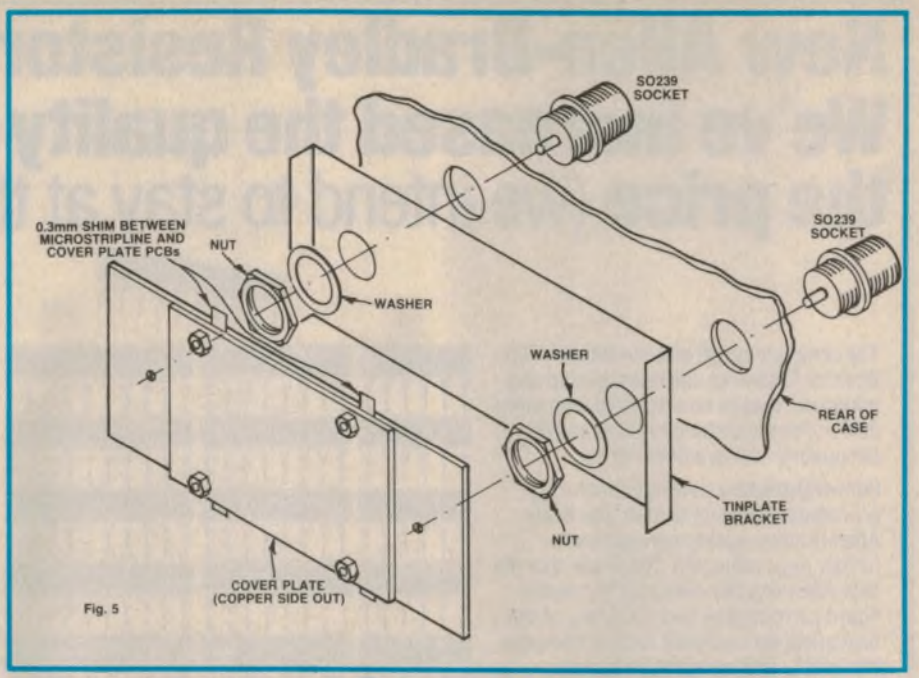


Fig.5: rear panel assembly details. The copper side of the cover plate faces outwards.

Final assembly

The VHF Wattmeter is housed in a black aluminium case, with the input and output BNC sockets mounted on the rear panel. Fig.5 shows the rear panel assembly details. Note that the tinplate bracket is used to provide a reliable earth connection between the sockets and the microstripline assembly.

The assembly procedure is as follows:

(1). Mount the tinplate bracket and BNC sockets and secure them using nuts and washers.

(2). Push the microstripline assembly down onto the socket terminals as far as it will go and solder the terminals to the pads.

(3). Working through the meter cutout, run a rivet of solder between the tinplate bracket and the adjacent earth pattern at both ends of the microstripline PCB.

(4). Attach flying leads to the PC stakes on the switch PCB and mount the assembly on the front panel. Trim the flying leads to length, slip a ferrite bead over each of the free ends, and solder the leads to the feedthrough capacitors on the microstripline assembly. Glue the ferrite beads in position using a dab of epoxy adhesive.

(5). Mount the meter and solder the flying leads to the switch PCB and tinplate shield as shown in Fig.4.

Calibration

There are two ways of calibrating the VHF Wattmeter; (1) by following the basic calibration procedure outlined below; or (2) by calibrating against a known reference.

No specialised RF test equipment is required for the basic calibration procedure which gives sufficient accuracy to allow relative power measurements to be performed. However, you do require a 3-10V variable DC supply, a multimeter (preferably digital), and a 100Ω 0.5W resistor.

The basic calibration procedure is as follows:

(1). Set the power supply to 3.7V as measured on the multimeter.

(2). Connect the 100Ω resistor in series with the positive lead from the power supply.

(3). Connect the negative supply lead to the tinplate bracket in the wattmeter.

(4). Set the direction switch to reverse (ie, to the left) and the range switch to the 30W position, and connect the power supply positive lead (via the 100Ω resistor) to non-earth side of R2.

(5). Adjust trimpot VR2 for full scale deflection on the meter.

(6). Disconnect the supply lead from R2, set the direction switch to forward, and connect the supply lead to the non-earth side of R1.

(7). Adjust trimpot VR1 for full scale deflection.

(8). Set the range switch to the 150W position and wind up the power supply to 9V as measured at the supply terminals.

(9). Adjust VR3 for full scale deflection on the meter, then disconnect the lead to R1.

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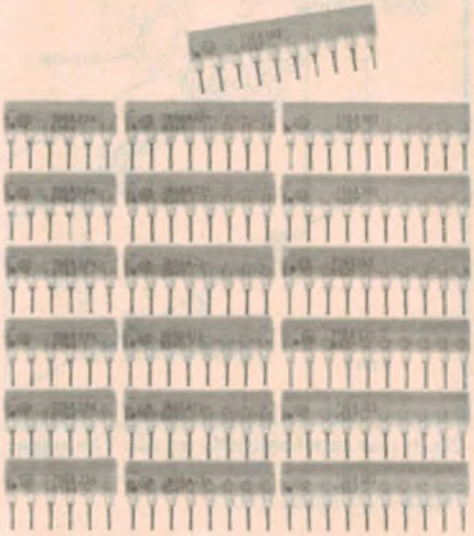

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VHF Wattmeter

That completes the basic calibration procedure which should give sufficient accuracy for most uses. Alternatively, if greater overall accuracy is required, Dick Smith Electronics will calibrate your completed wattmeter against a Bird Model 43 Throughline Directional Wattmeter, an industry standard instrument (see box).

How to use it

In a practical system, the forward and reflected power components vary along the length of the transmission line due to line losses. This means that the SWR is not constant along the transmission line but reduces progressively as one moves back from the antenna to the transmitter. Not surprisingly, the amount of this reduction depends upon the losses contributed by the line.

Because it is the antenna-feedline match that is of interest, there is only one correct place to make SWR measurements: as close as possible to the antenna end of the feedline. Unless feedline losses are quite small, any measurements taken at the transmitter end will be quite misleading.

An example will serve to illustrate the point. Let's say that transmission line losses are 3dB and that the antenna mismatch is such that the SWR is 2:1. Thus, if 100W is fed up the line, only 50W reaches the antenna due to line losses.

By substituting in equation 1, we find that only 44.4W will be delivered to the antenna while 5.6W will be reflected down the line. And, because of the 3dB line loss, only half this reflected power will reach the transmitter, ie. 2.8W.

Thus, inserting the wattmeter at the transmitter end results in a forward reading of 100W and a reverse reading of 2.8W. If we plug these figures into equation 1, we get a quite acceptable SWR figure of 1.46:1. This is significantly less than the real figure of 2:1, the latter representing a fairly serious mismatch.

It gets worse as cable losses increase. In the foregoing example, a 6dB line loss would result in a measured SWR at the transmitter end of only 1.18:1, while a seriously mismatched antenna with an SWR of 3:1 (6dB line loss) will still only give an SWR of 1.29:1 at the transmitter.

The message is clear. If you want to make accurate SWR measurements, install the wattmeter at the antenna end of the feedline.

Finally, in cases of serious mismatch, it will be necessary to make adjustments to the antenna. For example, it may be necessary to employ an antenna tuning unit (ATU), a matching transformer or to make adjustments by one means or another to the antenna itself. The exact approach will vary according to the installation.

Where to buy the parts

A complete kit of parts for this project is available from Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, NSW 2113. Phone (02) 888 2105. Alternatively, the kit may be purchased from your nearest Dick Smith Electronics store.

The kit comes complete and includes a pre-punched case, fibreglass PCBs and an artwork for the meter scale. Also included is a detailed construction manual and a chart for the calculation of SWR from forward and reverse power readings.

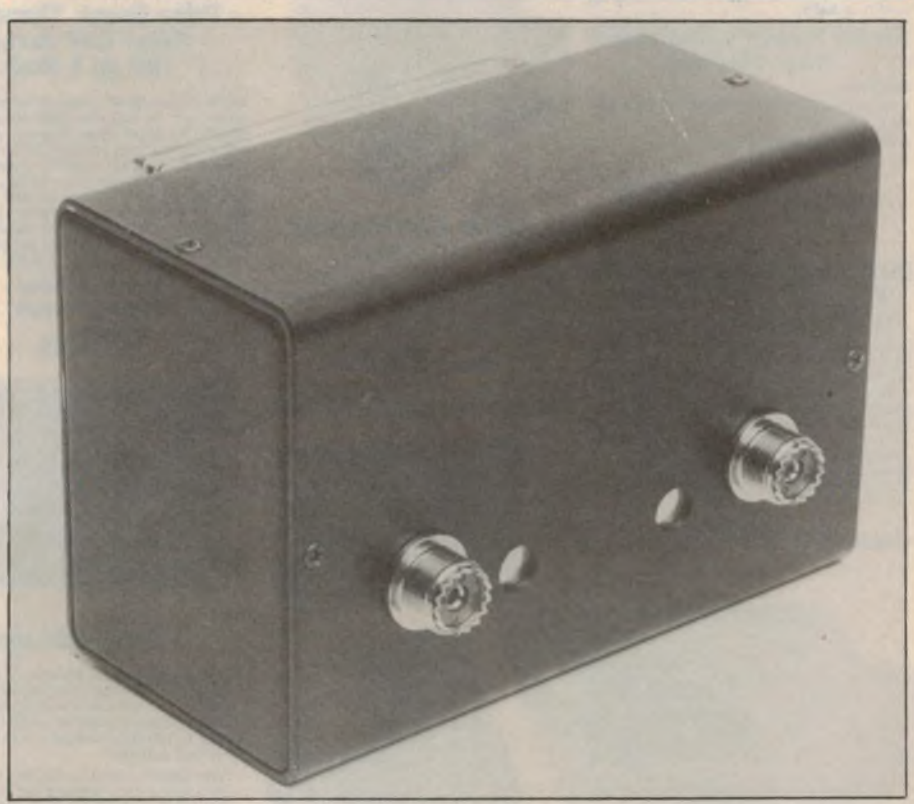
The cost is $49.95 plus postage and packing charges where applicable. The charge for the calibration service is $15.

PARTS LIST

R1, R2 — 75Ω
VR1, VR2 — 20kΩ miniature trimpot
VR3 — 50kΩ miniature trimpot
D1, D2 — 1N6263 Schottky diode
C1, C2 — .001μF feedthrough capacitor
C3 — .001μF ceramic capacitor
L1, L2 — 3503335 ferrite bead
S1 — SPDT miniature toggle switch
SK1, SK2 — SO239 panel-mounting socket
M1 — 0-200μA MU65 meter movement

Miscellaneous

Microstripline PCB (ZA1663A), cover plate PCB (ZA1663B), switch PCB (ZA1663C), pre-punched anodised case with screws, tinplate bracket, scale for meter, 4 x 4BA 12mm nylon screws, 4 x 4BA nylon nuts, 13 PC pins, 4 x 0.3mm thick shim washers (3.6mm ID), power/SWR chart, hookup wire.



The rear panel accommodates the two SO-239 sockets (socket 1 right; socket 2 left).

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Jack O'Donnell

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- LCD Readout
- Blood Pressure Monitor
- Pulse Rate Monitor

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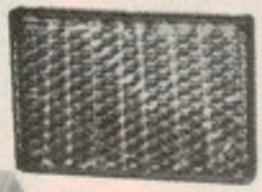

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The infra Red or IR detector for short is basically a high gain passive tuned receiver of a particular IR band. The heart of the unit consists of a high gain lens (antenna) which has a "Commutated" field of view. Its reception pattern is comb-like, but highly tuned to the IR wavelength of human bodies. When a human passes within proximity of the pickup area, the lens will selectively pick up IR radiation and then not. Movement across the pickup area will result in a series of pulses sent to a detector circuit. IR detectors are very reliable as they do not transmit and will not respond to non heat radiating objects.

Features:

- Lens simply 'snaps' to either **wide angle** (range 40 feet) for normal use or **Normal angle** (range 80 feet plus) for corridor applications.
- Snazzy integral mounting bracket allows corner 90 deg. mounting as well as normal surface mount. (This is a fantastic feature as these work best in corners and are visually unobtrusive)
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TECHNICAL INFORMATION Illumination: 22W Fluorescent **Weight:** 8.16kg **Lateral Extension:** 254mm **Vertical Extension:** 254mm **Fixing:** Heavy table base (grey & ivory) with two chrome plated flexible arms. Cat A 0980

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177.8 x 82.6mm Rectangular Piezo Horn Speaker suitable for HiFi and Sound Reinforcement. Full 90° Dispersion Angle • **Freq.Res:** 1.9 to 40KHz • **Sens:** 100db @ 2.8V **C 6140**

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Note: 1986 Cat.price should read $17.95

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The RS-232 surge protector is used to protect RS-232 ports from the possibility of costly damage from large voltage peaks caused by lightning or other power problems. The surge protector used Metal-Oxide Varistors (MOV) to protect pins 2,3 and 7. It has one male and one female connector with all 25 pins connected straight through and with MOV's connected between pins 1 and 2, pins 1 and 7. The MOV's will suppress any voltage above 26 volts without affecting the normal RS-232 voltage levels. The MOV's are capable of handling one joule of energy and 250 amps peak current **D 1510**

$19.50

RS-232 Mini Tester

This Tester indicates the presence of all important interface lines by LED illumination when signal is active. All 25 pins are connected straight through **D 1500**

$19.50

RS-232 Jumper Box

The RS-232 Jumper Box is used to make custom RS-232 interfaces. It consists of a small board with a connector on each end. All 25 pins of each connector go to the 25 solder pads. By custom wiring these pads, many different interfaces can be built: null modems, pin reversers, etc. Also a cable can be connected to tap signals from the RS-232 line. **D 1520**

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Null Modem

The RS-232 Null Modem is used to replace a set 25-pin RS-232 connectors with transit DATA and receive DATA CROSS CONNECTED. (Pin 2 of each connector goes to pin 3 of the other connector) Pins 1 and 7 are connected straight through. Each connector is set up in the loop back mode with pins 4 and 5 shorted together and pins 6,8 and 20 shorted together. The RS-232 Null Modem is used when the proper operation of a set of modems is in doubt. It also is handy when Transmit DATA and Receive DATA need to be reversed. **D 1530**

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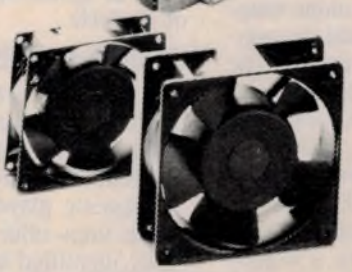

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There are a number of low cost 'Hobbyist' monitors around these days at prices unheard of a year or so ago. However, they all suffer from poor to medium definition or resolution—hence eye strain becomes a real headache. The situation has all changed with the release of the superb **Micron Series 3.** Non glare, naturally, and screen character resolution well worthy of mating up with top end personal or professional computers.

• 1050 lines resolution at centre screen • 22 MHz band width • Video input impedance switch allows networking use.

Specifications:

Screen—Green phosphor **Front Controls**—Power On/Off, character brightness/intensity, display centering **Rear Controls**—Background intensity, vertical and horizontal adjustment etc. **Input Impedance** Switch 75/10K **Bandwidth**—10Hz-22MHz **Resolution**—1050 lines minimum at centre screen **D 1115**

Green Non Glare $199

Universal Monitor Stand

With Pan & Tilt Adjustment

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Altronics Direct Import Price Is Now Under $30

$29.95

A practical approach to Electronics PART 8

How to service cassette decks Pt.2

Replacing the heads in most cassette decks is a relatively simple job. You can also replace the pinch roller and belts, and make motor speed adjustments.

by KINGSLEY HOWE

The heads most commonly used in cassette decks are of three types: mono, stereo and four track.

Monaural heads are found in the smaller, single speaker units. The wiring to these is fairly simple, as there are only two head connections. The head is used for both recording and replay, and differs from stereo heads in that the signals output is a mixture of both the left and right channels (assuming a stereo tape is being replayed).

Stereo Heads

There are three types of stereo heads. Standard stereo heads incorporate both record and replay capabilities in the one head. Some confusion can arise when replacing them. The four pins on the rear of the head may be connected to the internal coils in either a vertical or horizontal configuration. Testing with a multimeter is a must before soldering any leads to them.

Set the meter to the high ohms range to avoid magnetising the head or overheating the fine wire coils inside. The original head may have the coils connected horizontally, and the new head vertically. Check carefully, otherwise you may solder two earth wires to one coil and two signal wires to the other!

The second type of stereo head is called a 'play only' head. This is exactly what they do and no recording is possible. These heads are designed to fit car sound equipment and are cheaper to manufacture than the standard stereo head. They are therefore used where recording is not a requirement.

There is no difference in physical appearance between the two types. A standard record/play head may be used for a car cassette player without problems, but note that play-only heads fitted to a hifi deck will render the recording facility ineffective. If you have unintentionally fitted a head of this type, the erase will still work, but the end result will be a blank tape.

Metal heads are specially made to cater for the high demands of metal tape recording. The coils are more rugged electrically than the standard tape head. Any unit displaying a 'metal' label, should be fitted with a head replacement specified as 'metal tape capable'. These heads are rated at a 16kHz upper limit in reference to metal coated tape, as against the standard head rating of 12.5kHz.

Four Track Heads

Four track heads are really two stereo heads in one housing. They are capable of playing tape in either direction and are found mainly in automatic-reverse car cassette players, although some domestic units offer this facility. They are easily identified by the four pole pieces on the face, and tape guide fingers on both sides of the head. The connecting pins at the rear are usually attached to a small circuit board.

When replacing these heads, make an accurate sketch of the connections before removing the leads.

Head Brackets

The head bracket is the plate on which the head is mounted, and the tape guide fingers are formed from part of this. The bracket is, in most intances, spot welded to the head. It is important that the bracket is not bent or otherwise mistreated, as even the smallest distortion will throw the head out of alignment.

Several patterns of brackets are used. The most common types have a hole at one end and a slot in the other end. Some may have three holes, where two mounting pillars are fitted to the deck.

The size of the head may vary according to the manufacturer. A smaller head does not imply an inferior product, it is just a more compact design.

The most important point to check is the distance between the bracket mounting holes and the head face. If the distance is too short, there will be little or no contact with the tape. To compare the two, place the brackets together (turn one head upside down) so that the holes line up, and view the two head faces. These should be in line. Most are made to standard dimensions, but there are some exceptions.

Changing The Head

You will need a small Phillips head screwdriver to remove the locking screws and release the head. The screws will be found at either end of the mounting bracket, and are often covered with paint or lacquer to prevent movement of the head.

Desolder the wires from the head

first, then place the tip of the hot iron on the head of one screw. Leave it on for a few seconds, so that the lacquer becomes soft, then try to loosen the screw. If it turns easily, heat the other screw next and loosen that. Finally, remove the two screws, undoing each several turns at a time.

When the head is free, lift it out carefully. On the end where the spring is found, a small brass bush will be seen inside it. Lift the spring clear and grasp the bush with a pair of long nosed pliers. Several tiny washers may also be found. To avoid loss of these parts, place them in a plastic lid or the cap from an aerosol can.

The new head can now be mounted, and the wires soldered to the pins. Don't apply too much heat, as the insulation may peel back, leaving bare wires which will short out. If this is the case, use a toothpick to apply a coat of contact adhesive to the exposed wire.

Before going further, give the wires a light pull, to test the soldering.

All being well, anchor the cable(s) in the original position and, to avoid future trouble, place a few drops of contact adhesive where the cables contact each other or the deck. This is to minimise any strain at the joints on the head pins.

As the head moves in and out in use, the cables can flex and twist, causing the wire to break at the rear of the head. This is a common form of failure in cassette decks.

Head Alignment

Tighten the screw on the mounting pillar, then adjust the screw at the spring end, so that the head looks fairly level. Insert a cassette into the deck, and slowly depress the Play button. Watch the head carefully, it should enter the slot in the front of the case, without touching anywhere. Now look from behind the head. The top of the head and the case should be parallel.

Now comes the final adjustment procedure. Leave the cassette in place, set the volume control to a moderate level, and check that the cassette is properly seated. Switch the power on. The cassette should now start to play. If a scraping noise is heard, either the motor pulley, flywheel or the belt is catching somewhere. Give the deck additional support to clear this fault.

Adjust the screw at the spring end of the head bracket, up or down by a small amount. The sound will be loudest when the head is exactly in line with the recorded tracks. On either side of this position, the sound will appear muffled and bassy.

Adjust the screw for the highest volume, then very slowly make fine adjustments for maximum treble. Once this is achieved, switch off and pull the plug from the mains socket.

Coat both screws with contact adhesive. Use a toothpick to run the adhesive over the screw heads and down onto the bracket. This will lock the screws in place and prevent the head shifting.

External Adjustment

On some players, the head may be adjusted via a small hole in the case. Look near the cassette lid, on the side where the head is situated.

The hole will be found directly over the head position and adjustments may be made with a small screwdriver. Don't neglect to lock the head screw afterwards.

Pinch Roller Replacement

When a roller becomes worn or hard, it is best replaced. The roller is secured to a metal frame attached to a steel post on the deck. A spring is linked between the metal frame and the deck, to apply pressure to the pinch roller and spindle when the unit is playing. The position of this spring should be noted before any attempt is made to remove the pinch roller assembly.

A small circlip is employed to hold the frame to the post. This fits into a fine groove at the top of the post and may be eased off using a sharp pointed tool or small screwdriver. Do not try to remove it too quickly, as this may cause the circlip to fly off and be lost. Several small washers may be found on the post also, and these will need to be replaced during re-assembly.

When sliding the new frame onto the post, reset the spring to its original position before pushing the frame home. The frame may have to be manipulated to sit it down tightly, so that the circlip will fit on.

On many frames, a small tab will be found underneath. This extends into the deck linkage(s), and is engaged when the pause button is pressed. Before any other work is carried out, check this for correct operation. First, press the Play button. This should not be stiff or hard to move. If it is, the tab position is incorrect and will have to be relocated.

The play button should now work easily, with the head moving across the deck and the pinch roller contacting the spindle squarely. Now press the Pause button. It should operate with a smooth, easy movement, and give a distinct click on engagement and release. The pinch roller should swing clear of the spindle by several millimetres, and latch in this position.

A few decks have extra holes punched in them for the purpose of altering the spring tension. Unless the spring has become weak, do not increase the pressure. Higher than normal pressure will cause rapid wear on the spindle bearing and, on many decks, these are pressed in and not replaceable.

No Spare Parts

Not all pinch roller assemblies are available as spare parts. There are as many frames as there are deck designs, and some may be obsolete or not imported as spare parts. When faced with this problem, the roller may be purchased as a separate item or removed from a different type of frame. To do this, file the end of the roller pin right down to the frame, then punch it out. Place the new roller in the frame, and burr over the end of the pin to hold it in position.

Check that the frame is not bent out of shape and that the roller turns easily.

If the new roller hub is too high for the frame, it will be tight to turn. These white nylon hubs are of split construction, and the end can be prised off by inserting a thumbnail between the tyre and the flange. Remove the tyres from both rollers and swap them over. Filing the hubs down on the ends is not advised, as this will cause the roller to run up and down as it turns, and thus damage the tape.

"The din you are complaining about, mate, is a tape recording I made of the party you had yesterday!"

Servicing cassette decks

Belts

Belts are used on cassette decks for a multitude of purposes. They drive the flywheel/spindle assembly, tape counter, the fast forward and rewind capstans (depending on the design) and, on units fitted with electronic automatic stop circuits, the magnet or optical system.

Three main types may be found: flat, square or round. Over two hundred sizes are available all told, so choosing the right size can be tricky.

When a belt needs to be replaced, it will almost certainly be in a stretched condition, and the rule of thumb in this case is to use a belt one size down to allow for this.

A loose or worn main drive belt will cause speed variations and failure of the mechanical automatic stop to operate. A loose belt driving the electronic automatic stop will cause the player to stop frequently during play.

The belt should be examined for a shiny surface or oil contamination. A shiny surface indicates slippage and stretch, so turning it over is not likely to improve the grip. Oily belts may be cleaned and put back into service, provided the oil has not made the belt soft. Surface oil and grease may be removed from a belt with a tissue paper and methylated spirits.

Belts several years old can develop cracks in the surface. To test for this condition, stretch the belt slightly so that the cracks become visible.

Do not use a belt that is too small and thus overtight. This would impose a heavy load on the bearings in the deck and may cause the motor to run sluggishly or stall from overload.

Before removing any belts, make a sketch of the belt and pulley arrangement. A drive belt fitted onto the wrong side of a pulley may turn the takeup capstan in the wrong direction and tangle or spill tape.

Fitting Belts

Regardless of how much care is taken when new belts are fitted, some oil or grease will be picked up from the deck. Remove any oil so found from both the belt and pulley groove. When the belt is dry, remove any twists (if the belt is square) to avoid erratic speeds.

The thin circular belts used to drive the tape counter should be fairly slack. Check that the counter does not stick with the new belt — a clacking sound when running, or a jumping motion of the digit reels indicates jamming. Several pushes of the zero button may be needed to free it. No oil should be used, as the plastic is self-lubricating. In fact, lubrication will attract dust and the reels will eventually seize.

Correct tension on the main drive belt can be tested by holding the motor pulley tightly, then turning the flywheel by a small amount. The belt should tighten up on one side and slacken on the other, without much slippage. Next, turn the flywheel only. The motor pulley should rotate freely and without drag. If it feels stiff, the belt is too tight. As a rough guide, the flywheel should be only a little harder to turn than when the belt was off.

Cassette Motors

A wide variety of cassette deck motors is in use. These range from the thumbnail size 3-volt motors in "Walkman-type" portables, through to 240V AC motors in domestic decks.

The majority of cassette player motors are DC-powered, with 6, 9 and 12V types being the most common. All three may be obtained with clockwise (CW) or counterclockwise (CCW) rotation.

Fixed Speed Motors

Fixed speed motors generally rotate at a standard speed of 2400rpm. This speed is maintained by the use of a mechanical governor attached to the motor shaft. If the motor speed rises, contact points open the circuit to the windings, thus cutting off the power. When the speed falls, the points close, and the motor again receives power. The motor is therefore switched on and off very rapidly. Speed is not constant in the strict sense, but averages 2400rpm.

These motors are gradually being displaced by those with an electronic speed control, which is more responsive and reliable. The mechanically-governed motors have one advantage over the electronic type however, in that they may be reverse connected without damage.

Variable Speed Motors

Unlike fixed-speed motors, reversing the polarity on electronically-regulated motors will destroy the control circuit. The circuit is mounted on a small board inside the motor housing. Earlier makes were constructed from discrete components, but these are being displaced by dedicated ICs.

The speed control adjustment will be found on the bottom of the motor housing. It can be altered by means of a small screwdriver inserted through a hole in the housing. This hole may be open, fitted with a dust cover, or sealed with an adhesive label.

The screwdriver should be carefully inserted so that it engages the small trimpot slot inside.

As mentioned before, damage will result if the motors are connected wrongly, or an attempt is made to run them in reverse.

Motor Pulleys

Motor pulleys may be made of brass, aluminium, or plastic. Some are fitted to the shaft by a screw, or may be simply glued on. Plastic pulleys are easily removed by sliding them off the shaft. They are held on only by friction.

Metal pulleys may have screws through the boss, which will be covered with a sealer to prevent them working loose. The easiest way to remove these without chewing out the slot is to heat the pulley with the soldering iron, to soften the sealer. Pulleys that are glued to the shaft may also be loosened by heating. Make sure that you use a rag when handling the hot pulley.

When the motor is installed in the deck, check that the belt is straight and in line with both the motor and flywheel pulleys.

Auto Stop (Mechanical)

Some later model decks do not use a white plastic finger to sense the end-of-tape position. The plastic finger trips out the tape drive due to pressure exerted by the tape itself, whereas the alternate mechanical method involves sensing the lost motion of the takeup reel.

The latter is found on decks where there are nylon gears fitted. At the end of the tape, a cam or gear train is operated to disengage the tape drive. This may take between three and five seconds to operate. Many of these decks generate a rattling noise on fast forward or rewind, due to the clearance between the gear teeth.

Head Cleaning

When cleaning the cassette head, use only methylated spirits or a well known brand of head cleaner. The use of petrol, turps, kerosene, thinners or acetone will damage the epoxy resin surface which surrounds the magnet/gap assembly. The above solvents pit or etch the surface of the resin.

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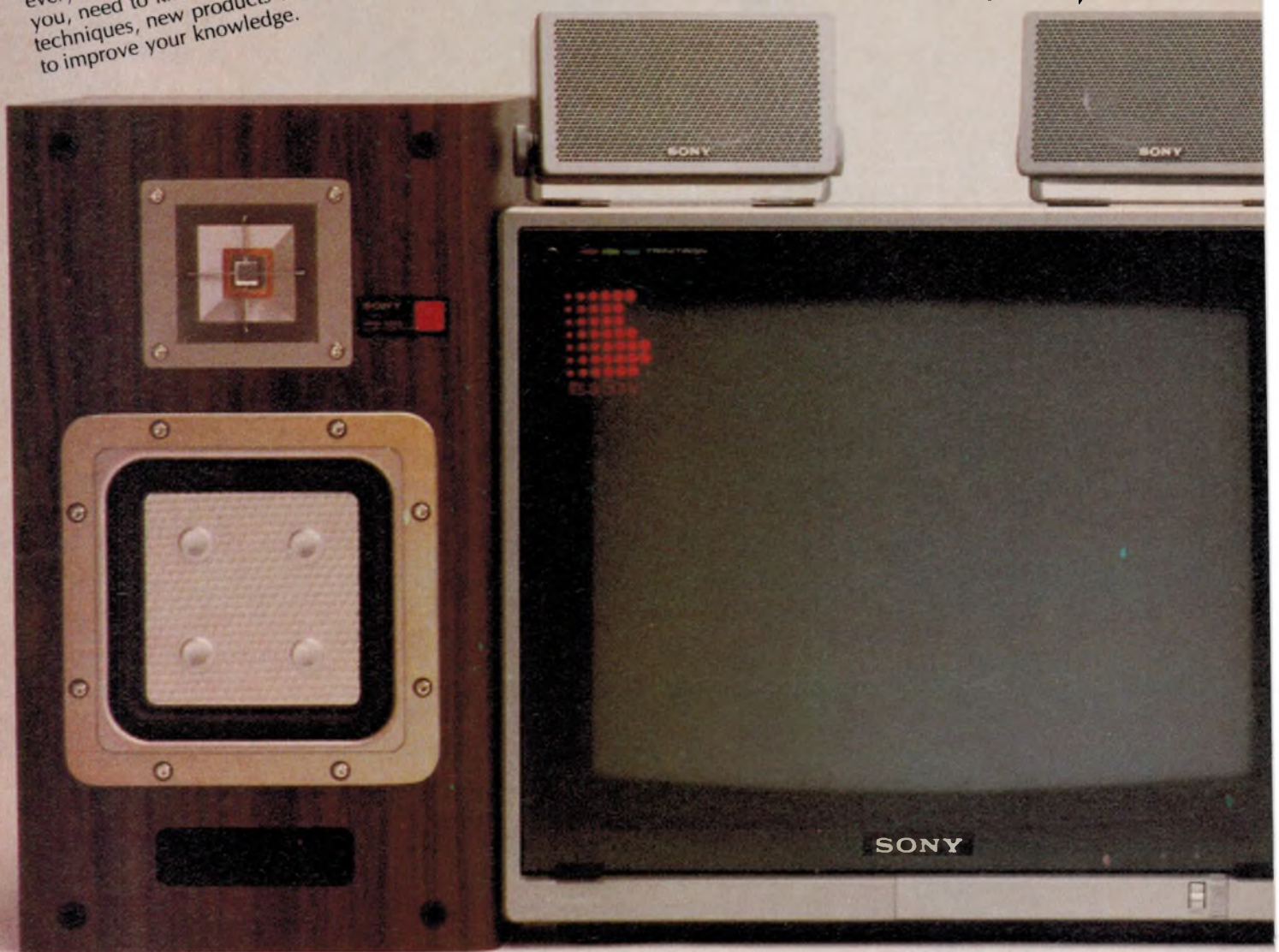

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Compact Disc Reviews

BY RON COOPER

DVORAK

Gipsy Melodies Op. 55.
Love Songs Op. 83
Biblical Songs Op. 99. Peter Schreier, Tenor and Marian Lapsansky, Piano. Capriccio CD 10 053. Playing time: 53 min 28 sec.
PC Stereo Pty Ltd, P.O. Box 242, Mt Gravatt 4122

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

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

Among Antonin Dvorak's various works, which encompass almost every musical genre, the song is an important form. His catalog of works includes several song cycles, and some of the most important of these are the "Gypsy Melodies", opus 55, "Love Songs", opus 83 and "Biblical Songs", opus 99.

The fascinating aspect of these songs is their richness of melodic invention and the depth of the emotions they express — characteristics which make

them as vivid today as ever.

In the "Gypsy Melodies", which first appeared in 1859, Dvorak selected seven texts of Adolf Heyduk (1835-1923) and set them in January 1880.

The "Love Songs", opus 83, compiled in 1888, centre around a melancholy basis tone. Only a few of them seem illuminated by a ray of hope. Love which is not allowed to blossom — the first song begins with this thought.

The cycle of 10 Biblical songs based on texts from the Book of Psalms was composed between the 5th and the 26th of March, 1894. This was a time when Dvorak sought consolation and strength in the word of the Bible. It was not long after the death of conductor Hans von Bulow, one of Dvorak's closest friends and most devoted supporters, and during this time he received the message from his homeland that his father was on his deathbed. The "Biblical Songs" are therefore an expression of the composer's most personal sentiments, and at the same time they document his deep religious feelings. Their content ranges from lament and fervent plea to a song in praise of God.

Contrast and richness of colour are a characteristic feature of this whole disc. However, apart from all this and the magnificent voice of Peter Schreier the piano accompaniment by Marian Lapsansky is a delight in itself.

Overall, the disc is magnificent and I thoroughly recommend it. (R.L.C.)

BARTOK

The Miraculous Mandarin. Dance Suite. Budapest Philharmonic Orchestra. Kossuth. Budapest Symphony Orchestra (No. 7) conducted by Arpad Joo. Kalman Berkes, Clarinet solo. Sefel Records, SE CD 5008. Playing time: 54 min 16 sec.
PC Stereo Pty Ltd, P.O. Box 242, Mt Gravatt 4122.

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

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

The Miraculous Mandarin (Op. 19) is the pantomime that crowns Bartok's stage works and marks a milestone in the history of this century's music for stage and in the composer's own creative development. In this work he presents a typically 'fin du siècle' atmosphere of crisis and the feeling of disharmony which he lived through as a humanist.

The Dance Suite was composed in 1923, four years after the completion of The Miraculous Mandarin, yet despite the many differences in features it is a close relative of the pantomime — a complement to it, as it were.

Kossuth was written in 1923 after Bartok had been influenced the previous year by the first Budapest performance of Also Sprach Zarathustra.

There is a strong sense of vitality in this recording which I am sure is due in no small way to this magnificent all-Hungarian cast performing their native music. Whilst the Mandarin is inherently noisy and not everyone's cup of tea, (Bartok fans may disagree) the dance suite and Kossuth provide an interesting and rythmic contrast. The orchestral performance is really superb, with an extremely well balanced audio and without any obvious intrusions. For Bartok fans this disc is a must. A further bonus is the extensive seven pages (all in English) of information on these works. (R.L.C.)

SCHUBERT

Symphony No.8 in B. Minor. Symphonic Fragments in D. Academy of St. Martin-in-the-Fields conducted by Neville Marriner. Philips 412 472-2 DDD. Playing time: 57 mins 27 sec.

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

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

Schubert's symphonic career spanned a mere 18 years, during which time he set about writing a symphony at least 13 times. His endeavours occupied him, intermittently, from 1811 when he was a lad of 14 to the last weeks of his life in

1828. Yet of the 13 attempts, only seven yielded complete, finished symphonies: for whatever reason, six symphonies were left unfinished. Those he did finish are now, for the most part, well-loved repertory pieces which offer scarcely any clues as to why the others should have been abandoned. It is only in the last quarter of the twentieth century that all the fragmentary works have been identified, transcribed, and made ready for performance.

With his 8th Symphony he composed and scored two complete movements, began a scherzo but probably never finished it, and left behind him no trace of a finale. It remains a mystery that he should have offered the resultant half-composed work to the Styrian Music Society at Graz in gratitude for an honorary diploma conferred on him by that society. No less puzzling is the subsequent action of Anselm Huttenbrenner, the society member into whose hands the manuscript passed, who hoarded it for some 40 years, evidently well aware of its importance yet doing nothing to secure a performance of it. The first performance was given on December 17, 1865 under Johann Herbeck.

This recording can only be described, as just right. Perhaps, I should use all the superlatives I can muster but that's what it is. From the very first quiet opening bars of this delightful evergreen the atmosphere was there, almost scary, because when listening in a semi-darkened room your ears tell you there are people in front of you, no electronics anywhere. So as a reviewer you keep listening, for sooner or later you will find some minor critical point. There was none, and I did! Even the minor chair creaks in the very soft passages only seemed to reinforce the feeling of "being there".

The reconstruction by Brian Newbould of the missing movements are simply Schubert to me and delightful.

The vigorous 3rd movement and "Rosamunde" 4th movement are a bonus, now disappointingly missing from other performances. The symphonic fragments, though unfamiliar, were for me, a new Schubert Symphony and another delight. Oh, I could go on all day. For goodness sake, for nearly an hour of bliss, rush out and buy it! (R.L.C.)

MOZART

Symphonie Concertante, in E flat for flute, oboe, horn, bassoon and orchestra, K297B.
Oboe Concerto in C, K314.
Academy of St. Martin-in-the-Fields conducted by Neville Marriner. Heinz Hollinger (oboe). Philips CD 411 134-2. Playing time: 48 min 27 sec.

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

The Symphonie Concertante in E flat (K.297-B) has a complicated history. According to Mozart's letters, it was commissioned in April 1778 by Jean Legros, director of the leading Paris concert series, the "Concord Spiritual". It was written for wind virtuosos of the time. However, while there is some argument about its authenticity it is none the less a delightful work.

As is usual with Mozart's chamber music it contains very clever and complicated detail with interwoven parts. This allows considerable scope for individual feeling among the players while creating a glorious blend of different sounds between the wind players. The sort of sound that when skillfully recorded can bring joyous tears to the eyes.

Compact Disc Reviews

However, with this particular recording I was disappointed. It lacked the homogenous blend of sound I am used to with Marriner's earlier recording on Philips LP ten years ago.

The program notes refer to a new reconstruction and this contains many surprises for those familiar with it. Whilst the players can only be described as technically faultless I much preferred the smoother and less forceful performance of the earlier version by the Academy with William Bennett on flute. But as this is one of my favourites I am bound to be biased.

The Oboe Concerto in C is the same as his 2nd flute concerto in D and this performance by Heinz Holliger is, as ever, excellent.

The sound quality is close but well suited to the work and allows the fine detail of Holliger's playing to be even more appreciated. The performance and sound balance of this work is a pleasant contrast to the other work on this recording and if merited on its own I would say 9 for both performance and sound quality. (R.L.C.)

MOZART

Symphony No. 38 in D major "Prague" K504.
Symphony No. 39 in E-flat major, K543. The Vienna Philharmonic Orchestra conducted by Karl Bohm. Deutsche Grammophon CD 413735-2. Playing time: 55 min 10 sec.

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

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

The works which Mozart described by the term "symphony", more than 40 all told, demonstrate the evolution of this genre from the simple Italian opera sinfonia to the fully developed classical symphony. They grew not only in scale and in richness of formal design, but also in their musical substance.

A review of a performance of the Symphony in D major, K.504, given at a memorial concert in Prague three years after Mozart's death in 1794 concludes with the words: "Mozart seems

to have written for Bohemia; nowhere is his music understood and performed better than in Prague." Prague was, indeed, the only city in which Mozart had a large, faithful public during his lifetime.

From the solemn introduction (Adagio) right through to the Presto finale in the style of a swift-moving buffo scene there is obviously a close connection between this music and opera buffa. By comparison the Symphony in E flat major K. 543 is more serious in effect. Despite its elements of lively animation and serenity, the principal impression left by this music is of the dignified pathos of opera seria.

This is the first of three masterly Symphonies (in E flat, G minor and C major) which Mozart composed during the incredibly short space of six weeks during the summer of 1788. Mozart hoped with these works to repeat the success of his first years in Vienna. To no avail, however — the symphonies were never performed during his lifetime. It was not until years after Mozart's death that the general public began to recognise his importance, and to react in a manner comparable with that demonstrated at that memorial concert in Prague in 1794.

This analog recording is fairly typical of many DGG releases in that the sound balance strongly favours the strings with apparent natural reverberation carrying the woodwinds and brass, with the tympani somewhat boomy. The result, though very pleasant is dated, not up to the standard of later recordings. However, with these excellent works of Mozart under Bohm's baton you tend to forget such things and become totally absorbed in the music.

The tempos to me were just right and if you like Mozart but are unfamiliar with these symphonies don't be too concerned. You only need to hear these once and you're hooked! (R.L.C.)

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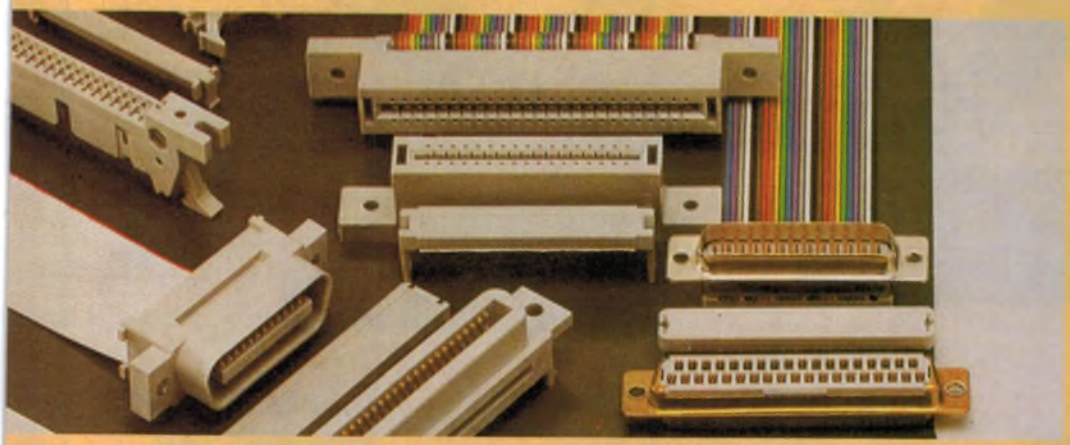

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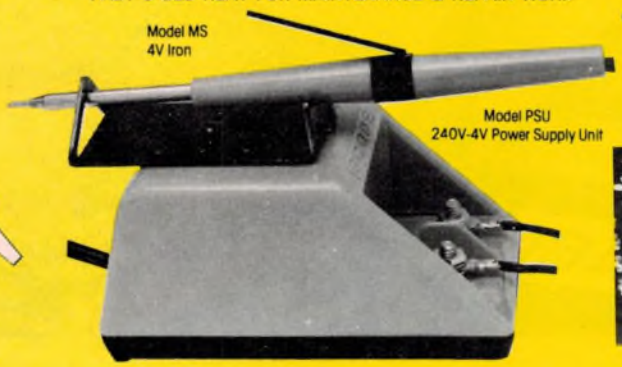

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JMS 196

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly

June 1936

TV in France: (from the editor visiting Paris) the service has been in operation for about two months, but has not created any great public interest. The definition is only 180 lines, which means pretty rough pictures, and there are 25 pictures per second, without any interlacing, which means plenty of flicker.

The programme consisted first of Punch and Judy, then a Spanish dancer, a Chinese contortionist and a couple of female sopranos. It would have been much nicer if the contortionist and sopranos had been left out as they were painful to look upon. The dancing act was considerably hampered by focal limitations, the picture going out of focus if the dancer moved about two feet nearer or farther from the scanner.

Cordless microphone: (caption) O.B. Hanson, chief engineer at N.B.C., explains the new "top hat" micro-wave radio transmitter, through which celebrities will broadcast descriptions over the N.B.C. The transmitter is concealed in the silk hat; power to run it comes from batteries in the belt and the small microphone is little larger than a watch.

Mousketeers: (advertisement) Hey! Are you a Member of the Mickey Mouse Club? Learn the rules by tuning to "The Adventures of Mickey Mouse" each Wednesday and Friday at 5.15 p.m.

Trade Tariff: very few of the radio trade expected that the tariff schedule recently introduced would have such a profound effect on the radio industry as a whole.

Undoubtedly its effect will be that Australian radio will become more and more self-contained, and that Australian factories will in future supply the complete needs of the country in radio goods. Those which it is not practicable to manufacture here will be imported from other Dominions, or from Great Britain.

RADIO, TELEVISION and HOBBIES

June 1961

Large screen TV: the first public demonstration of large screen (12ft x 9ft) simultaneous colour television to be held in Britain was seen recently by 400 delegates at a convention.

The large screen display consisted of a colour television projector capable of accepting NTSC type colour TV signals. The wide angle viewing characteristics of the screen enabled the large audience to view pictures with maximum clarity.

Burning it off: an electric shaver which has no cutting mechanism but burns the whiskers off instead has been patented in America. The shaver is powered by a low amperage current at 600 to 800 volts which is fed to alternate metal teeth in a cutting head shaped like a comb.

When the shaver is turned on very small electric arcs are caused between the teeth and as it passes over the face the beard is burned off.

End of FM: according to a recent announcement, the Broadcasting Control Board has recommended the cessation of "experimental" FM Broadcasts, which have been conducted by the P.M.G. and the A.B.C. for some 10 years.

Reason given for the step is that the frequencies are required for country television stations. As a further observation, it has been stated that very few people listen to FM.

An introduction to hifi

ARMS AND TURNTABLES

A mix of geometry & physics

Having discussed groove characteristics in conventional analog phono discs, playback cartridges and styli, we now turn to pickup arms, turntables, drive systems and other aspects of phono decks. As before, precision and attention to detail determine the ultimate playback quality.

by NEVILLE WILLIAMS

A pickup arm may appear, at first glance, to fill a fairly routine role in supporting the playback cartridge as it moves across the surface of the disc. In fact, the reverse is true, as will become evident from a closer look at the geometry of the system.

When inscribing the original groove in a master recording, the cutting head is guided across the surface by a leadscrew mechanism, broadly similar to the tool feed in a lathe. As indicated in Fig.1a, the stylus tip follows a straight line (radius) path from the perimeter of the disc towards the spindle.

With the stylus support axis at 90 degrees to the traverse path, it will form a tangent, at the point of contact, with the groove being cut. Lateral movement of the stylus, with modulation, will therefore be in line with the radius and at right-angles to the incremental direction of the groove.

If all recordings used a spiral of uniform pitch, the above geometrical relationships could conceivably be preserved during playback by using a matching transport system for the pickup head. But that is not to be because, in practice, groove pitch varies widely from disc to disc.

When recording program material in which the signal level is modest and uniform, record producers tend to use relatively close spacing, making possible a longer playing time. With music involving frequent loud passages, the opposite applies.

In addition, groove spacing is further manipulated to provide run-in and run-out grooves and identifiable gaps between selections.

A playback pickup must consequently be able to follow the track spiral on any given recording, without imposing significant sideways pressure on the groove walls. By far the most common approach is to fit the playback head to a pivotted arm, as illustrated in Fig.1b.

Tracking error

It will be apparent from the diagram that, with a pivotted arm, the playback stylus moves across the record surface in an arc rather than a straight line, pointing up an obvious discrepancy between recording and playback geometry.

By selecting the distance between the pivot point and the turntable spindle, the stylus axis can be tangential to the groove at a particular radius but, elsewhere, the stylus will be tracing the groove from an oblique angle.

As a result, it will respond in a slightly different way to the inward and-outward excursions of recorded waveforms. The problem is described as "tracking error" and the end effect as "tracking distortion".

Tracking error can be reduced by using a longer arm and thereby describing a shallower arc but it is not a very practical solution. Longer arms are more awkward to accommodate and, being heavier, they are also less compatible with high compliance cartridges.

Another option is to use an articulated design, such that the head swivels on the end of the arm as it moves across the surface of the disc. The idea works, as evidenced by the now discon-

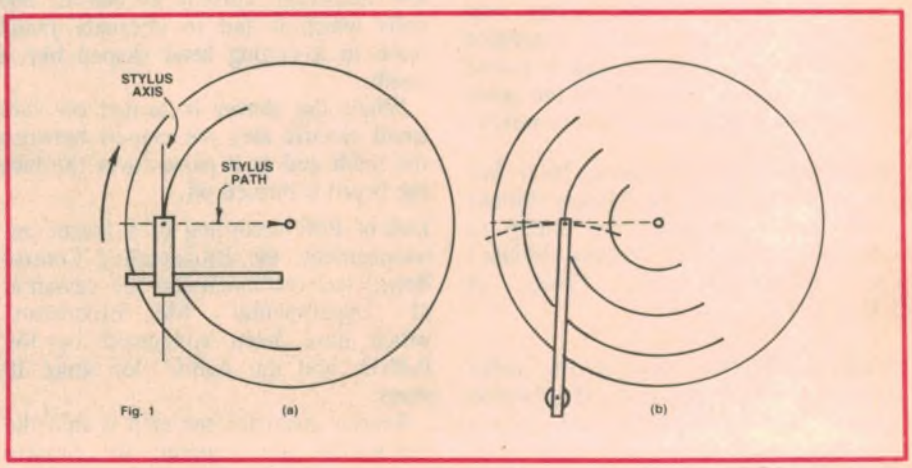

Fig.1: A recording stylus (a) travels across the record in a straight line. With a pivotted playback arm (b), the stylus travels in an arc, leading to problems with tracking error and tracking distortion.

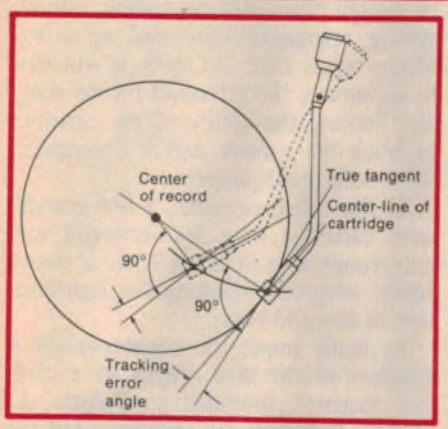

Fig.2: By offsetting the headshell and cartridge axis, relative to the pivot-stylus line, it is possible to obtain much improved — but still not perfect — tracking.

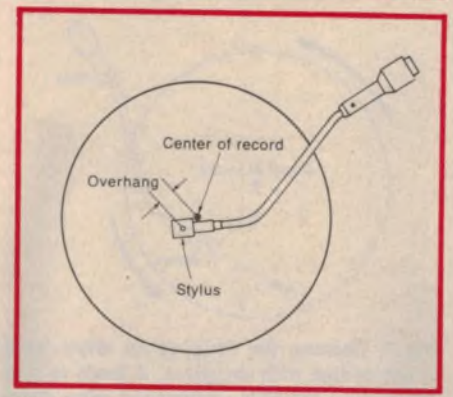

Fig.4: Assuming that a pickup arm has been correctly designed, and the cartridge correctly fitted, optimum tracking will normally be obtained if the overhang is as specified by the manufacturer.

tinued Garrard "Zero-100" player, but it presents problems in terms of complexity, cost and quality control.

The preferred and virtually standard approach is to use a rigid arm but to offset the head, inclining it inwards, as in Fig.2. Correct tracking becomes possible at two radii, while the error elsewhere is considerably reduced, compared with an in-line head, for the same pivot-stylus distance.

The shape of pickup arms — or "tonearms" — has long been the subject of unfounded claims. The fact is that the determination of offset angle for an arm of any given pivot-stylus size is a purely mathematical exercise, which can yield zero tracking error at two nominated radii and predictable — but unavoidable — discrepancies elsewhere.

It is immaterial, as far as tracking is concerned, whether the specified offset involves a headshell attached obliquely to the end of a straight arm, as in Fig.3 (left), a J-shaped arm (centre), an S-shaped arm (right) or any other conceivable contour.

The mathematically based arm dimensions that govern ultimate tracking characteristics are the head offset angle, the pivot-stylus distance, and the "overhang", as illustrated in Fig.4.

Where an arm is an integral part of a deck, care is necessary when replacing a cartridge, to ensure that it is positioned in the headshell so that the stylus/pivot distance and/or the overhang are as specified — or as before.

Where an arm is to be fitted for the first time, all three dimensions should be cross-checked: spindle/pivot, stylus/pivot and stylus overhang.

Some arm and cartridge manufacturers provide alignment guides for setting up their products. While these may be helpful in ensuring that the system conforms to the best calculated tracking compromise, they cannot eliminate the basic problem.

Fig.5 is a graph of the tracking characteristic of a typical high quality phono player. Note that one region of minimum tracking error includes the critical inner grooves (60-70mm radius) where the recorded wavelengths are small and tracking distortion is likely to be most troublesome.

Balance & anti-skating

Normal practice is to provide an adjustable counterweight at the rear of a pickup arm to balance the weight of the arm, headshell and cartridge. With the phono deck on a level surface, it should be possible to adjust the counterweight so that the arm floats freely, with the stylus tip just clear of the record surface — a condition described as "static" balance.

By careful distribution of mass and the placement of the respective pivot axes, it is possible for a pickup arm designer to achieve a condition described as "dynamic" balance, whereby the stylus will continue to float in the same position relative to the surface of the

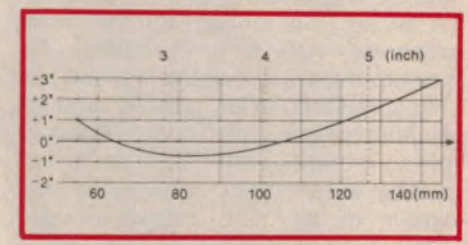

Fig.5: The published tracking error curve for a high quality Technics phono deck using a conventional S-shaped pivotted arm. It would be typical of other 230mm (9-inch) pickups.

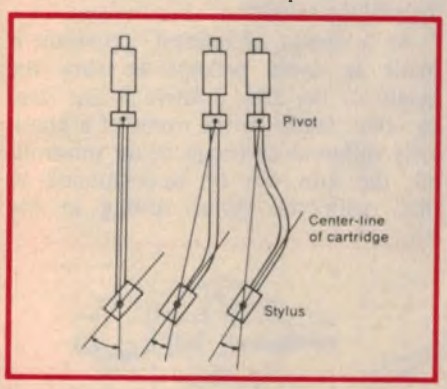

Fig.3: In terms of tracking characteristics, the shape of the pickup arm is immaterial. What matters is the distance from the pivot to the stylus and the offset angle of the head relative to the pivot-stylus line. (See also Fig.4).

Linear tracking turntables

Over the years, a few playback turntables have been released, fitted with a linear tracking arm mechanism. In most cases, the arm is supported by a rail but pulled along, as necessary, by an electronically controlled, motor-driven loop or belt.

Sensors at the pickup head, operating in conjunction with a servo system, ensure that the pickup arm moves along the support rail at a rate commensurate with the groove pitch. Automatic or user push-button controls take care of start, skip, reject, end of play functions, etc, to obviate the need for manual handling.

As the name implies, linear tracking turntables do obviate the tracking problems of radial arms, reducing error to less than 0.1 degree. But, as with articulated arms, they introduce other complications which reduce their appeal to hifi devotees as, for example, a limited choice of compatible replacement cartridges.

Their main application, to date, has been in push-button "space age" compact music centres, rather than in traditional audiophile systems but they are available in the hifi marketplace, if you look for them.

An introduction to hifi

disc, even if the whole deck is gently nudged or tilted.

While there may seem to be little point in striving for this capability, the fact is that, in typical listening rooms, vibration from foot-falls and high-power bass loudspeakers can "nudge" phono decks and produce spurious sonic effects. By stabilising the pickup arm, dynamic balance helps to minimise the problem.

Straight arms, with an offset head, as in Fig.3 (left) lend themselves to dynamic balance, relying on a spring to apply the requisite playing force to the stylus.

Most manufacturers, however, tend to favour J- or S-shaped arms — particularly the latter — for their ability to accommodate interchangeable shells and cartridges. Dynamic balance can still be a design objective, while tolerating sufficient residual unbalance to allow the playing weight on the stylus to be determined by adjustment of the counterweight (Fig.6, right) — claimed to be more predictable than a spring system.

A complication of any offset head is that the drag of the groove on the stylus (A in Fig.7) is in line with the head rather than with the pivot (dotted). As a result, it tends to pull the arm inwards (B), increasing stylus pressure against the inner groove wall. The side-thrust is said to average about 12% of the stylus playing weight, being greatest at the outside of the disc, because of the greater groove velocity.

To offset the side-thrust, quality phono players include "anti-skating" devices of one kind or another, intended to swing the arm gently outwards. On the left, in Fig.8, a small weight and a nylon thread serves the purpose; in the centre a weight and a couple of small levers achieve a similar result. On the right, a spiral spring is fitted in the base, with a knob allowing the anti-skating bias to be adjusted according to the selected playing weight.

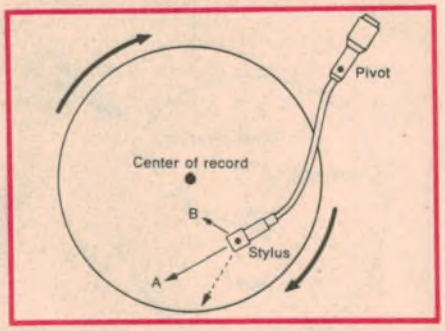

Fig.7: Because the drag on an offset head is out of line with the pivot, it tends to pull the pickup inwards, calling for some form of anti-skating bias to equalise the pressure on the respective groove walls.

Moving mass

While it is usually possible, by means of a spring or a counterweight, to achieve static balance and correct playing weight with arms, headshells and cartridges of relatively high mass, another problem has to be considered, namely that of "moving" mass.

The greater the mass of the above components, the greater their inertia and the effort either to initiate or restrain movement. For example, in the presence of undulation or eccentricity in the record grooves, the effort needed to lift the head or move it sideways may be sufficient to displace the cantilever of a high compliance cartridge from its normal median position, resulting in higher distortion.

A lightweight cartridge and headshell — with the counterweight wound in closer to the pivot — presents less of a problem. Similarly, lightweight arms are preferred, although the design and the material used in their construction must provide adequate rigidity and relative freedom from structural vibration modes.

Bass resonance

In this general context, consideration also has to be given to the natural mechanical resonance which occurs between the mass of the arm, etc, and the compliance of the stylus system.

If a highly compliant cartridge is fitted to a high mass moving system, the resulting resonance may end up somewhere below 6Hz. As such, it will tend to accentuate the effects of record warp, etc, limiting the ability of the cartridge to track the groove and/or "pumping" the woofer loudspeakers.

At the other extreme, a low compliance cartridge in a featherweight arm may result in a resonance at or above 16Hz, adversely affecting the reproduction of low-end bass.

(In many arms, the counterweight is attached to the arm proper by a resilient support, intended to reduce the "Q" — therefore the severity — of the overall system resonance.)

Arm suspension

With the progressive refinement of groove, stylus and cartridge technology, it is essential to ensure that the vertical and horizontal pivotting arrangements for the arm are as near to friction-free as possible. At the same time, they must support the arm positively and firmly, so that the player will be practical and reliable as a consumer product.

Simple bushed bearings are unacceptable, as also are the one-time mechanical trips and levers of mass-produced automatic players and record changers. Modern high quality decks may, indeed, offer automated play facilities but using optical or electronic sensing rather than mechanical trips, and (typically) miniature bearings of "watchmaker" precision.

Such precautions, along with suitably flexible connecting leads, can reduce the total mechanical friction, in either direction, to a few milligrams at the stylus tip — two orders of magnitude less than the playing weight.

As a matter of interest, provision is made in some pickups to vary the height of the arm, relative to the base by about 6mm. In the event of a physically different cartridge being substituted, the arm can be re-positioned so that, with the stylus resting in the

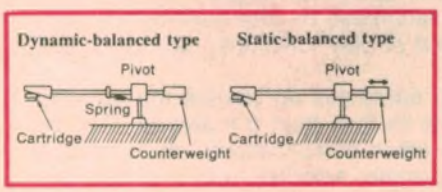

Fig.6: A fully dynamically balanced arm relies on a spring (left) to provide the tracking pressure. Most rely on gravity for the playing weight (right), even if dynamic balance is compromised.

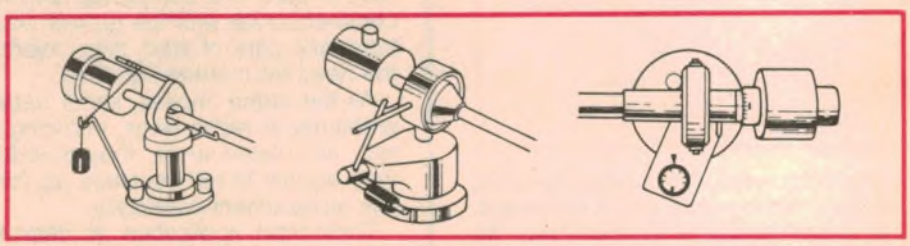

Fig.8: Typical anti-skating devices. They may not exactly cancel stylus drag at all radii but manufacturers' recommendations should be followed in setting them up.

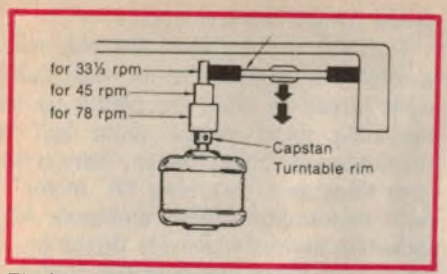

Fig.9: Well suited to mass production, idler wheel drives are popular in budget priced record players. A resilient idler, however, offers only limited isolation between the motor and turntable.

groove, the underside of the arm and cartridge are parallel to the record surface.

Phono turntables

As with pickup arms, there is a lot more to phono turntables than the mere ability to spin discs at the appropriate speed. An indifferent turntable can compromise the sound in various ways and those found in quality decks normally reflect a high level of precision in both design and finish.

Whereas budget priced turntables are normally pressed from steel plate, quality units are more commonly die-cast and machined from aluminium or a non-magnetic alloy, both for accuracy and to obviate interaction with magnetic cartridges. Individual static and dynamic balancing ensures that they will run smoothly, even if operated on a non-level surface.

The mass, normally concentrated close to the rim, is usually kept as high as practical, in order to achieve a good flywheel effect but not so high as to prejudice normal starting and stopping.

Special care is taken with the main bearing, to ensure that it is free from rumble and that the turntable runs absolutely true. Rumble can all too easily be communicated to the stylus and cartridge and be amplified along with the recovered signal. Needless to say, these qualities have to be displayed in long term — not just when the player is new!

A point which needs to be watched is that a turntable must not behave like a gong, chiming spontaneously when tapped with a knuckle! It should be as acoustically inert as possible, so that noise and vibration reaching it from an extraneous source will not be reinforced and passed on to the stylus and cartridge.

Turntable mats can have an important bearing on the acoustic qualities of turntables and, as such, are the subject of frequent debate. They range from a felt-like texture, through rubber and plastic in a variety of patterns to glass-wool.

Curiously, while most hifi manufacturers favour fairly heavy machined aluminium turntables (2.5 to 3.0kg) a few opt for very lightweight platters. NAD International, in their 5120 model, use a thin aluminium platter with a 7mm thick dense rubber mat, which they consider to be acoustically inert.

Without seeking to debate such options, it is reasonable to assume that turntables from specialist hifi manufacturers will do a good job, even though they may differ widely in their design philosophy.

Turntable motors

With the introduction of microgroove records, it became necessary to devise a turntable drive mechanism more amenable to multi-speed operation than the old-style governor type electric "gramo" motors. Hopefully, it would be possible simultaneously to reduce 50Hz hum radiation, along with bearing and governor rumble, and to ensure more predictable playing speeds.

The initial answer was the system depicted in Fig.9 — a mains powered induction motor, with a stepped capstan, driving the inside rim of a (normally) pressed steel turntable, per medium of a resilient idler wheel. A knob or lever allowed the idler wheel to be re-positioned to engage the required step on the capstan.

Turntable speed was determined by — and dependent on — the nominally synchronous speed of the motor, stepped down by the diameter ratio of the capstan and turntable rim.

The rim drive system remains a popular choice for budget-priced record players but suffers the basic problem that a resilient idler wheel can provide only limited mechanical isolation between the drive motor and turntable.

As a result, residual vibration and rumble from the motor, plus noise from the idler wheel, can still be communicated to the turntable and thence to the stylus and cartridge. Even speed regulation is likely to be no better than passable.

While these limitations can be countered by more demanding — and costly — design and production standards, the idler rim-drive system still equates more to economy players than to true hifi equipment.

Belt drive systems

When the limitations of the idler drive system became apparent, hifi buffs turned to belt drive, on the assumption that a flexible rubber or neoprene belt

An introduction to hifi

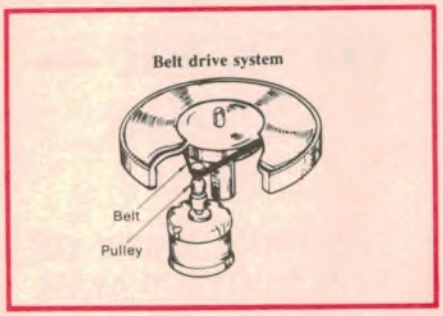

Figure 10: Belt drive offers good isolation between turntable and motor but tends to need more care and maintenance than other systems. Some audiophiles prefer them, however.

would more effectively isolate the drive motor from the turntable. This certainly proved to be the case, although manipulation of the belt for speed change purposes proved to be more of a problem.

Fig.10 illustrates belt drive to an inner drum from a two-step pulley (speed change lever not shown). The thinking behind this is that, by driving an inner drum, the heavy outer rim is able to function more effectively as a flywheel, smoothing out residual vibration and speed variations.

At the other extreme, systems like the Australian "JH" used a tiny synchronous motor to drive the outside rim of an extremely light aluminium platter, with a round rubber belt of about 1.5mm diameter!

While belt drive proved smooth and substantially noise-free, it had its own problems in the way of belts that variously slipped, perished, sagged and fell off, and for which replacements were often difficult to locate.

Nevertheless, they built quite a following among audiophiles and, even today, some of the most prestigious record players boast the time honoured "high quality AC synchronous motor" and "precision neoprene belt drive".

Back to direct drive

Then in the early '70s, the major Japanese hifi manufacturers came up with an alternative to gears, idler wheels and belts: ultra low speed, direct drive (DD) motors, requiring no intervening drive mechanism and relying, in most cases, on electronic control for speed change and regulation.

Typically, a direct drive turntable uses a brushless multipole motor with sufficient torque to bring the platter up to operating speed within about half a revolution. In reality though, there is no such thing as a "brushless DC motor". Such motors are actually multipole AC induction motors which are driven by a set of four transistors in bridge configuration from a DC source.

These motors were originally developed by the Japanese to solve the problem of commutator hash in battery operated turntables and tape decks.

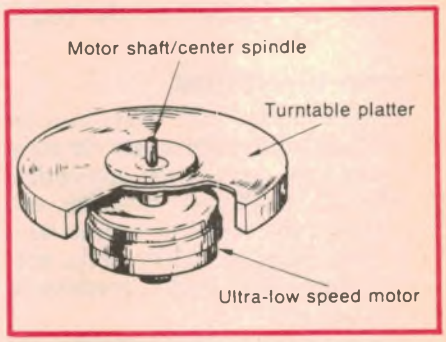

Fig.11: The Technics SP-10 (1970) claimed to be the world's first high performance, multi-speed direct drive turntable. In later designs, the turntable is more intimately integrated with the rotor.

From there they were improved and used in increasingly refined speed control circuits which culminated in "servo controlled" and "quartz controlled" turntables which have now been on the market for about 15 years or so.

These work as follows. Under the rim of the turntable is a set of optical or magnetic markers and sensors which allow the unit to generate a train of pulses which are directly proportional to its speed. These are processed by a frequency/voltage converter into a DC voltage, as indicated in Fig.12, and compared in a voltage comparator to a preset reference voltage appropriate for the required speed — 33 or 45rpm.

The difference, fed as a control signal to the DC drive transistors, adjusts the torque of the turntable motor accordingly. It is, in effect, a feedback or servo system which matches the speed of the turntable to a predetermined standard, as signified by the reference voltage. Its potential accuracy is a function of the precision and sensitivity of the electronic circuitry.

For the ultimate in accuracy and stability, a quartz oscillator and phase comparator stage can be added (dotted in Fig.12) to provide a continuous and instantaneous comparison between the phase of the pulses from the turntable and divided-down reference pulses from the crystal.

In circuitry of this general type, it is possible to provide a vernier speed adjustment (pitch control) which, in its most ambitious form, can provide for a speed variation up to about ±10%, crystal locked and accurately calibrated.

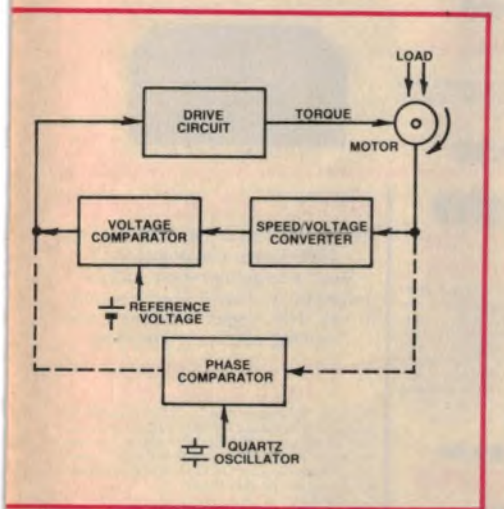

Fig.12: Most direct drive turntable motors operate on DC, with a feedback or servo system to ensure accurate and constant speed. Many have supplementary "quartz" circuitry (dotted) for extreme precision.

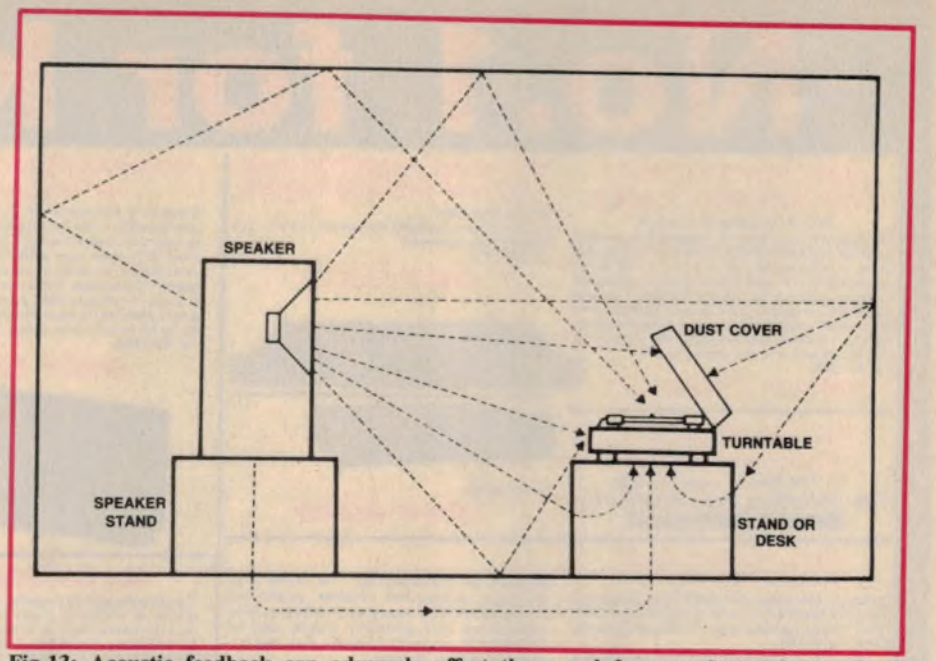

Fig.13: Acoustic feedback can adversely affect the sound from a phono player. Good basic design helps but care also needs to be taken with its placement.

Add to this logic and timer circuitry for the panel controls and the auto return and switch-off facility and it amounts to quite a package of electronics, usually concentrated nowadays to one or more dedicated ICs.

Reservations?

Not surprisingly, this "high-tech" approach has had its own problems, one criticism having to do with "cogging" — a slight roughness or flutter caused by magnetic interaction between the multipole rotors and stators. Fortunately, it appears to have been sorted out.

Even so, quite a few traditional hifi devotees seem still to prefer the belts and pulleys, which they can see and understand, to the enigmatic mysteries of high-tech electronics.

In fact, the performance specifications of typical good quality quartz DD electronic turntables are generally rather better than those of prestige audiophile belt drive models, although both are subjectively adequate.

DD speed accuracy and stability is typically greater than with a synchronous AC motor (±0.002% compared with ±0.5%). Wow and flutter is lower (0.025% RMS v 0.4%) and S/N ratio (rumble) better (−73dB DIN-B v. −70dB).

Acoustic feedback

A phono disc and cartridge together form a rudimentary microphone. The disc can respond to vibration and noise which, when communicated to a stylus and cartridge, produces an electrical signal, capable of being amplified and heard through loudspeakers.

Perhaps the most serious aspect of this is that a phono player can "hear" the sound from high powered loudspeakers, as illustrated in Fig.13, giving rise to a complete feedback loop: an electrical path from the player to the loudspeakers and an acoustic path from the loudspeaker back to the player.

If the gain around the feedback loop is high enough, the system may become unstable and break into a howl or roar. But, even with a lower loop gain, the feedback can affect the quality of the reproduced sound, tending to make bass notes "boomy" and adding a sense of noise and intermodulation to the middle and upper register.

Well designed phono players incorporate means of cushioning the pickup and turntable jointly from the external framework of the player, plus the provision of resilient feet. A dynamically balanced pickup arm helps, while the perspex lid can also block some of the sound waves.

Try to avoid having the player on the same shelf, or in the same structure, or even any closer to the loudspeakers than it strictly needs to be. To quote an old but helpful maxim: if you have big loudspeakers on a springy floor, bracket your phono deck to a wall!

Footnote

Most of the illustrations used in this article are reproduced from a Technics publication, by courtesy of National Panasonic (Aust.) Pty Ltd.

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Ref: EA December '85 - Feb '86

This tuner will outperform any commercially available tuner REGARDLESS OF PRICE. We could not say that unless it was true. As well as getting an FM stereo section which is at least as good as any synthesised tuner ever built, it is the only unit featuring a genuine wideband, low distortion AM stereo (CQUAM) tuner! Not only do you get that you get a digital frequency readout, 12 station memory, automatic station seek and an optional infra red remote control.

Cat. KA-1635

ONLY $399.00

"ULTRA FIDELITY" PREAMPLIFIER

Ref: AEM October - December 1985

The definitive Preamplifier by ***David Tillbrook***

Cat. KM-3030

ONLY $289

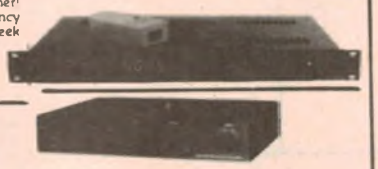
REMOTE CONTROL FOR AM/FM STEREO TUNER

Ref: EA April 1986

Go all the way and build the remote control - you deserve it. Complete kit.

Cat. KA-1636

ONLY $89.50



5000 POWER AMP "BLACK MONOLITH"

The Jaycar "Black Monolith" is WITHOUT DOUBT the best 5000 amplifier kit on the market today AT ANY PRICE. There have been imitations but none have the features of our kit.

- *Completely redesigned flag heatsinks for the driver transistors. Thoroughly endorsed by D.T. himself.*
- *Strategically located ventilation slots in the covers.*
- *Blind tapped holes in the original "Superfinish" front panel.*
- *Heavy gauge EXTRUDED heatsink bracket.*
- *Our one-and-only "Superfinish" front panel - the best!*
- *Dual 3 pin DIN 30V power outlets.*
- *Naturally all of our much copied features as well as standard viz: 1% metal film resistors, prewound chokes, pretinned fibreglass PCB's, heavy earth braid, quality capacitors, flux shorting straps and of course the original chassis bar design (developed by Jaycar).*

The "Black Monolith" is a special kit for a very special person - the perfectionist.

Cat. KE-4200

ONLY $359

"BLUEPRINT" PREAMPLIFIER

Featuring a Moving Coil Cartridge Preamp with unbelievably low noise.

Cat. KE-4202

COMPLETE KIT NORMALLY $339.00

SAVE $50 ONLY $289.00

⅓ OCTAVE (28 BAND) GRAPHIC EQUALISER

This kit enables you to control 28 narrow bands of frequencies between 31.5Hz and 16kHz. By being able to do this you will be able to very efficiently compensate for acoustic deficiencies in any indoor environment.

SPECIFICATIONS:

S/N Ratio	−102dB with respect to 1V
Freq. Response	12Hz-105kHz to −1dB
Boost/Cut	14dB (28dB total)
Distortion	100Hz (0.007%), 1kHz (0.007%), 10kHz (0.008%) essentially irrespective of cut or boost.
Current Consumption	Approx 100mA @ ±15V (requires 30V AC CT)

Cat. KE-4204

USUALLY $209 each

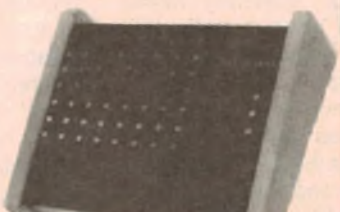
SAVE $35 ONLY $174.00 each

8 CHANNEL AUDIO MIXER JAYCAR 8002

A balanced input/output 8 channel mixer with features found in units costing well over $2,000!!

MAIN FEATURES: ● Balanced (600 ohm) mic inputs/line inputs ● Input attenuators ● Cannon connectors' included in the price ● Bass, mid and treble equalisation on each input ● "Effects" (i.e. echo, etc) capability ● Foldback on all 8 inputs ● Stereo pan on all 8 inputs ● 60mm slide faders used throughout ● 19" rack mount capability (or console mount) ● Professional black front panel with format borders and multicoloured knobs to assist function indentification ● Designed for quick and easy service ● VU metering ● Only high quality components used ● 5534A OP amps used for low noise and very low distortion.

Cat. KJ-6504 **ONLY $560.00**



WATCH OUT FOR THE NEW AEM POWER AMP

AEM 6000 - 200 WATT MOSFET MODULE

Ref: AEM April 1986

These are the power amp modules that will be used in David Tillbrook's new stereo power amp.

Cat. KM-3044

ONLY $109 (mono)

CD ADAPTOR

Ref: EA April 1986

Have you ever wanted to fit a CD player to your car but were scared off by the high cost? This simple circuit will allow you to use one of the new portable CD players. It plays through your existing car stereo and even gets its power from the car.

Cat. KA-1645

ONLY $32.00

COMPACT DISC PLAYER ATTENUATOR

If you have just purchased a compact disc player your amplifier could be in trouble! CD players seem to have standardised on a 2V output level whereas most Hi Fi amps have a 500mV sensitivity for full rated output. In order to overcome this you may need a CD attenuator. It does not distort the signal in any way. It makes an ideal project for beginners but can be useful to the most advanced constructor. The Jaycar kit includes box, switch, front panel, etc.

Cat. KA-1624

ONLY $7.95

MUSICOLOR IV

The ultimate lighting controller ● Front panel LED display ● 4 different chaser patterns ● Auto and manual reverse chase ● Sound triggered chase ● Inbuilt electret mic ● Safe, opto isolated circuitry - AND JUST LOOK AT THE PRICE!!

Cat. KA-1010

ONLY $99.90

DON'T PAY $119

IONISER KITS - Complete

High efficiency emitter head - fits completely inside a high quality ABS box (NOT a metal lid) - only 2 core mais flex protrudes from the box - you can pay over $80 for a built-up inferior unit!

Cat. KJ-6611

NORMALLY $49.50

SAVE $15 ONLY $34.50

SHORTFORM KIT

Runs directly from 240V mains and has a low power consumption. Produces high intensity electric field with an output of around 7.5kV. Does not necessarily produce ozone in standard form. Ideal for those who wish to try an ioniser at an economical price.

Cat. KJ-6610

NORMALLY $27.50

SAVE $8 ONLY $19.50

NEW NEW NEW NEW NEW

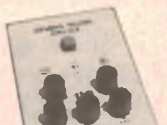
ETI 1402 DIGITAL SAMPLER

Ref: ETI May - June 1986

This kit enables you to record short bursts of sound i.e. "sample" or behave as a digital delay. It is a very low cost way of getting "into" digital sound techniques. You never know you may end up becoming the next "Frankie Goes to Hollywood"! The Jaycar kit includes case, knobs, plug pack, all board components etc.

Cat. KE-4720

ONLY $119.00



CD COMPRESSOR

Ref: EA June 1986

This little black box allows you to record from compact disc to cassette without losing the highs and lows, thereby retaining the quality.

Cat. KA-1665

ONLY $69.50

SAVE $30 JAYCAR 2010 MkIIA STEREO EQUALISER

If you can't afford to pay for 2 x ⅓ octave 5000 graphic equalisers then the 2010 might be for you. The 2010 is an octave (i.e. one control per octave) equaliser. Octave centre frequencies: 31, 62, 125, 250, 500, 1k, 2k, 4k, 8k & 16kHz. This still gives you tremendous room equalisation. The 2010 also features separate level controls for right and left channels, and a multi-function pushbutton mode switch. Supplied in a pre-punched 88mm (2 rack unit) cabinet which matches the 5000 system or looks on its own.

Cat. KJ-6535

NORMALLY $159.00

ONLY $129.00

GORE HILL OPEN TILL 4pm SATURDAY

NEW CATALOGUE!

Haven't got your new copy of the 1986 Jaycar Catalogue yet? Send a large stamped address envelope and we'll send you one. It has 100 pages crammed with exciting electronic goodies.

"PEST OFF" ULTRASONIC PEST REPELLER

Ultrasonic type pest repellers have become very popular. Far too many commercial food processors now use ultrasonic pest control for it to be considered ineffective. You can build this kit and save a fortune over commercial units. The kit is in fact far superior to some commercial units tested.

Cat. KA-1620

ONLY $44.50

BRAND NEW 100 page 1986/7 ENGINEERING

MAIL ORDER HOTLINE (02) 747-1888

AEM 6102 - 2 WAY VIFA KIT

This system consists of 2 x P21 Polycone 8" woofers and 2 x D25T Ferrofluid cooled dome tweeters with Polymer diaphragms, and 2 pre-built quality cross overs. The cabinet kit consists of 2 knockdown boxes in beautiful black grain look with silver baffles speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

SPEAKER KIT Cat. CS-2460

ONLY $499.00

CABINET KIT Cat. CB-2650

ONLY $179.00

OR TOGETHER FOR $599.00

SAVE $79.00

COMMERCIAL UNITS COST ABOUT $1,400

AEM 6103 - 3 WAY VIFA KIT

The system consists of 2 x D19 dome tweeters, 2 x D75 dome midrange, 2 x P25 woofers and two pre-built crossovers. The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

Call into any of our stores for an audition.

SPEAKER KIT Cat. CS-2465

ONLY $790 pair

CABINET KIT Cat. CS-2652

$319.00 pair

SAVE A MASSIVE $110.00

BUY BOTH TOGETHER FOR $999.00

WATCH OUT FOR THE NEW PLAYMASTER 60 + 60 AMP KIT *OUT SOON!*

ONLY $229.00

LOW COST SPEECH SYNTHESISER

AEM 4504 - see AEM Feb 1986

This is the real thing. It can be interfaced to any computer having an 8 bit I/O port. It uses the SP0256A-AL2 General Instruments chip. DIP header and computer connector are not supplied. IC sockets ARE supplied.

Cat. KM-3042

ONLY $39.95

NEW

INTELLIGENT MODEM POWER SUPPLY

ETI 684 - see ETI March 1986

The high quality power supply to match the new Modem due out in May.

Cat. KE-4715

ONLY $49.95

UHF/VHF CONVERTOR

Ref. EA April 1986

This kit is about ½ the cost of a built-up unit. It converts UHF signals to VHF so you can pick them up on your older type colour TV. It is tuneable, so it covers more than just channel 28.

Cat. KA-1650

ONLY $59.50 NEW

ETI 4600 DUAL SPEED MODEM

Ref. AEM December 1985

This project enables you to construct a modem that operates at either 300 Baud full duplex or 1200/75 Baud half duplex (i.e. CCITT V.21 Orig, CCITT V.21 Ans, CCITT V.23 (mode 2) Orig & CCITT V.23 back) for a fraction of the cost of equivalent built units. The Jaycar kit uses all original components and after much field testing, has been de-bugged. It works well!!

Cat. KM-3040

NORMALLY $169.00

SAVE $20 ONLY $149

ETI 668 MICROBEE EPROM PROGRAMMER

Ref. ETI February 1983

This simple, low cost unit plugs into the Microbee's I/O port and enables you to save programs in any of 5 different EPROM's (2716, 2732, 2532, 2732A & 2764), which can be used in your Microbee or any other microprocessor based system. As your Microbee I/O port is effected with a Z80 PIO chip, this programmer can be used with any other system employing the same I/O.

Cat. KE-4651

NORMALLY $67.50

SAVE $12.50 ONLY $55.00

ETI 1527 ECONOMY HOME BURGLAR ALARM

This clever design by Robert Irwin features 4 sectors (2 with entry delay two without) ability to use N.O. AND N.C. reed switches on the one circuit, a comprehensive LED status display. All electronics fit on the one board. The Jaycar kit includes all PCB components and an attractive Scotchcal front decal.

Cat. KE-4698

NORMALLY $26.95

SAVE $7 ONLY $19.95

These are not kits, but built and tested modules

SUPER HI FI BI-FET PREAMP - 0.005% distortion

This magnificent preamp measuring 200(W) x 110(D) mm has many features. Phono in (RIAA equalisation within 0.2dB), phono out (to tape), and auxiliary input (as many as you like). Provision for switching "loudness" control in or out as well as the provision of a 'tone defeat' switch. Bass, treble AND midrange controls are provided as well. A 40 detent clicker volume potentiometer is also provided. Naturally frequency response is flat over the audio spectrum and beyond and the S/N figures are outstanding. (Requires ±15V 200mA power supply, a circuit for this is included).

Cat. AA-0315

ONLY $69.95

INFRA RED REMOTE CONTROL SYSTEM

The system comprises two basic components: the handheld transmitter and the receiver. The handheld transmitter is supplied in an attractive plastic case and is powered by a 9V battery. It has an approximate range of 10 metres. Both transmitter and receiver use a proprietary Hitachi encoder/decoder IC set to preclude false triggering by daylight, sparks, flashes etc. The receiver output is by relay with N.O. or N.C. output. The relay is NOT 240V AC mains rated but will switch considerable DC loads, i.e. 5 amp (resistive) at 12-24V or up to 100V AC. An on-board switch configures the unit to either operate while the transmitter switch is held 'on' or alternatively in latch mode, i.e. press transmitter button and switch 'on', press again to switch 'off'.

P.S. It also works as an event counter.

Cat. AA-0346

ONLY $42.95

DUAL LED AUDIO LEVEL METER ASSEMBLY

This meter enables you to display power levels from −30dB to +5dB. The meter operates directly from the output of your amplifier, i.e. from the speaker leads. It does not consume any amplifier power. The level meter is powered by any voltage source between the range 3-20 volts so it is ideal for 12V auto use. The meter can be calibrated to operate on amplifiers from 1 - 200 watts! A circuit for mains power supply is included.

Cat. AA-0326

ONLY $32.50

80 + 80WRMS PRE-MAIN AMPLIFIER

A complete preamp and high power amp - with power supply electronics and loudspeaker protector in the one package! All that you need to connect is a power transformer and a signal source! The AA-0310 features TWO huge heatsinks for the power transistors, bass, treble and midrange controls, a microphone preamp and mixer pot, balance and volume control. There is a facility for preamp out (to dub from source to tape) as well as phono out. All in all it's a very well thought out unit. The main board measures 245(W) x 240(D). The heatsinks 130(W) x 75(D) x 70(H)mm are connected to the main amp board by about 150mm of wiring.

Cat. AA-0310

ONLY $149.95

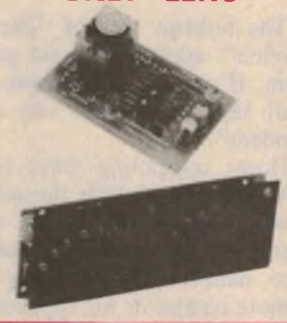
Suitable power transformer 4361 type - Cat. MM-2015 **$55.00**

STEREO LOUDSPEAKER PROTECTOR

An absolute must for all high power amplifiers. If anything goes wrong with a high power amplifier that is OCL* (i.e. does not have a large coupling capacitor between the final output stage and the speakers) a very high power source of DC can present itself directly across the voice coils of your expensive speakers destroying them probably before a fuse blows. The AA-0320 measuring 85(W) x 55(D) x 35(H)mm draws very little current at 12V DC. (A circuit showing how to connect it inside an existing amp is shown as well as a separate power supply). The protector has a 3 second de-thump turn on delay and a DC fault sense circuit. The protection relay is massive and will not offer any significant voltage drop in even the highest power amps. Cheap insurance. *Output capacitor less. The enormous bulk of Hi Fi and PA amps are now built this way.

Cat. AA-0320

ONLY $22.95



MINIATURE FM TRANSMITTER

THE LATEST & GREATEST IN A LONG LINE OF FUN BUGS

KE-4711 is a two transistor two stage transmitter that has the other benefit of being VERY compact.

Cat. KE-4711

ONLY $8.95

THE 'LISTENING POST'

This device attaches between the audio output of a shortwave receiver and the input port of a computer. It allows decoding and printing out of morse code, radioteletype (RTTY) and radio facsimile (FAX) pictures.

Cat. KM-3015

ONLY $37.50

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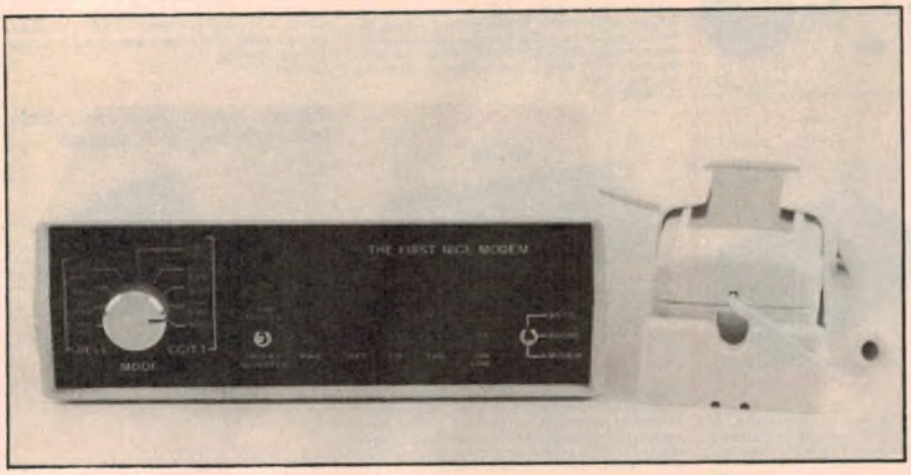
New Products...

Product reviews, releases & services



New modem comes with its own telephone

If you're in the market for a modem, how about a nice one? Or, more accurately, a Nice Modem from the Nice Computer Company of Western Australia.

The unlikely title of "The First Nice Modem" adorns the front panel of this item. If computers can have a veritable fruit salad of names, why not a Nice Modem?

Home computing takes on a whole new perspective with the addition of a modem. Suddenly, your terminal is transformed into a potential news service, data source, answering service and remote controller for appliances.

In addition to accessing commercial database systems both in Australia and overseas, the modem equipped home computer operator can communicate with any of the dozens of bulletin board services throughout the country. And computing students can access university computers from home instead of waiting hours to use a terminal on the campus.

So that you won't have to be bothered with rewiring telephone connections, the Nice Modem is supplied with a "mini-phone" pushbutton telephone. The junction for this phone and the modem is already made inside the modem. Just unplug your old telephone and insert the new connector.

The purchase price of $279.00 also includes a diskette with file transfer and videotext software. Commodore 64 ($20 surcharge) and RS232C versions can be supplied, with IBM software available from Neologue.

Also included in the package is the power supply, instruction manual and, for the Commodore version, a connector/adaptor. The manual (21 pages) is quite detailed and easy to read. A computer enthusiast who had no prior modem experience should have no trouble in setting up with the help of the manual.

Here are the specifications: 300 baud full duplex, 1200/75 (and 75/1200) baud and 600/75 baud half duplex. It can be used with Directronics Videotext, Telecom Viatel or Bell systems. The transmission standards are Bell 103 and 202, ccitt v.21, ccitt v.23 (mode 1 and 2).

An explanation of these standards is provided in the manual. Also included is an explanation of how to use the software as well as a listing of some bulletin boards available throughout Australia. For the operator who winds up in hot water, there's a whole page of troubleshooting checks.

For further information contact the Nice Computer Company of Australia, GPO Box S1517, Perth, WA 6001.

Multimeters from Benelec

Two new digital multimeters, the model DT-4500 and the DT-4600, are being distributed by Benelec, along with a number of optional accessories.

These 4½-digit multimeters both feature liquid crystal displays, auto or manual ranging and a low battery indicator. A rather unusual speciality of these multimeters is the ability to measure frequency to 100kHz with an accuracy of ±0.02% ±1 digit. In addition, the Model DT-4600 has true RMS capability.

The optional accessories include touch hold probes for data hold, shielded cable for small signal, high resistance measurements, temperature sensors covering various ranges and a useful carry case.

For further information contact Benelec Pty Ltd, 1 Grenville Street, Randwick, NSW 2031. Telephone (02) 665 8211.

Data and voice transmission system

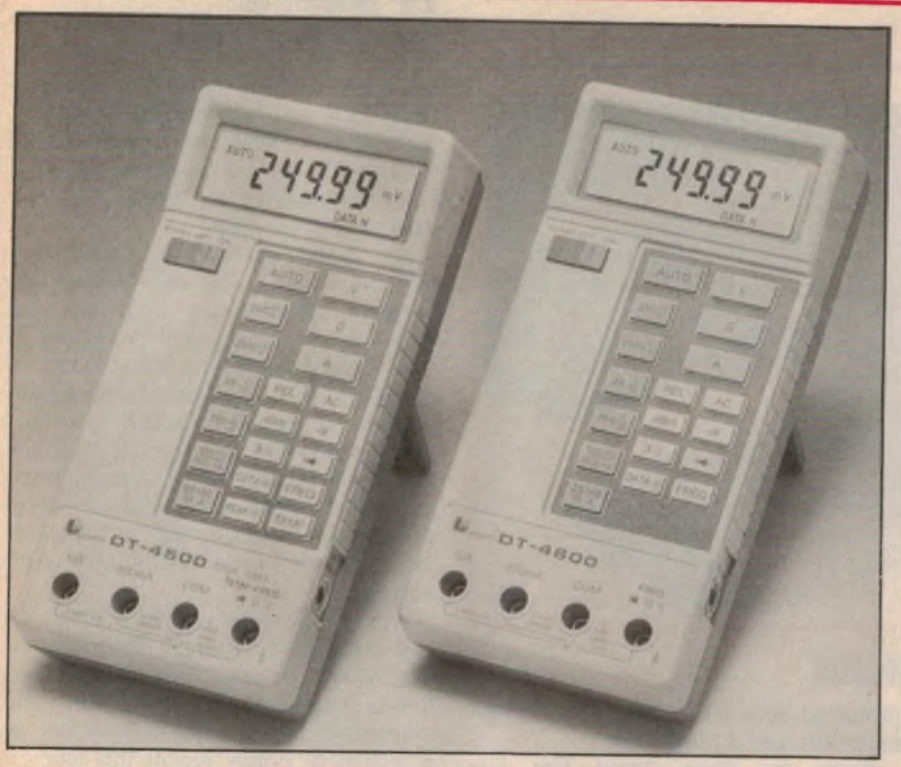
Skyswitch is a self contained communications system which uses the latest satellite technology. The equipment and its microprocessor control software were designed by Skyswitch Satellite Communications Company of Colorado USA and, with the exception of the antenna dish and high power amplifiers, is manufactured in-house.

The system consists of an outdoor antenna assembly and one indoor cabinet. This can usually be placed in the same room as any telephone equipment. It also has standard interfaces compatible with most Private Automatic Branch Exchanges (PABX).

Each of the stations can support up to 60 channels. Data communications above 4800 bits per second between two Skyswitch locations can be established by plugging in the appropriate modules.

Skyswitch operates in both the Ku-band and the C-band. Satellite transponders operating at the higher, relatively uncongested Ku frequency band (12/15GHz) offer two principal advantages: smaller antennas that are much easier to install, and reduced interference with other networks.

For further information contact Itco-Nichols pty Ltd, 20 Smallwood Street, Underwood, Qld 4119. Telephone (07) 341 0788.



Non-contact digital tachometer

The Concorde is a hand-held digital tachometer suitable for design, production, maintenance and service engineers. It features a high-brightness LED display, enabling the instrument to be used under difficult light conditions.

Safety grilles and guards do not have to be removed from equipment as there is no contact with machinery being checked. When the Concorde is 'on target' a lamp glows steadily to indicate correct alignment. An over-range indicator shows if the speed exceeds the maximum in the range selected.

There are two ranges: 50-19,999 RPM and 500-199,999 RPM with resolutions of 1 digit on the low range and 10 digits on the high range. Accuracy is estimated at ±1 digit. A crystal controlled timebase updates the reading every 0.6 seconds and calibration is unnecessary.

For further information contact Warsash Pty Ltd, PO Box 217, Double Bay, NSW 2028. Telephone (02) 30 6815.

Microwave training kit

The ARRA microwave training kit model MT-1 has been designed for military, college, industrial and vocational school training courses in microwave theory and applications.

The kit introduces the novice to the concepts of microwave theory and propagation, and the components which are used in the transmission of microwave energy. It consists of electronic equipment for generation and detection of microwave signals, waveguide components to transmit the energy, and a technical training manual. The mathematics is held to a minimum, and only a background of algebra is necessary to read and perform the experiments.

For further information contact Scalar Distributors Pty Ltd, 20 Shelley Avenue, Kilsyth, Vic. 3137. Telephone (03) 725 9677.

LCD screens for laptop market

Vicom's GRid portable computer now has a new screen which offers greater readability. The screen features a high contrast ratio battery-powered gas plasma display.

The GRidcase line of laptop computers offers up to 512K RAM, a built-in 3½-inch floppy disk drive (720K), and as much as 512K of user installable software in ROM.

For further information contact Vicom Australia Pty Ltd, 7 Duke St, Windsor, Vic 3181. Phone (03) 62 6931.

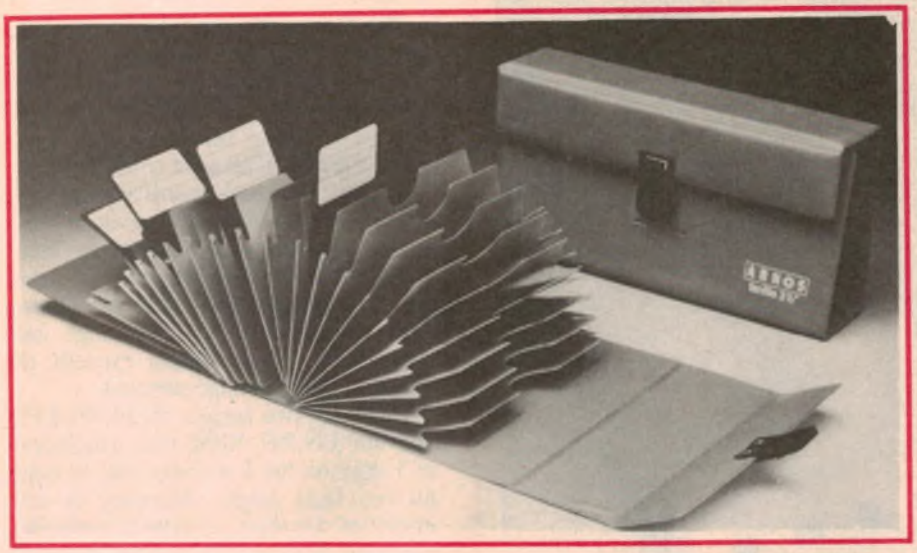
Optical wavelength meter

The model MF91A optical wavelength meter from Anritsu can be used to measure the optical power and wavelength of light emitting diodes and laser diodes.

With its three plug-in modules, the device can cover the wavelength range of 0.4 to 1.6μm. Optical power can be measured over the entire wavelength range without recalibrating the wavelength sensitivity.

For further information contact STC Pty Ltd, PO Box 42, Thornbury, Vic 3071. Telephone (03) 480 1255.

New Products...



Computer disk storage systems

Arnos Melbourne Pty Ltd has introduced to Australia a new range of computer disk filing systems. The range includes Fan Files, Minidisk Albums, Diskette Files, Minidiskette Files, and A4 Easelbinders without pockets and designed to house Minidisk or Microfiche panels.

Illustrated here is the Arnos Fan File, a protected, portable storage unit which gives complete access to disks at a glance. At the same time, the disk is protected in its own pocket so that it remains flat and pressure free.

There are three Arnos Fan File models: 8-inch for diskettes, 5-inch for minidiskettes and 3-inch for microdiskettes. The covers and pockets are chemically neutral and anti-static to protect the disks from contaminates.

For further information contact Arnos Melbourne Pty Ltd, 1226 Nepean Highway, Cheltenham, Vic 3192. Telephone (03) 583 2254.

Cable connectors

East-West Electronic Distributors are local agents for the Amp Interconnect System.

This miniature cabling interface system provides reliable contacts and comes in a variety of models. Each termination is based on dual plated phosphor bronze cantilevers which provide a minimum of two contact points per conductor. These are fitted to a precision moulded housing which provides solid and stable cable relief.

Pin header assemblies are also manufactured with the same attention to detail. The posts are made from gold-plated phosphor bronze, while stand up or right angled posts provide the design engineer with maximum flexibility.

For further information contact East-West Electronic Distributors Pty Ltd, 117 Smith Street, Fitzroy, Vic 3065. Telephone (03) 419 9833.

TV antenna for Wollongong

Do you live in Sydney? How many times have you been unable to watch a football or cricket test match because Sydney TV stations have been banned from broadcasting the action while the game was in progress?

For those who live in a favourable location, there is a way around the problem. More often than not, the match you're missing will be carried by one of the Wollongong TV stations, either Channel 4 or Channel 5A. Sydney viewers are generally unable to receive these stations for two reasons: (a) their antenna is unsuitable for these stations, and (b) the antenna is pointed towards the Sydney stations and is therefore broadside on to the Wollongong transmitters.

With this in mind, Jaycar Pty Ltd has just released a Channel 4/5A antenna for Sydney viewers. Provided that you live in a good signal location (ie, with reasonable line of sight), it should be sufficient to simply mount this antenna on the top of your house and aim it in the general direction of Wollongong.

To avoid degrading the performance of the existing antenna, Jaycar recommends that a separate cable be run back from the new antenna to a second wall socket. A masthead amplifier may be necessary in low signal areas.

The catalog number for the new antenna is LT3190 and the retail price is $59.95. For further information contact Jaycar Electronics, 115-117 Parramatta Road, Concord 2137. Telephone (02) 747 2022.

Programmable logic arrays

Fairchild Semiconductor has added Programmable Logic Arrays to its Fast (Fairchild Advanced Schottky TTL) logic family with a series of vertical fuse devices featuring propagation delay times as fast as 15ns and 50MHz clock frequency.

Called FASTPLA, it is compatible with industry standard medium 20-pin PAL(R) devices.

The devices will be available in versions that meet MIL-STD-883. Operating temperature range is 0-75° commercial and -55-125°C military.

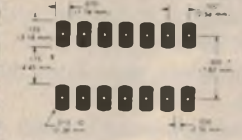
For further information contact Fairchild Australia Pty Ltd, 366 Whitehorse Road, Nunawading, Vic 3131. Telephone (03) 877 5444.

EVERYTHING YOU NEED TO MAKE PRINTED CIRCUITS

NOW STOCKING COMPLETE RANGE OF E-Z CIRCUIT DRAFTING AIDS

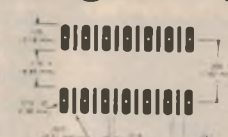
FULL RANGE OF RISTON MATERIALS, CHEMICALS CALL FOR PRICES

Dual in Line Packages All $4.37/pack



Cut Pad

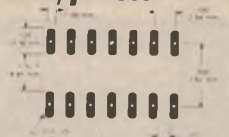
No. of Leads	Qty/ Pkg	Scale	Catalog Number
14	32 28	1X 2X	EZ8014 EZ6038
16	32 28	1X 2X	EZ8004 EZ6108
18	28 26	1X 2X	EZ6900 EZ6901
24	12 121	1X 2X	EZ6535 EZ6536
28	12 12	1X 2X	EZ6903 EZ6904
40	8 8	1X 2X	EZ6906 EZ6907



Cut Pad With Conductors

* Use where conductor traces must be routed between pads

No. of Leads	Qty/ Pkg.	Scale	Catalog Number
14	32 28	1X 2X	EZ6760 EZ6761
16	32 28	1X 2X	EZ6783 EZ6784
40	8 8	1X 2X	EZ6884 EZ6885

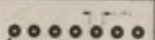
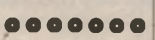
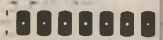
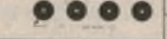


Narrow Cut Pad

* Use where a longer terminal area is desired. Can be used with conductors between terminals

No. of Leads	Qty/ Pkg.	Scale	Catalog Number
14	32 28	1X 2X	EZ8013 EZ6071
16	32 28	1X 2X	EZ6453 EZ6244
40	8 8	1X 2X	EZ6887 EZ6988

Pre-Spaced Pads $4.37/pack

Center to Center Spacing	Pad Type	Scale	Pads Per Strip	Strips Per Pack	Catalog Number
.100"		1X	40	6	EZ5000
		2X	20	7	EZ5001
		1X	40	6	EZ5003
		2X	20	7	EZ5004
		1X	40	6	EZ5017
		2X	20	7	EZ5018
		1X	40	6	EZ5020
		2X	20	7	EZ5021
.156"		1X	25	6	EZ5014
		2X	13	7	EZ5015

P.C. Drills

Take your pick of tungsten carbide or high speed steel. Available in 0.8, 0.9, 1.0 and 1.2mm T.C. drills $5.85 each. H.S. Steel $1.75 each.

Donut Pads

The basic all-purpose PC terminal area for termination of wire or component leads extending through the PC board. ID aids in accurate pad location to grid centers.

E-Z CIRCUIT Tape Donut Pads are unsurpassed for uniformity and accuracy. These photographically opaque terminal areas are accurate to ± .002" (±0.05mm). E-Z Circuit opaque black pads are only .005" (0.13mm) thick.

$3.35/pack

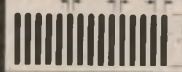
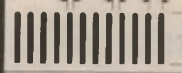
1. Select the largest possible pad. Allow enough room for conductor traces and the physical conditions of artwork preparation and manufacturing of the actual board (MIL-STD-275).
2. A small ID makes registration easy but may make it difficult to locate pad center after photo reduction.
3. Choose an ID smaller than hole to be drilled. (Drill size for plated-through holes must be larger than final hole.)
4. Use Multi-Pad configurations for multi-pad terminal patterns.

It is much easier, much faster, and much more accurate to lay down a whole pattern printed to specific tolerances than to tediously position individual pads.

STANDARD INCH

OD in.	OD mm	ID in.	ID mm	Cat No.	Qty/ Pkg.
.080	2.03	.031	0.79	EZD216	50
.100	2.54	.031	0.79	EZD101	50
.125	3.18	.031	0.79	EZD239	50
.125	3.18	.035	0.89	EZD102	50
.156	3.97	.031	0.79	EZD144	50
.156	3.96	.047	1.19	EZD103	50
.160	4.06	.040	1.02	EZD247	100
.187	4.75	.031	0.79	EZD138	100
.200	5.08	.031	0.79	EZD139	100
.250	6.35	.047	1.19	EZD109	100
.300	7.62	.062	1.57	EZD111	100

Edge Connectors $4.37/pack

Center to Center Spacing	Patterns shown 1X (1:1) scale. Dimensions shown 1X (1:1) scale for 2X scale, multiply values shown by 2	Scale	Contacts/ Strip	Catalog Number	Strips/ Pack
.100"		1X	44	EZ6805	2
		2X	22	EZ6809	5
.125"		1X	35	EZ6704	2
		2X	17	EZ6716	4
.156"		1X	28	EZ6708	3
		2X	14	EZ6720	6

Precision Slit Tapes

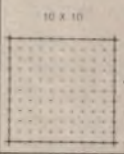
"Super" 201 is a flexible extra-strong photographically opaque pressure-sensitive precision slit tape with exceptional adhesive characteristics. It will not creep or lift if stretching is avoided during application. "Super" 201 is extremely flexible and has a non-reflective matte finish. Only .005" (0.13 mm) thick.

- Precision slit to exacting tolerances to assure highest quality PC artwork and photography.
- Manufactured from the same high quality materials as E-Z CIRCUIT PREKUT TAPE SHAPES to insure compatible PC artwork and photography.

STANDARD INCH
20 Yds./Roll

Tape Size in.	Tape Size mm	Cat. No.
.020	0.51	EZC3000 $3.05
.026	0.66	EZC3002 $3.05
.031	0.79	EZC3004 $3.25
.040	1.02	EZC3006 $3.25
.050	1.27	EZC3008 $3.25
.062	1.57	EZC3010 $3.35
.080	2.03	EZC3012 $3.35
.093	2.36	EZC3014 $3.35
.100	2.54	EZC3016 $3.35
.125	3.18	EZC3018 $3.35
.200	5.08	EZC3020 $3.46
.250	6.35	EZC3022 $4.57
.500	12.70	EZC3024 $5.70

Accurate Grids

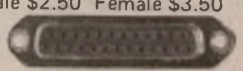


Grids are produced on accurate stable film with 0.1" pattern for maximum accuracy. Matte one sided .003" thick.

Sheet Size	Catalog Number	
8" x 10"	EZ1463	$2.63
11" x 17"	EZ1466	$4.87

CONNECTOR SPECIALS

25 WAY 'D' CONNECTORS
Great special on panel mounted D connectors.
Male $2.50 Female $3.50



CENTRONIC 36 WAY PLUGS
Solder type with metal backshell. No special tools needed to fit these!! ONLY $4.50

DIN41612 Connectors All $4.37/pack

DIN41612 connectors patterns have three row designations A, B and C. Three pattern combinations are available AB, AC and ABC. They are also available with round or square pads.

ROUND PAD

64-Pin Pattern (A-B) Scale	Symbols Per Pkg	Catalog Number	64 Pin Pattern (A-C) Scale	Symbols Per Pkg	Catalog Number	96 Pin Pattern (A-B-C) Scale	Symbols Per Pkg	Catalog Number
1X	2	EZ6869	1X	2	EZ6875	1X	2	EZ6871
2X	2	EZ6870	2X	2	EZ6876	2X	2	EZ6872

SQUARE PAD

64-Pin Pattern (A-B) Scale	Symbols Per Pkg	Catalog Number	64 Pin Pattern (A-C) Scale	Symbols Per Pkg	Catalog Number	96 Pin Pattern (A-B-C) Scale	Symbols Per Pkg	Catalog Number
1X	2	EZ6878	1X	2	EZ6881	1X	2	EZ6884
2X	2	EZ6879	2X	2	EZ6882	2X	2	EZ6885

8.30 to 5 Monday to Friday. 8.30 to 12 Sat.
Mail Orders add $3.00 to cover postal charges.
Next day delivery in Sydney add $5.00.
All prices INCLUDE sales tax.
Tax exemption certificates accepted if line value exceeds $10.00.

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GEOFF WOOD ELECTRONICS P/L
(02) 427 1676 INC IN NSW

229 BURNS BAY RD.
(CORNER BEATRICE ST.)
LANE COVE WEST N.S.W.

TWX 71996
P.O. BOX 671
LANE COVE N.S.W. 2066

OR CASH CHEERFULLY ACCEPTED

specialising in electronic components for the professional and hobbyist.

New Products...

Dual-trace 20MHz oscilloscope from Altronics

Quality test gear has never been cheap, but with the Australian dollar languishing in its present state, we might as well be prepared for some hefty price hikes. Chances are, it won't be too long before a 'bread and butter' oscilloscope doesn't leave any change from $1,000. For the moment though, there are still a few good buys around — like the Labtech CRO from Altronics.

For any serviceman or serious hobbyist, a CRO would have to be well up the list of essential test equipment. The remarkable sophistication of some expensive CROs is really not an advantage for most routine servicing work. As a 'standard', a good servicing CRO would have dual traces (with invert on channel 2), 20MHz bandwidth, 5mV sensitivity, several different triggering modes (including external), an "Add" mode and a bright display with clear graticule.

The latest offering from Altronics fits the bill quite neatly. It is a dual trace, 20MHz CRO with all of the features mentioned above. In addition, it has a built in component tester and "Z Axis" input which modulates the trace brightness.

The component tester is an unusual feature for a low price CRO. It can be used with in- or out-of-circuit components and produces a characteristic display for resistors, capacitors, zeners and inductors.

The display gives a good idea of a circuit's characteristic, but it would be difficult to use in determining an actual value. For example, a capacitor produces an ellipse tilted to the right. You can tell at a glance that a circuit is capacitive if this display is given. Faulty components will usually produce a display which is a combination of two characteristic shapes.

The "Z Axis" input (on the back panel) is an interesting feature. It allows the brightness of the display to be modulated in response to an external display. This allows you to highlight part of a trace. It can be easier to use than a normal external trigger.

The probes incorporate switching for x1, x10 and ground and cost an extra $39.50 each. The leads are of the thin, flexible type.

The Labtech Q0155 sells for $699 and comes with a full 12-month warranty. Further details can be obtained from Altronics, PO Box 8280, (105 Stirling St) Perth, WA.

LV cable fault locator

The new Telefault P240 low voltage cable fault locator from CDS Ltd is battery operated and microprocessor based. The instrument utilises the pulse echo technique of fault location and, on a typical underground power cable, can cover lengths of up to 3.2km over five separate ranges.

An LCD panel displays the reflected pulse signals while calibrated cursors are used to measure the distance to the fault.

Error messages are given when comparing two waveforms if the control settings are dissimilar. A viewing angle control allows the display to be adjusted to suit the ambient light conditions.

For further information contact Macey's Electrical Accessories Pty Ltd, 37 Ryedale Road, West Ryde, NSW 2114. Telephone (02) 807 4739.

Termination kit for optical fibres

The OFTK20 optical fibre termination kit comprises a range of ferrules to suit multimode fibres plus two jewelled fibre guides. The kit provides simple and rapid fibre termination which can be either temporary or permanent when crimped.

The kit also includes a very robust, lightweight, sapphire facetted fibre cleaner tool which is used to give square-end cleaves. Fibres terminated in this way may be interfaced to test instruments, IR sources or detectors cheaply and effectively, according to the manufacturers, as an alternative to the more expensive method of permanently connecting a fibre end.

For further information contact Stantel Components Pty Ltd, 1/190 George Street Terrace, Parramatta, NSW 2150. Telephone (02) 633 9166.

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,000 sold!

For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS SERIES 5000 POWER AMPLIFIER

- 1% Metal Film

~~SPECIAL, ONLY $329~~

~~SAVE $30~~

...signed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms.
POWER AMPLIFIER: 100W RMS into 8 ohms (+ - 55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0 -0.4 dB 2.8Hz to 65KHz, +0 -3 dB. NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100W ouput.
HUM: 100 dB below full output (flat).
NOISE: 116 dB below full output (flat, 20KHz bandwidth).
2nd HARMONIC DISTORTION: 0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + -56V SUPPLY rated at 4A continues 0.0003% for all frequencies less than 10KHz and all powers below clipping.
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).
INTERMODULATION DISTORTION: 0.003% at 100W (50Hz and 7KHz mixed 4:1).
STABILITY: Unconditional.

Cat. K44771 ..... $359

Assembled and tested $549

packing and post $10

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS ...

~~SPECIAL, ONLY $299~~

~~SAVE $20~~

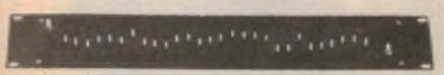
...we believe that dollar for ... a commercial unit available that sounds as good!)

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input 15Hz - 130KHz +0, -1dB. Low-Level input-conforms to RIAA equalisation + - 0.2dB.
DISTORTION: 1KHz -0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V)-92dB flat -100dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input 50ohms source resistance connected -86dB flat-92dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200uV input signal -71dB flat -75dB A-weighted.

Cat. K44791 ..... $319

Assembled and tested $599

packing and postage $10



THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands from 31.5Hz to 16KHz.
NOISE: -0.008mV, sliders at 0, gain at 0(...
20KHz BANDWIDTH DISTORTION ...sliders at 0, gain at 0...
FREQUE...

~~SPECIAL, ONLY $209~~

~~SAVE $10~~

...unit $219

$429

packing and postage $10

SERIES 4000 SPEAKERS

8 Speakers	$349
8 Speakers with Crossovers	$579
Speaker Boxes (assembled with grill and speaker cutout)	$349
Crossover Kits	$249
Complete kit of parts (speakers, crossovers, screws, innerband boxes.)	$899
Assembled, tested and ready to hook up to your system	$995

Errors and Ommissions Excepted

ELECTROSTATIC HAZARD DETECTOR KIT

It's called electrostatic hazard and if it, or even its baby brother, jumps on the back of your IC or transistor, then the poor device is never likely to be quite the same again. So out of a very ordinary collection of bits and pieces, ETI has fashioned a black box that will sit quietly on a corner of your bench for years at a time and beep when ever high tension appears. It may save you a lot of trouble, particuly if you ever work with CMOS. (ETI 173 May 86)

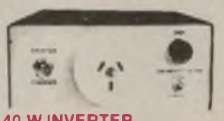
Cat. K41720

Please phone for price and availability

PLAYMASTER FM/AM STEREO TUNER

The new Playmaster FM/AM stereo tuner will out perform anything presently available on the market regardless of price. As well as including a FM tuner section which is every bit as good as any other synthesised design, it is also the only unit featuring a genuine wideband, low distortion AM stereo tuner. Naturally, it has a digital readout, 12 station memory, automatic seek and an optional infrared remote control.
(EA Dec. 85 Jan-Feb 86 85tu12)

Cat. K86020 ..... $399



40 W INVERTER

This 12-240 V inverter can be used to power up mains appliances rated up to 40 W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May 82) 82IV5

Cat. K82050 ..... $69.95

MULTI SECTOR ALARM STATION

Protect your home and possessions from burglars with this up to the minute burglar alarm system. It's easy to build, costs less than equivalent commercial units, and features eight seperate inputs, individual sector control, battery back up and self-test facility.

Specifications

- Eight sectors with LED status indication.
- Two delayed entry sectors.
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds; exit delay variable between 5 and 45 seconds; alarm time variable between 1 and 15 minutes.
- Resistive loop sensing, suits both normally open and normally closed alarm sensors.
- Battery back-up with in-built charger circuit.
- Built-in siren driver.

Complete kit including deluxe prepunched metal work and electronics for only...

Cat. K85900 ..... $129

SAVE $6

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.
(EA Oct. 84) 84MS10

Cat. K84100 **Normally $26.95**

SPECIAL, ONLY $20.95

SAVE $5

ELECTRIC FENCE

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automative ignition coil, it should prove an adequeate deterrent to all manner of livestock. Additonally, its operation comforms to the relevant clauses of Australian Stnd 3129. (EA Sept. 82) 82EF9

Cat. K82092 **Normally $19.95**

SPECIAL, ONLY $14.95

SAVINGS BONANZA!

50 W AMPLIFIER MODULE (ETI 480)

Cat. K44880 ..... $27.50
(Heatsink optional extra)

100 W AMPLIFIER MODULE (ETI 480)

Cat. K44801 ..... $29.95
(Heatsink optional extra)

FUNCTION GENERATOR

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting.
(EA April 82 82AO3A/B)

Cat. K82040

Cat. K82041 ..... $109

SAVE A HUGE $24!

12-240V DC-AC INVERTER INCLUDING 300 WATTS TRANSFORMER

This EA inverter is capable of driving mains appliances rated up to 300VA and features voltage regulation and full over load protection.
(EA June 82) 82IV6

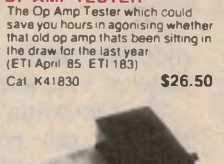
Nominal Supply: Voltage 12V DC
Output: Voltage see table
Frequency: 50Hz + -005%
Regulation: see table
Maximum Load: 300VA
Current Limiting: 30A (primary)
Efficiency: see table

Resistive Load Watts	Output Voltage (RMS)	Input Current (A)	Efficiency (%)	Battery life 40Ah-20h Rate (minutes)
0	210	1.2	0	
40	235	4.5	60	240
100	240	11.3	62	80
140	240	15.0	69	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28

P&P $10.00 Anywhere in Australia

Cat. K82062 **Normally $219**

Now on special at $195



OP AMP TESTER

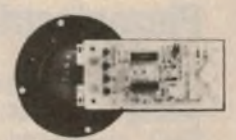
The Op Amp Tester which could save you hours in agonising whether that old op amp that's been sitting in the draw for the last year.
(ETI April 85 ETI 183)

Cat. K41830 ..... $26.50

ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!
(ETI Aug. 84) ETI 1524

Cat. K55240 ..... $34.95



EA SUPER SIREN

Ever wanted to build an earsplitting alarm which would be compact and not draw much current? This is just the circuit for you. It uses a piezo electric tweeter in a pulsed mode to form an arresting and very efficient alarm. (EA Nov. 82) 82AL17

Cat. K82111 ..... $28.95
(battery extra)

AEM KITS!

AEM DUAL SPEED MODEM

The ultimate kit modem featuring 1200/300 baud, case etc. Exceptional value for money!
(AEM 4600 Dec. 85)

Normally $169

THIS MONTH, ONLY $149

AEM ULTRA FIDELITY PREAMP

Now in stock! This superb preamp includes the case components, prepunched front panel etc. There's nothing else to buy.
(AEM 6010, Oct/Nov. 85)

Cat. K90000 ..... $269

LISTENING POST

(AEM 3500)

Cat. K93015 ..... $37.95

STROBE KIT

Includes perspex cover!
(AEM 9500)

Cat. K93018 ..... $59.95

PARALLEL PRINTER SWITCH KIT

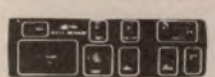
Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently so that you can select one or the other at the flick of a switch.
(ETI 666, Feb. 85)

Cat. K46660 ..... $79.95

STEREO ENHANCER

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheated and creates an 'enhanced stereo effect' with a small unit which attaches to your amp.
(ETI 1405, ETI MAR 85)

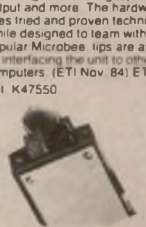
Cat. K54050 ..... $79.50



COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER KIT

Here's what you've been asking for... a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are available on interfacing the unit to other computers. (ETI Nov. 84) ETI 755)

Cat. K47550 ..... $135



ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.
(ETI May 83) ETI 164

Cat. K41640 ..... $11.95

SAVE $4

TRANSISTOR TESTER

Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept. 83) 83TT8

Cat. K83080 **Normally $18.95**

SPECIAL, ONLY $14.95

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Errors and Omissions Excepted

New Products...

Variable data imprinter

Thorn EMI has released the Cardwriter 1800, a high speed computer-controlled system that permanently imprints variable data on the front and/or back of standard plastic cards.

The 1800 accepts data from a microcomputer, magnetic tape or from a mainframe. The microprocessor interprets this data and prints from high security foil. If required, it can also encode the three tracks on the magnetic stripe of a standard plastic card.

The Cardwriter 1800 is a desk top system and can produce cards for PIN (personal indentification numbers), customer lists, club cards, identification cards, etc.

For further information contact Thorn EMI Technology, 111 Wicks Road, North Ryde, NSW 2113.

Control system for security applications

The Proscan is a microprocessor control panel operated by a 16-button keypad. To use the panel the client must enter a unique 4-digit master code which is programmable by the owner. An additional auxilliary code is also available for use by the serviceman.

All the technical programming is done through the front keypad and the unit may be connected to most of the popular security communicators being sold in the marketplace.

Main features of the unit include seven alarm zones, an alarm memory, a built in 1A power supply and a one year warranty. Programmable options in-

Line conditioners from

Ferguson Transformers Pty Ltd has a range of ferroresonant line conditioners which provide a relatively constant output voltage regardless of supply line fluctuations. These come in six models ranging from ELC160 to ELC3500 and with ratings ranging from 160VA to 3500VA.

In addition to providing a constant output voltage, these units can provide isolation from electrical noise; modification of the input waveform from square to sine wave; or a combination of any

VZ serial terminal

Connecting a modem to the popular VZ-200 and VZ-300 computers is now possible with the recently released Serial Terminal kit from Dick Smith Electronics Pty Ltd. The kit is both inexpensive and easy to assemble.

When plugged into a VZ series computer, the serial interface provides all hardware and software necessary to emulate a simple 300 baud terminal with full or half duplex operation. It also has a printer echo option to record the conversation.

The device incorporates facilities to set serial data format, add an optional auto line feed on carriage return, and to dump all communications to a parallel printer if one is connected.

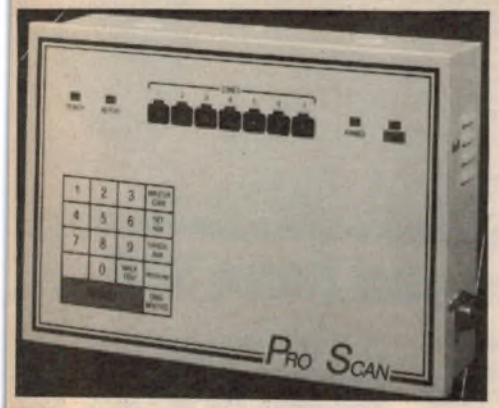
For further information contact Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, 2113. Telephone (02) 888 3200.

Piezoelectric buzzers and sirens

IRH Components now stock a slow pulsing version of their popular PKB5-3AO piezoelectric buzzer. This new buzzer includes internal oscillator circuitry and is driven by a DC supply between 3-30V. The resonant frequency is 2800Hz and the sound pressure, with an applied voltage of 9VDC, is typically 85dB at 30cm.

Also new from IRH is the KPE1100 range of piezo buzzers and sirens for the security industry. These high output sirens have an output of 110dB minimum at one metre with a voltage of 12VDC. The overall operating voltage is 6 to 12VDC, the current drain is 450mA maximum at 12VDC, and the output is swept between 1.5kHz and 3.5kHz.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe, NSW 2141. Telephone (02) 648 5455.



clude an entry time of 10-100 seconds, an exit time 10-100 seconds and the isolation of alarm sectors.

For further information contact CMA, Unit 6d, 23-25 Windsor Road, Northmead 2152. Telephone (02) 630 8700.

Ferguson

of the above factors.

Other features of the units include full overload protection and fast response time. Two or more identical units may be paralleled for additional capacity, while three single phase units may be used to supply a three-phase load, providing the load is not out of balance by more than 10%.

For further information contact Ferguson Transformers Pty Ltd, Bag No. 27, PO Liverpool, NSW 2170. Telephone (02) 602 1222.

Automatic audio test system

The SZ340 Sound-Program Circuit Analyser from Radio Manufacturing Engineers (RME) measures parameters which are relevant for judging the quality of mono or stereo audio amplification and transmission circuits.

Combining transmitter and receiver capabilities the analyser can function as one or the other , or both. For each of these functions, three basic modes of operation are possible: manual control, program control (built-in microprocessor), or remote control via the ubiquitous IEEE-488 interface.

Typically, the SZ340 measures THD, distortion vs frequency, noise (peak, RMS, CCITT, CCIR) etc, and crosstalk.

For further information contact RME Pty Ltd, Unit A, 30-32 Skarratt Street (PO Box 259) Auburn, NSW 2144. Telephone (02) 648 2531.

COMPARE OUR PRICES BEFORE YOU BUY

Dear Customer, Over the last 9 years we at Altronics have toiled away often into the night with one major goal in mind — to provide you will competitively priced quality components and products with a **superior standard of service.** Looking back in 1986, I guess you could say the 10's of thousands of Shop and Mail Order Customers served, stand testament to our endeavours. We have resisted the "high powered advice" from Advertising firms to churn out expensive colour brochures and the like as eventually this must add to the cost of our products and unnecessarily waste your hard earned cash. (Even today Altronics Ads and Catalogues are produced "in house" at a fraction of the cost otherwise). The secret to our phenomenal growth we believe must lay, apart from our extremely conciencious attitude to service and delivery, in our policy of employing **Electronic Enthusiasts, Just like yourself,** in virtually every section of **Altronics,** so remember when you want a little technical advice — help is as close as your phone. **Then of course there is the matter of our low prices!!**

Jack O'Donnell

Build These Great Kits and Save $$$

Series 200 Mosfet Integrated Amplifier

Ultra Fidelity

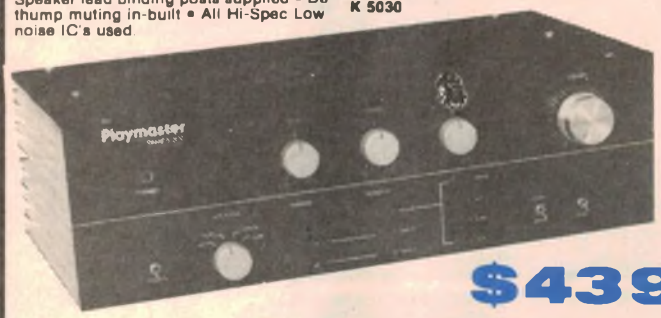
Features: - This brilliantly designed stereo amplifier will equal or better just about any integrated commercial amp regardless of price. It is a no-compromise design capable of delivering 100 watts per channel at very low distortion. Four basic stereo inputs are provided for both moving magnet and moving coil cartridges. Also three high level stereo inputs are provided for compact disc players, AM/FM tuner and auxiliary input which could be from a stereo TV tuner of Hi Fi VCR. Input facilities are also provided for two stereo cassette decks and full monitoring facilities are available for either deck plus dubbing from Deck 1 to Deck 2 or vice versa • Full CMOS Analog switching (soft touch) • Twist Type Speaker lead binding posts supplied • De-thump muting in-built • All Hi-Spec Low noise IC's used.

• Incredibly accurate RIAA equalisation - No control wiring whatsoever • Led indication of switch status (on/off) • All components mount on the PCB, even pots and sockets • Super efficient Toroidal Transformer—Low Hum • Uses Hitachi Mosfet Power devices • In-Built over drive protection • Centre detents on Bass, Treble and Balance Controls; multiple detents on volume control • Heavy Duty Heatsinks.

Specifications:—

Power Output: 100W RMS into 8 Ohms (per channel) **Freq.Response:** 8Hz to 20KHz +0 -0.3db 2.8Hz to 65KHz +0 -1db **Input Sensitivity:** 0.775mV for full power Hum: -100db below full output **S/N Ratio:** 94db flat -100db A-weighted **Distortion:** 0.01% @ 1KHz **Stability:** Unconditional

K 5030



$439

12/240V Inverter for Small Appliances

Low Power Design also Works as a Battery Charger

The inverter is ideally suited to powering low wattage mains appliances from the car battery while camping. This considerably improves the comfort level of the civilised camper. Similarly, it has uses in boating. Typically, it can be used to power an electric shaver, electric blanket, electric can opener or a 40W light bulb. Alternatively, back in the home (or still on the camp site). Frequency sensitive items such as belt or idler driven turntables can be powered at a very precise crystal controlled frequency for accurate sound reproduction. If speed variation over a small range is required, then a switch is provided to change from the crystal based 50Hz signal to a variable oscillator. **K 6705**

$69.50

300 Watt Inverter with Auto Start

240V Mains Power From your 12V Battery

(See EA Sept.'85)

Just think how handy it would be to have 240Volt AC Mains Power when camping, or for your Boat or Caravan—well this brilliant new design from Leo Simpson and the Design Team at Electronics Australia is the answer.

• **Super Compact** - kit supplied in Altronics **H 0482** Tough "ABS" Case • **Uses High Efficiency Toroid Transformer** thus keeping down heat disapation, battery drain and weight • **Auto Start** draws power from your battery only when appliance is plugged in and "turned on" i.e. battery can be left permanently connected if desired • **Thermal Over Load** automatically shuts down if/when output stage is overheated (through high ambient temperature and high load or combination thereof — Automatic reset • **Current Regulated** indicates inverter is being used within designed load limits • Current Overload unit self limits — LED indicates overload conditions. Single P.C. board construction — easy to build as there is very little internal wiring.

Complete Kit K 6752 **$199**

Fully Built and Tested K 6754 **$269**

Check Appliances And Electrical Wiring

Megohm Meter

(1985 Successor to the "Megger")

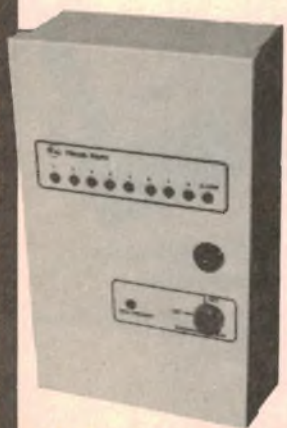
It uses a translator inverter to produce a regulated 1000V DC supply which is applied to the insulation under test. Insulation resistances between 2M Ohm and more than 2000 Ohm can be measured. **K 2550** (See EA July '85)

$49.95

Super Low Price on Famous EA 8 Sector Alarm System Kit

(See EA Mag. Jan '85)

$119.50



Features:

- Alarm has 8 separate input circuits - 8 sectors can be monitored independently.
- Each input circuit is provided with an indicator LED and a sector On/Off switch.
- Individual sector isolation allows the user to have some areas of the premises habited while others remain protected e.g. Inside Off/Outside On.
- Inputs accept both normally closed and normally open sensors.
- Two inputs provided with an entry delay between 10-75 seconds).
- Internal trip warning buzzer—alerts owner/occupant of pending alarm operation—great for the "forgetful" amoungst us. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm.
- Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short. **e.g. someone trying to bridge reed switches etc.**
- Switched output can be used to send a silent alarm through an auto-dialler circuit or similar.

K 1900 (without Back Up Battery) **$119.50**

S 5065 (12V 1.2AH Backup Battery) **$22.95**

Laboratory Power Supply

3 - 50 Volt at Up to 5 Amps

Designed by Electonics Australia, this supply has been one of our most popular throughout 1985. Our superb 1986 version incorporates the lates refinements and is now housed in an attractive, tough "ABS" Instrument case. This all new compact version has been made possible by the use of a high efficiency Toroid Power Transformer.

So you win four ways - Less heat, less weight - Greatly enhanced appearance and easier to build - **Remamber the Altronics Kit is fully drilled and punched.**

Brilliant Switch Mode High efficiency design by the Design Team at Electronics Australia.

$149.50 K 3300

10 Turn Output Voltage Control Option

(K 3300 is normally supplied with standard pot)

K 3301 **$12.50**

Auxiliary + And -12V Output Terminals Option

(Fixed Outputs Independent of Variable Main Output)

K 3302 **$12.50**

Make Your Next Party Swing With The Fantastic Musicolour IV

Ideal for Parties, Shop Signs, Display Windows, special lighting effects etc.

Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portionof frequency spectrum concerned). Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc. **K 5800**

$99

Stereo Enhancer

Widen your Stereo Image

This fantastic circuit increases the difference between the two channels thus actually making music sound "Wider". Therefore the stereo effect can be percieved although speakers are relatively close together.

This unit is self contained including power supply and enhancement metering. **K 5405**

$89.50

Car Security System

The Ultimate In Vehicle Protection

Uses Microphone Sensing to Guard Against Tampering and Vandalism.

The lates **'State of the Art'** Vehicle Security System. This ETI design provides protection that could save you a fortune. Strategically placed resonance microphones detect any tampering with your vehicle e.g. Lifting of a door handle, scratching of a coin etc.

- Auto Arming with Exit and Entry delays
- Dash Mount status indicator
- Remove Protection of bolt-on accesories
- Inc. circuitry to monitor any failure of dash warning lights.
- Normally closed and normally open circuits available.
- Supplied in high quality "ABS" Case with drilled and screened front panel.
- **Protect your expensive stereo** — Simply run a wire from the alarm system normally closed terminal to any earth screw on your stereo.

K 4340 ..... **$59.50**

Ultrasonic Pest Repeller

Build EA's new "Pest-Off" and save a small fortune on insect sprays.

The "Pest-Off" generates frequencies between 23KHz and 64KHz. Claimed to be the best for driving off most vermin.

Altronics Kit Includes • Strong "ABS" Case • Efficient Piezo Tweeter • Screened Front Panel. **K 1600**

$39.95

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Blue Ribbon Dealers are highlighted with a ■. These dealers, generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

Don't forget our Express Mail and Phone Order Service—for the cost of a local call, Bankcard, Visa or Mastercard holders can phone order for same day despatch.

Please Note: Resellers have to pay the cost of freight and insurance and therefore the prices charged by individual dealers may vary slightly from this Catalogue — in many cases, however, Dealer prices will still represent a significant cost saving from prices charged by Altronics Competitors.

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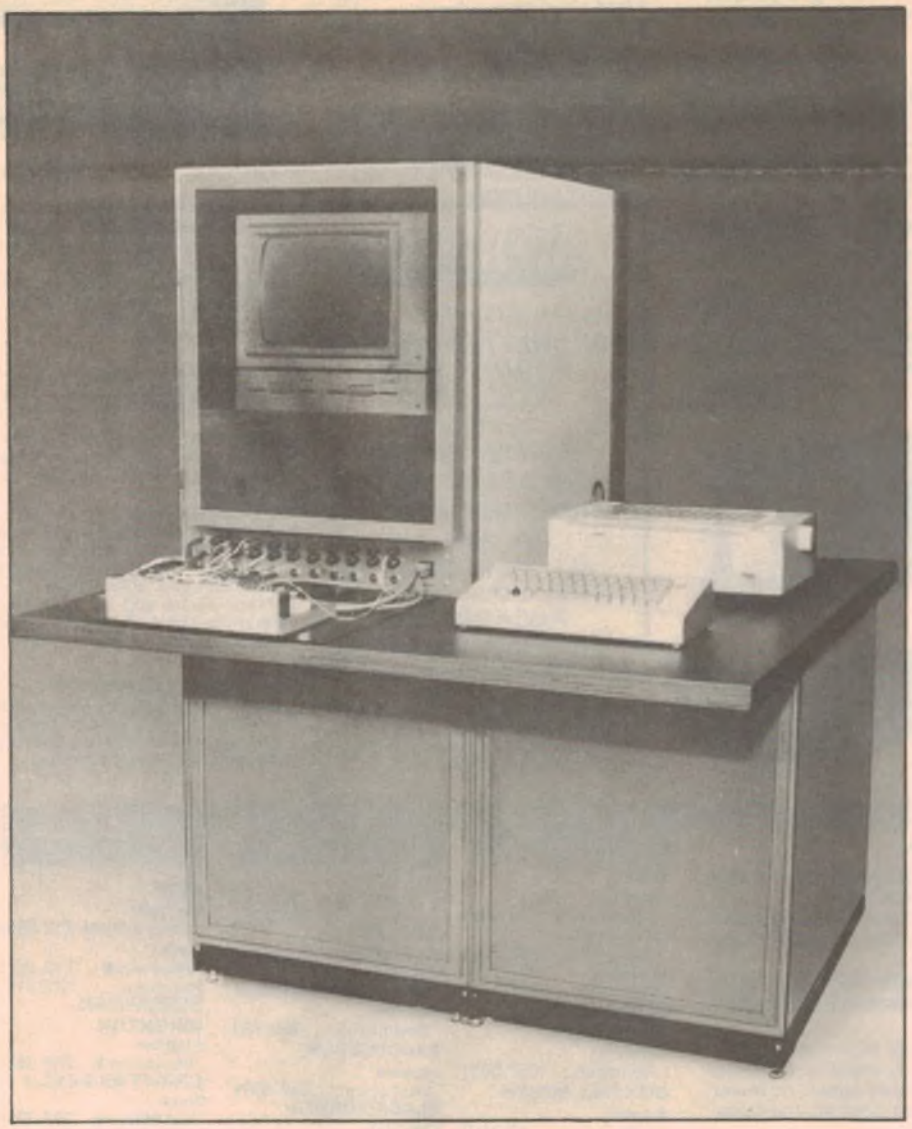


New power supply test system

The "Qualifier" Power Supply Test System from Datapower, Inc. has been updated so that its testing throughput is now three times faster than its original speed.

In addition, the systems are now packaged in a choice of two roll-about consoles — a 1.8m high, single-bay 56cm wide cabinet and a double-bay benchtop 118cm wide model.

Either cabinet can typically accommodate five or more loads of various kinds, a programmable power source, an interface module, and a complete computer system including a CRT display, two floppy disc drives, a keyboard and an impact printer.

Load combinations can be selected from four standard power ratings: 0.50A, 250W or 0-200A, 600W units; high voltage types (0 to 2.5A and 250W); and a 'quad' version that provides a 0-10A from each of its channels. AC and DC source modules are also offered.

As the system configuration may need to be tailored to comply with a customer's particular requirements, interested buyers should contact Datapower, Inc., Department QTE, 3328 West First Street, Santa Ana, California, 9203. USA.

Scrambler for the Sawtron 990

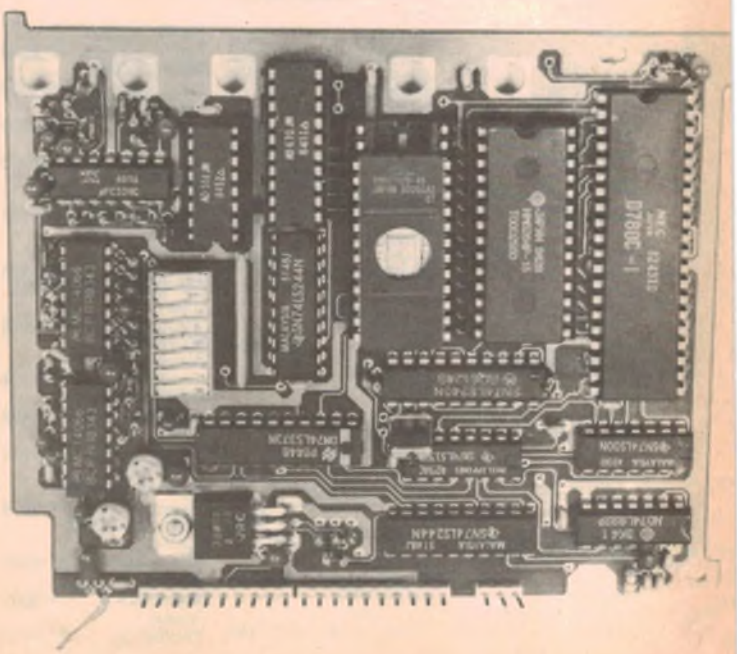
Inmark Pty Ltd has released the Digiscram Voice Security System for use with the Sawtron 990 2-way radio.

The Digiscram operates by 'scrambling' the voice into an unintelligible signal before transmitting it on the chosen carrier frequency. When this signal is received by the complementary Sawtron 990, the signal is decoded and fed to the speaker as a normal intelligible voice signal.

Digiscram is a high security digital time domain reversal scrambler with a total of 65,535 code combinations. Each transceiver can be programmed to one of 256 codes by the appropriate switch settings.

At present, the Digiscram plugs straight into the options interface on the Sawtron 990 transceiver but a version will soon be available to fity any type of transeiver.

Further details can be obtained from the designers and manufacturers Imark Pty Ltd, 167 Roden Street, West Melbourne, Vic. 3003. Telephone (03) 329-5433.



Printed circuit design software

smARTWORK transforms your IBM Personal Computer into a CAD system for circuit-board artwork

Entertainment Audio Pty Ltd has signed a manufacturing and distribution agreement with the Wintek Corporation of Indiana (USA). Wintek is the manufacturer of the popular smARTWORK PCB design software and the agreement gives Entertainment Audio Pty Ltd exclusive rights to manufacture and distribute Wintek products in Australia.

To this end, Entertainment Audio Pty Ltd has set up a local software production facility. In addition, the company has installed a 008 'hotline' for registered users of the software, with experienced engineers available to answer inquiries.

smARTWORK is an IBM PC (or equivalent) based CAD software package which allows the designer to create and revise PCB artwork without the tedium and inflexibility of tape, or the delay and cost of manually drawing layouts. The latest version can handle either single-sided or double-sided PCBs and features selection of pad shapes and sizes.

For further information contact Entertainment Audio Pty Ltd, 59 King William Street, Kent Town, SA 5067. Telephone (08) 363 0454.

Mobile radio call system

IQD Selcall is a universal selective calling system for base-to-mobile and mobile-to-mobile radio. It is equally suitable for original equipment and retrofit applications and has the convenience of standard DTMF signalling together with individual mobile calling, with either 2-digit or 4-digit access codes.

The unit can be supplied as a replacement microphone, incorporating both the encoder and decoder; or as an individual board for mounting inside the radio to give decoding only.

When the microphone is removed from its hang-up position, the decoder is reset and the conversation continues, using the standard PTT on the microphone; the radio remains activated until the microphone is returned to the hang-up position.

IQD Selcall operates on +5VDC, has an operating current of 10mA and a standby current of less than 5mA.

For further information contact DNA Communications, PO Box 47, Alstonville, NSW 2477. Telephone (066) 28 3454.

New Products...

Super-compact video security system

An interesting new product from Sony is the Portable Watchcam HNS-14AS, a video home security system.

This compact system incorporates a black and white camera with a sensitive microphone and super compact monitor for remote surveillance of the family home or a small business.

The unit comes with various installation accessories for mounting on the ceiling, wall or connected through the front door viewer. The fish eye camera lens has a 150° view which is visible on the 10cm compact monitor while a microphone picks up sound from the viewing area.

Another feature of the Watchcam is that it can be connected to household VCRs so that recordings of the surveillance area can be made.

For further information contact Sony (Australia) Pty Ltd, 33-39 Talavera Road, North Ryde 2113. Telephone (02) 887 6666.

Protected power op amp

National Semiconductor Corporation has introduced the LM675 power operational amplifier capable of delivering output currents of 3A at up to 60V, in both AC and DC applications.

In addition to providing built-in current limits of at least 3A, the LM675 features safe operating area and thermal limit protection and is internally compensated for gains of 10 or greater.

Other parameters which may be of interest include an input offset voltage of 10mV, a typical gain bandwidth product of 5MHz and a maximum slew rate of 8V/μs.

For further information contact National Semiconductor (Australia) Pty Ltd, 21/3 High Street, Bayswater, Vic 3153. Telephone (03) 729 6333.

Programmable RF power amplifiers

Two programmable RF Power Amplifier Systems for susceptibility testing, wattmeter calibration and high-power testing of active and passive components are now available from Elmeasco.

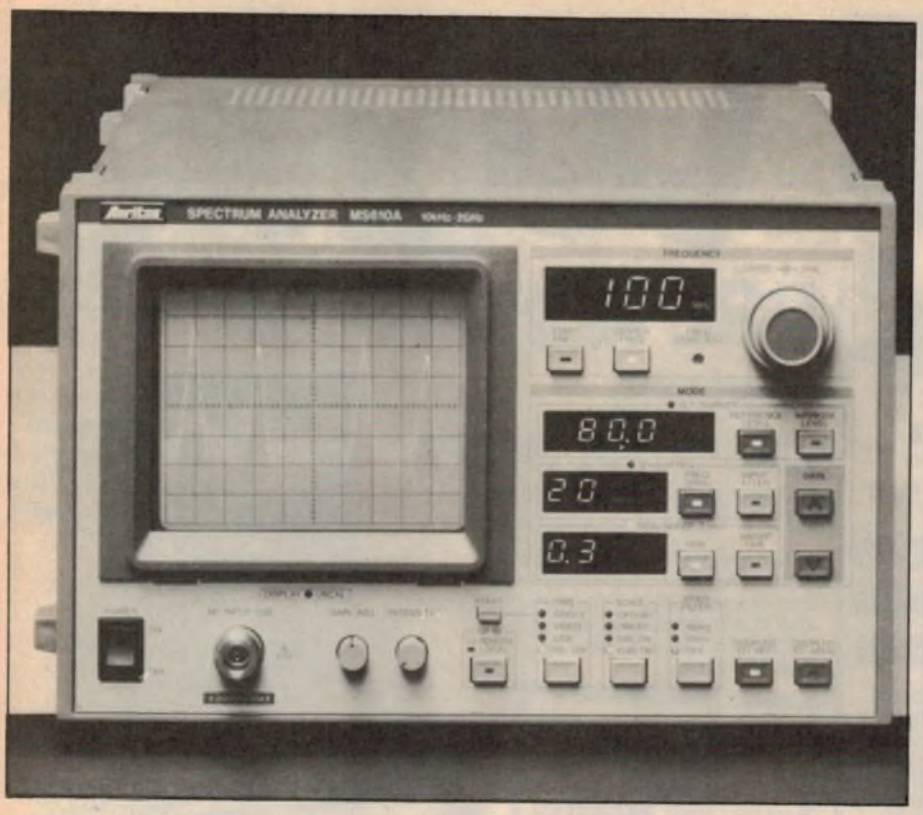
The Eaton 363/800 Wattmeter Calibrator and 8C100 RF Power Centre are each an assembly of several amplifiers within a GP-IB compatible control and filter network. They cover from 2MHz to 1GHz and supply up to 800 watts of filtered CW power.

The instruments provide an automated source for high power RF outputs in a number of test and measurement applications such as high power transistor testing, transmitter testing, nuclear magnetic resonance testing, medical research, RF wattmeter calibration and laser modulation.

In operation, the frequency is selected either manually or via the bus with the control unit connecting the appropriate amplifier and filter, applying power to the amplifier, connecting the appropriate amplifier, and connecting the input signal. DC power is applied only to the amplifier in use and the RF input is always removed prior to any switching action to prevent "hot" switching and possible damage to relays and filters.

The amplifiers which make up the Eaton 363/800 and 8C100 feature full solid-state design, RF power directional wattmeters, ALC-levelling capability, active VSWR protection and automatic thermal shutdown with reset.

For further information contact Elmeasco Instruments Pty Ltd, PO Box 30, Concord 2137. Telephone (02) 736 2888.



Spectrum analyser covers 10kHz-2GHz

Just released by STC, the Anritsu Spectrum Analyser MS610B is a compact, lightweight instrument which covers the frequency range from 10kHz to 2GHz. It features a coupled function which boosts measuring efficiency and a digital display function to monitor measured level.

The MS610B also provides for upgrading functions to a general-use spectrum analyser. There is a GP-IB interface to facilitate automatic measuring and a noise field measurement function with a QP detector.

For further information contact STC Pty Ltd, PO Box 42, Thornbury, Vic 3071. Telephone (03) 480 1255.

Digital power meter

Yew has just released its new model 2533 Digital Power Meter which simultaneously measures and displays volts, current and power for single, 3-phase 3-wire or 4-wire circuits.

An optional integration module provides an ampere hour meter or a watthour meter and has a number of computing functions to simplify data collection.

Also available are scaling and exponential averaging functions. For test systems or laboratory use, communications via RS232C or GP-IB (IEEE) interfaces can link the 2533 to a personal computer.

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

100MHz portable oscilloscope

The Hitachi V1100A is a new 100MHz oscilloscope with four channels and delayed sweep. The latter is a big advantage for close analytical waveform work.

In addition, the V1100A provides a definable comments display line of up to 30 characters. The waveform and setting conditions are all shown on the screen.

Two cursors control the on-screen readout of the inbuilt digital voltmeter and frequency counter.

Channels 1 and 2 have a vertical sensitivity of 1mV/div, while channels 3 and 4 have 0.1V/div sensitivity.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe, NSW 2141. Telephone (02) 648 5455.

WE'VE GONE CRAZY! CHECK OUR KIT PRICES.

UHF/VHF DOWN CONVERTER

NEW FOR '86

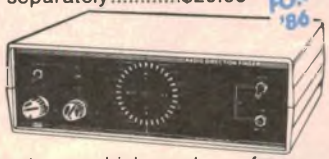
Brilliant kit which enables your VHF-only TV to receive UHF. Pre-aligned for ease. Covers UHF bands 4 and 5 (Ch. 28-63). Features 'bypass' switch for viewing VHF without the need to disconnect, then re-connect antenna lead. Also tuner module (K-6051) available separately.....$29.95

Cat K-3236

$69.50

RADIO DIRECTION FINDER

NEW FOR '86



An easy to build, valuable amateur accessory! Quickly locates RF signal direction using an electronic rotating antenna which produces frequency modulation by Doppler shift. Features 32 LED 'positional' indicator.

Cat K-6345

$139

2m LINEAR AMPLIFIER

Powerful, all mode amp that provides access to distant repeaters. 13.8V — suits mobile and base station use. Requires as little as 3W input. Includes huge heatsink. Freq. range:144-148MHz. Insertion loss: 0.6dB. Input VSWR: < 1.2:1.

NEW FOR '86

Cat K-6313

$249

VHF WATT METER

Measures power output of VHF transceiver and antenna efficency. Useable freq. range: 144-148MHz. Max. power: 150W. Ranges: 0-150W., 0-30W. Accuracy: +/-10%.

Cat K-6316

$49.95

BREATHE EASY...

NEW FOR '86

Negative ion generators counter the effects of excessive positive ions, reduce the effects of hayfever, etc. Build one yourself and save! Kit includes 24 stage voltage multiplier (app. 8.1kV output.)

Cat K-3333

$34.50

DICK SMITH ELECTRONICS PTY LTD

"LOONEY DSE MULTITECH

POWERFUL COMPUTING PRICED FOR HOBBYISTS!

At last a powerful 128K RAM home computer with a built-in 360K floppy disk drive that serious programmers can afford! And because it operates MS-DOS there's an extensive range of software to run.

Monitors available from $299

EXPANDS FOR FUTURE NEEDS!

Full colour & sound plus graphic capability!

ONLY **$1395**

Multitech System One matches IBM's JX feature for feature — but costs over $400 less even with their discounts! Its 84 key, ergonomically designed keyboard boasts 10 function keys and numeric pad. Connect a wide variety of monitors. Expand with peripherals: includes game port, parallel printer connection and serial port. Plus many more fine features.

- 256 expanded ASCII character set
- Fully integrated crystal real time clock/calendar with battery back-up
- IBM compatible colour graphics interface with 640x200, 300x200 graphics resolutions and 16 colour text mode.

Cat X-8000

SEE DICK SMITH ELECTRONICS — FOR THE FINEST SOFTWARE RANGE

INFRARED CONTROLLER

Talk about luxury! A remote control just the size of a 'match box' but has the power to turn on/off electrical appliances — TV, lamp, stereo, etc. — up to 12m away! Low power drain for high battery life.

Cat K-3428

NEW FOR '86

GREAT BUY!

$69.95

120W MOSFET AMP MODULE

Gives moderately powered PA and amps more oomph! And what performance! Second and third THD below 0.001%, intermodulation distortion below 0.003% at 10kHz. Full power noise is limited to -100dB. And freq. response (flat) is within +/-0.4dB from 8Hz-29kHz. Includes heatsink.

NEW FOR '86

Cat K-3443

$99.50

DSE Kits — Easy to build and affordable.

JUNE"

CRAZY MID YEAR BARGAINS!

NOW CAT COMPUTERS ARE EVEN BETTER VALUE!

HUGE SAVINGS!

If price has held you back from entering the world of powerful computing, then our popular CAT is the 'purr-fect' choice. Its impressive 64K RAM provides huge memory capacity for serious programming. And the 81 key keyboard features a numeric pad and 8 function keys for 24 software/program functions. Even enjoy sound and full colour... great for graphics. Includes inbuilt cassette, joystick, RS-232C serial and printer connections.

Cat X-7500

Was $499

NOW $399

DATAPHONE 1200 MODEM

Easy data transference without the high cost! Features its own RS-232 serial interface, push button phone with 12 number memory and last number re-dial. 300/600/1200 full or half duplex modes. And it's Telecom authorised. Cat X-3300

Telecom Authorisation No: C85/37/1353

$349

DATAPHONE 300 MODEM

Super economy 300 baud, full duplex modem that comes with its own push button phone. Features an answer/originate switch. And considering it measures a mere 135 x 95 x 47mm, it does a big job of transfering data.

Cat X-3301

Telecom Authorisation No. C85/37/1373

ALL NEW!

ONLY $199

TAKE OUT THOSE SPIKES AND SPRUGLES FROM YOUR COMPUTER!

Deluxe mains filter eliminates all the garbage from your computer for a clean line of supply. So if you're having 'crashing' problems this could be the answer! Rated at 240V, 2 amps. Cat M-9850

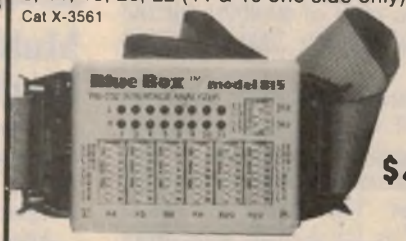
ENERGY APPROVED AUTHORITY

$125

'BLUE BOX' INTERFACE ADAPTOR

Acts as a quick connect RS-232 interface test set, status activity monitor and configuration device on mini, micro and main frame computers. Ideal for trouble shooting RS-232 installations too! Transmission speed: 50-19200Baud. Monitors lines: Pins 2-6, 20, 22. Cross connectable lines: Pins 2-6, 8, 11, 19, 20, 22 (11 & 19 one side only).

Cat X-3561



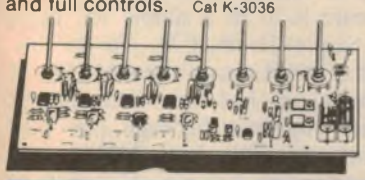
ONLY $199

Telecom VIATEL AUSTRALIA'S NATIONAL VIDEOTEX SERVICE

FREE INFORMATION & ORDER SERVICE ON DSE VIATEL NO. 34 5720

FOUR INPUT MIXER PRE-AMP KIT $59.95

Garage bands love it! Use all 4 inputs to connect guitars or a mix: guitar mic, line inputs. Features selectable gain and impedance on individual inputs and full controls. Cat K-3036



NEW FOR '86

VHF 2m AMATEUR YAGI ANTENNA

With an amazing 10dBd gain! Get superior performance with this great kit. 9 Elements and comes pre-drilled — so there's no tuning hassles, and it can be assembled in no time! Cat K-6297

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DISKS FROM ONLY $2.75 EACH!

Huge savings on DSE Floppy Disks! The highest quality single/double sided, double density disks at a DSE value price. You know how much you pay for the others so look at DSE disks for the quality, reliability and incredible savings.

X-3500 Single sided, double density.
In box of 10 ..... $27.50

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Enjoy the latest in Electronics.

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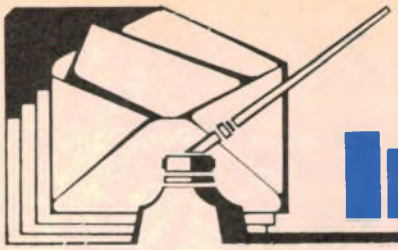
DICK SMITH ELECTRONICS PTY LTD



Information centre

Matching CD players to amplifiers

I have just become a compact disc "buff" and was very interested in the article on the CD Attenuator published in the January 1986 issue.

My player is a Hitachi DA4000. It has an auxiliary output — a 5-pin DIN socket for future compact discs with video output. I would be interested to know about this new development and whether such discs are available yet. Can you help?

The input attenuator described in January does not, in my view, really solve the problem of matching amplifier inputs. CD players have a high rated output to partly compensate for the high dynamic range. In my case, the CD player has a dynamic range of 95dB while my FM tuner has a dynamic range of 65dB.

This may not look too great a difference on the logarithmic scale, but represents a voltage ratio of 60,000:1 for the CD player as against 2000:1 for the tuner.

When I switch from tuner input to player input, I want to turn the amplifier's volume control up, despite a rated 2.5V output from the player and 0.3V from the tuner. The reason for this is that the 2.5V is for a 95dB note from the player and the 0.3V is for a 65dB note from the tuner. If we consider a 40dB note from the player, it represents a voltage from the player of only 100/60,000 x 2.5V or 4.1mV whilst a 40dB from the tuner is 100/2000 x 300 = 15mV.

Thus, to play the 40dB note at the same loudness the amplifier's volume control must be turned up.

My amplifier is rated at 150mV input sensitivity which means I am limited to a setting of 0.15/2.5 on the volume control to avoid overloading on a 95dB note. If I installed the CD adapter, I could use more of the volume control but would have to turn it down dramatically when switching to tuner input.

Except on rare occasions, I cannot play compact disc through my amplifier because of its loudness on some notes. (I would lose my wife!). I have partly solved the problem by building a matched headphone amplifier for personal listening.

Finally, I was interested in your article on the new Carver compact disc player, in particular its tracking performance on the Philips 4A test disc where I am sure my Hitachi would also fail the black spot test. The current fad of rating a player's performance by this ability to track over surface imperfections on the disc seems an inappropriate measure of the quality of a player unless achieved without any loss of fidelity. The only way I know my discs are dirty and need cleaning is when the player produces a hiccup! (W.L., Harbord, NSW.)

• It is not true to say that, because a CD player has a dynamic range of 95dB, it will have a program dynamic range of 95dB. In practice, the majority of compact discs have no more dynamic range than their equivalent vinyl discs, ie, about 65 to 70dB at best. In effect, the extra dynamic range of the compact disc medium is used to ensure that very soft sounds are recorded well above the system noise floor and very loud sounds are recorded without crushing. It would be very rare that a CD music recording gave the maximum 0dB output (typically 2V rms). If it did, it would indicate that the recording system had been used right to its limits.

At the same time, compact disc players generally do have a higher average output level than say, tuners or tape decks, which typically have a maximum output level of 77mV rms, or thereabouts. Therefore, to avoid amplifier overload on the loud passages, the CD attenuator is a desirable accessory for many amplifiers.

As far as our checks on error correction are concerned, it is true that many compact disc players which won't fully track the Philips defect disc will give perfectly satisfactory performance for most users. However, your CDs will not

Multi-sector burglar alarm

I have been waiting patiently for someone to write to you with problems similar to mine with the Multi-Sector Burglar Alarm, EA Jan/Feb 1985.

After purchasing my kit, I received an errata sheet without the two most effective alternatives listed. I put the alarm to the test one Sunday, leaving the house for six hours. I returned home to find all fuses in our meter box removed.

Shortly afterwards, some neighbours explained that the alarm sounded for some three quarters of an hour. A friend who had collected both the June and August issues of *Electronics Australia* advised me that errata had been listed for the alarm.

The kit was purchased in mid October and, as these changes were not mentioned, my faith in that particular supplier has dropped beyond repair. Additionally, several parts were missing in the kit.

With the changes incorporated, I left for a three-week holiday. On the second day, I phoned a neighbour, only to find that the alarm had malfunctioned again.

I eventually discovered that the alarm was being triggered whenever the kitchen fluorescent lamp was switched on. Also, it was triggered by the light being switched off after some time.

The triggering only occurs when the 240V is connected to the alarm — it remains set if the 240V is disconnected. Also, it was triggered by the light being switched off after some time.

No other appliance seems to affect the alarm, except the refrigerator.

Could you please advise me of some reason for this and a solution. (R.B., Donvale, Vic.)

• By now, you have probably seen our February 1986 issue which detailed the solution to your problem (page 117).

The cure is to fit a simple RC delay circuit to pin 11 of IC7b. To do this, connect a 330kΩ resistor between pin 11 of IC7b and pin 3 of IC8e, then connect a .047μF capacitor between pin 3 of IC8e and ground. In addition, the .01μF capacitor on pin 13 of IC4f should be changed to 0.47μF to extend the length of the test pulse.

stay in pristine condition forever. You may be able to clean off smudges and finger-prints but this very process means that sooner or later, they will collect their share of scratches. And accidents will always happen. One of our test discs inadvertently acquired a very deep scratch in spite of all care. (Editor: If I ever find out who did it there'll be hell to pay!)

Severe scratches can render a disc completely unplayable to the extent that the disc contents will not even be loaded, let alone one or two tracks not playing. It is at this point that some CD players are way ahead of others. A CD player which has superior error correction will effectively increase the life of your disc collection because it will continue to play discs that other decks cannot.

Compact discs with video "stills" should be available later this year.

Problem with Playmaster Series 200

Shortly before Christmas I purchased the Playmaster Series 200 Amplifier from Jaycar Electronics. Construction went ahead without much difficulty, except that, on completion, I ended up obtaining a good signal from the RH channel and severe motorboating and loss of signal from the LH channel.

The following is a summary of the major symptoms, and these apply entirely to the LH channel:

(1) The motorboating on the CRO produces a high frequency spike. I was unable to measure this because it varied considerably depending on the nature and direction of physical pressures exerted on the board, mainly degree of flexing.

(2) Careful lifting at various points in the LH circuit has isolated the trouble to somewhere between IC3 and the main amplifier section.

(3) Finger tapping of various components in this region of the circuit produces little effect on the motorboating except in the case of the variable potentiometers and the coupling capacitor (6.8μF) connected to pin 6 on IC5. The latter considerably increased the noise level when the exposed section of the metal can at the base was touched. This suggests that there is severe instability in the feedback to the tone control circuit.

(4) The volume control, when set to zero, eliminates the noise at the output end, and the noise increases as the volume control is turned towards maximum. Placing a finger on the spindle of the volume control produces a big increase of the noise.

(5) All the components from IC3 up to the capacitor on pin 6 of IC5 have been switched or checked (in the case of the resistors), resulting in no change in the symptoms.

(6) Pushing either of the heatsinks inwards caused marked changes in the nature of the noise. This can be seen on the CRO.

(7) All solder points in the region have been resoldered, and careful examination of the tracks on the PCB with a magnifying glass revealed no faults.

The conclusion is that I have a fault in the PCB which I have been unable to locate. I would be very grateful for any suggestions you may have to the contrary, otherwise I am up for a new circuit bord and replacing a lot of the components. (J.M., Wulguru, Qld.)

• We suspect that one of the op amps is faulty, either IC4 or IC5. Try replacing IC4 and IC5 with the right channel op amps. If this does not solve the problem, check the potentiometers. One of these may have a fault such that the potentiometer case is connected to the resistance element within the pot. It may not show up as a short but as a high impedance leakage.

Problem with code switch

I have endeavoured to build the code switch as in Circuit and Design Ideas on page 52 of the March issue of "Electronics Australia" but unfortunately I have not had success with the circuit.

Firstly, I cannot get any reading from MR pin 15 on IC4 or CLR pin 4 on IC5 at initial switch on.

Secondly, I cannot get any reading from the output of IC2 (pin 10) onwards. Pin 11 remains high whether switches are pressed or not.

Having disconnected IC1 and IC2 from switches 1 and 2, the circuit still reacts by pressing switch 1 a number of times and again switches off after a short time by again pressing switch 1. Having IC1 and IC2 connected makes no difference.

Pins 3, 4, 10, and 1 of IC1 and pin 4 of IC2 have a low reading, while pin 3 of IC2 has a high reading. Pin 4 of IC2 goes high when the switches are momentarily pressed while pin 3 has no reaction.

I realise the circuit is not one of your designs but this idea to my mind is good for burglar alarms. I have the 8-sector Home Burglar Alarm and would like to have a system like this one rather than they key switch.

I would be very grateful if you could help in any way possible to get the circuit working. (R.H., Picnic Point, NSW).

• Unless you have a CRO, you will not be able to observe the very brief reset pulse that is applied to the MR and CLR inputs of IC4 and IC5 respectively on power up. However, correct operation is indicated if pin 3 of IC4 is initially high and pin 1 (Q) of IC5 is low. The NAND gate outputs (IC2b-IC1a) should all be high.

Assuming this is the case, hold down S1 and check that pin 4 of IC2b goes low. If this checks out, release S1, hold down S2 and check that pin 3 of IC2a goes low. The outputs of the remaining NAND gates can now be checked in similar fashion.

Note that the relay should turn on when output 6 (pin 5) of IC4 goes high.

If the circuit fails to work correctly, check your work carefully for wiring errors. The output of IC2d should go high only if the wrong switch is pressed. This then resets IC4 via IC2c, IC3b and IC3c.

Notes & Errata

PLAYMASTER STEREO AM/FM TUNER (February 1986, File 2/TU/57): several electrolytic capacitors are shown with reversed polarity on the parts layout diagram on page 60. These are the 1000μF capacitor located at the bottom right hand corner of the PCB and the two 10μF electrolytics immediately to the right of the 7805 regulator (the one with the heatsink) near the centre of the board.

In addition, a 39Ω 0.25W resistor should be added to the parts list.

AUTOMATIC BRAKE LAMP FLASHER (November 1984, File 3/AU/42): the voltage drop due to the light gauge wiring used in many modern cars can cause improper resetting of the circuit. In most cases, this can overcome by connecting a resistor in parallel with the 22μF capacitor on pin 16 of IC2. Try 100kΩ to start with and choose a value which gives a reset time of between five and 10 seconds.

If this proves unsuccessful, try increasing the value of the .01μF capacitor on pin 15 of IC2. Alternatively, try connecting this capacitor to the other side of D2 (ie, directly to the positive supply rail).

LETTERS

Continued from page 5.

amp: "It looks so good your friends won't believe you've built it!"

Which brings me back to N.M. The hard fact is that there aren't very many N.M.s anymore! If there were I would guess that this very competitive market would make a greater effort to cater for them.

Most people these days simply do not have the time to chase the sometimes dozens of individual manufacturers or agents for the relevant parts. Even if they did have the time, the (generally) multinational parts suppliers are not interested in serving an individual. Most large companies simply will not contemplate selling one off parts to individuals. Their 'systems' were not designed for it.

The same applies to metalwork. If an individual does not have the considerable resources to fabricate for himself, the alternative is the professional supplier. Some 'jobbing' metalwork companies will make one cabinet — but you will have to double-mortgage your house to pay for it.

Finally, many parts for kits are nowadays not even normally stocked in Australia. The kit supplier must order the goods — in quantity — many months before so that the supplier can indent the goods from overseas.

The alternative, of course, is to try to buy the parts from the kit supplier. Is this a problem? Yes — and no!

Technically, there is no reason why Jaycar could not sell any individual specialised kit components. There are, however, commercial realities.

The first reality is that very few people actually ask for such a service. In order to provide ex-stock availability of kit parts in all six Jaycar stores, we would have to increase the number of lines carried in each store by over 1200 lines! To justify the investment, the price of each part would need to be very high. There is an interesting parallel.

The automotive spare parts trade is sometimes criticised for high prices. It has been said that a $10,000 car off the showroom would cost at least $50,000 if you bought the parts and put the car together yourself. And that's not counting labour!

I have no doubt that the auto spare parts trade is competitive. So why are the parts expensive? Basically, it is to finance the capital tied up in an enormous amount of inventory of parts that may wait on a shelf for years until someone wants them.

Whether you sell bumper bars or special ferrite cores, the economic realities are the same.

Another important point — while not covered in N.M.'s letter, some people write to us with the following theme:

"I wish to purchase the following special parts from the xyz kit . . . (a list of parts follows)."

This is especially typical of New Zealand enthusiasts who have particular problems.

Invariably, the parts that the customer has are the bog standard components which, by their very nature, are the lowest cost components anyway. They generally comprise less than 5% of the value of a complete kit.

Some people ask for a kit — but with such parts removed! The fact is this: it would cost us more to remove the low cost parts than to keep them in!

Let me ask N.M. a question: would N.M. be happier if we cataloged every item if the final cost of the ultimate finished product was (say) five times the cost of the original kit?

We think we know the answer!

But let's get back to the Playmaster AM/FM Stereo Tuner.

Neville Williams made a very good point — by implication — about purchases of 'high cost' equipment: ". . . one wonders how people get on who want to buy a good quality commercial tuner . . ."

It would be absurd to contemplate purchasing built gear in parts — so why are kits different?

As Mr Williams pointed out, we take most credit cards and we can also arrange finance to approved customers on the spot. That way you can have the whole kit in one go but the payments can be sliced up instead of the kit!

When the idea of the Playmaster tuner was first discussed, Jaycar, among other kit suppliers, was canvassed to gauge interest. Whilst we at Jaycar were very enthusiastic, apparently other suppliers were not. They (rightly) realised the enormous component sourcing problems and decided (we assume) to adopt a 'wait and see' approach.

I made a definite commitment at the time to produce a full kit for this project. With the knowledge of commercial support, EA went ahead and produced a superb design.

Jaycar did indeed — as Neville Williams says — stick its neck out, but to the tune of many tens of thousands of dollars, not just thousands!

But like all companies, we need to optimise our investment. We would be of little use to future generations of hobbyists if we went broke!

The commercial viability of the AM/FM tuner kit is by no means clear and has certainly not been reached yet. Whether we make a profit out of this project or not, we at Jaycar will continue to produce kits for projects that our competitors ignore.

Over 90% of readers who want to construct this project are delighted to be able to buy the project "prepackaged", ie. as a "kit". It is obvious that this market is our first and foremost.

We certainly sympathise with N.M. and his colleagues, but the economic realities preclude us from being all things to all mankind.

Gary Johnston,
Managing Director,
Jaycar Pty Ltd.

*Dick Smith is no longer associated with Dick Smith Electronics Pty Ltd which is now a wholly owned division of Woolworths Ltd.

HIFI REVIEW

Continued from page 61.

At −10VU without Dolby, the upper +3dB point was 10kHz, with Dolby B, 9.5kHz and with Dolby C, 9kHz. Signal-to-noise ratio was 47dB without noise reduction, 68dB with dbx, 57dB with Dolby B and 60dB with Dolby C, all with respect to 0VU recording level. THD at 1kHz and a 0VU level was 2.5%.

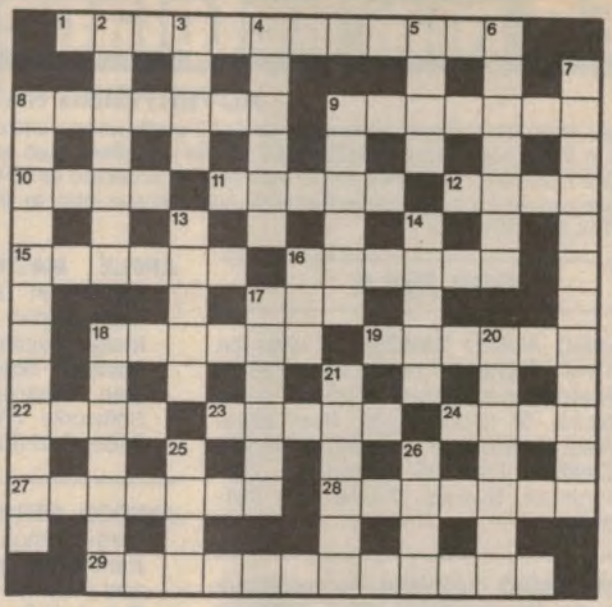
Separation between channels was 41dB at 100Hz, 47dB at 1kHz and 28dB at 10kHz which are very good results.

Overall, the Teac W-880RX Stereo Double Reverse Cassette Deck has very good performance. Its frequency response and distortion characteristics are good particularly when chrome or metal tapes are used. The signal-to-noise ratio is also good, especially with quality tapes and when either dbx or Dolby noise reduction systems are used.

We think it's an impressive machine, offering a wealth of facilities in a handsome package.

Recommended retail price for the Teac W-880RX is $999. For further information regarding Teac products, contact your hifi dealer or Teac Corporation, 115 Whiteman Street, South Melbourne, Vic 3205. Phone (03) 699 6000. (J.C.)

JUNE CROSSWORD



ACROSS

1. Representation of a circuit. (5, 7)
8. Source of potential. (7)
9. Common form of bias. (7)
10. Conductor in a transport system. (4)
11. Electrode. (4)
12. Non-conical type of speaker. (4)
15. Light units. (6)
16. Central cores. (6)
17. Information storage component. (3)
18. Excellent conductor. (6)
19. Portion of radiant energy. (6)
22. Having great volume. (4)
23. Derived SI unit. (5)
24. Said of sinusoidal wave. (4)
27. Generate data again. (7)
28. Satellite-tracking facilities. (7)
29. Electrical fault. (5,7)

DOWN

2. Metal used in certain batteries. (7)
3. Positioned a pick-up in a player. (4)
4. Desiccating. (6)
5. Briefly, strobes check it! (4)
6. Yacht rig named after radio man. (7)
7. Communication machines. (12)
8. Popular property-protecting project. (7,5)
9. Element 88. (6)
13. Means of measuring lag. (5)
14. Particle emitted by 9 down. (5)
16. Type of gate. (3)
17. Kind of control. (6)
18. Sounds like a speaker with a complaint! (7)
20. Wave giving rise to saturation current, or perhaps squelch? (7)
21. Liquid with a high pH-meter reading. (6)
25. Acronym for rubbishing computer's results. (4)
26. Its members may race around another form of 29 across. (1,1,1,1)

SOLUTION FOR MAY

E	L	E	C	T	R	O	N	S		F	A	D	E	R
T		A		A		X		H		I		R		H
H	A	R	T	L	E	Y		O	F	F	L	I	N	E
E		P		K		G		C		O		V		O
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O		A		U		G		N		I		T		S
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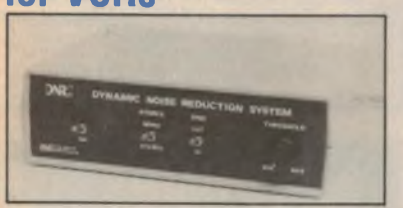
Dynamic Noise Reducation System for VCRs



Give your mono VCR sound a lift with this dynamic noise reducation system which reduces tapes hiss and adds simulated stereo. The simple circuit uses the standard DNR chip from National Semiconductor.

Toshiba XR-P9C portable CD player

Next month we review Toshiba's fancy entrant into the portable CD player stakes. The XR-P9 has a futuristic wedge shape and is fully remote-controlled.

Next month in Electronics Australia

Low-cost Converter for the Apple of Microbee

Measuring, monitoring or metering with your micro? You need an A-D Converter. This low cost unit plugs into the Apple games port or the parallel port on the Microbee. Included with the article will be listings in Basic for both machines.

Surface-mount devices

The revolution in surface mount devices is gathering pace. Our major feature on this subject will describe these new components in detail and tell about the techniques needed to mount these minuscule devices.

Note: Although these articles have been prepared for publication, circumstances may change the final content.

EA marketplace EA marketplace

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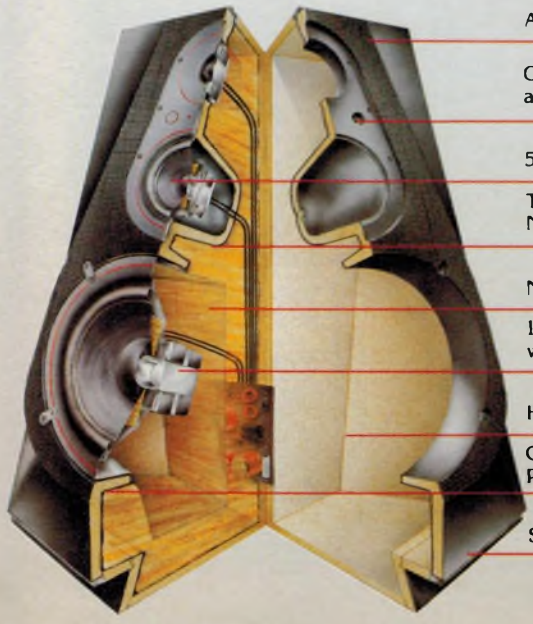

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