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SEPTEMBER 1979

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ELECTRONICS Australia

Volume 41 No. 6 September, 1979

Australia's largest selling electronics magazine

This new musical doorchime uses a microprocessor and automatically steps through a repertoire of 24 tunes. Find out how to build it on p60.

COMING SOON — a sensitive metal locator that you can build for yourself at low cost. Who knows, you may find a gold nugget!

Don't miss our October issue!

Our October issue will contain a special bonus insert — a big 144-page catalog from Tandy Electronics that's crammed full of electronic gear. Don't miss out on your copy.

On the cover

Our cover photo sets the theme for this month's special feature on "The Personal Computer Revolution". Shown clockwise from upper left are: Apple II (Computerland), TRS-80 (Tandy Electronics), Exidy Sorcerer (Dick Smith Electronics), and Commodore Pet (Hanimex). For the full story on these and other personal computers turn to p12.

FEATURES

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Editorial Viewpoint

Communications in a new light!

Those of us who have spent a lifetime in wireless/radio/electronics still continue to be impressed by its ever-widening horizons, as reflected by engineering publications from around the world.

Originally, wireless/radio engineers were concerned mainly with communication and broadcasting, with limited expansion into related fields such as audio and instrumentation.

Then came World War II and, with it, radar — a whole new engineering concept which has since revolutionised terrestrial navigation and triggered a vast program of space research. As it happened, radar technology also paved the way for modern television and the world of video — a further and unique branch of the art.

While television largely dominates our leisure, another major developmental stream is rapidly penetrating our everyday activities: digital technology, the computer, the microprocessor and automation. This new and burgeoning technology is not only breeding its own race of specialist engineers, it is also posing major problems for society itself, so profound are its ramifications.

Meanwhile, communications technology itself is taking on a complete new look, with satellites carrying everything from international phone calls to colour television, complex computer data and top secret military and surveillance traffic. But that is not all.

The June and September issues of the "Proceedings of the IREE Australia" serve to remind the reader of yet another offshoot of electronic research which is not widely known, but is of enormous potential importance. I refer to communication by means of modulated light, ducted through optical fibres.

A series of papers in the June issue of "Proceedings" outline current research and application of fibre optics in the United States, United Kingdom, Australia, West Germany and Japan. They reveal that, while the idea of communication via ducted light is not new, technology has been developed to its present level substantially within the last decade.

Scanning the papers, one finds reference to optical fibres that exhibit a transmission loss of less than 1dB per kilometre; to diameters which are typically one-twentieth that of metallic cables — and less dependant on repeaters; to light-borne information systems that promise a bandwidth of around 800MHz — a modulation bandwidth that bears comparison with the total radio frequency spectrum that we have substantially exploited to date.

If you want to gain a closer understanding of the subject, I commend the two issues for your attention*.

— Neville Williams

*"The Proceedings of the IREE Australia," June and September 1979. Edited by Professor A. E. Karbowiak. The IREE is at 35-43 Clarence Street, Sydney 2000. Tel (02) 29 4051.

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*Recommended and maximum price only.

News Highlights

Weather forecasts now on Prestel viewdata service

Weather forecasts — revised every six hours — are now available to subscribers of the British Post Office's Prestel viewdata service. Operators at the Meteorological Office in Bracknell prepare each new forecast using an editing keyboard to change the text and coloured weather areas. The information is then stored in the Prestel computer.

Forecasts, which can be updated hourly if weather patterns change dramatically, cover shipping, holiday resorts and even ski conditions. Three regional forecasts, a three-day and a monthly forecast are also fed into the computer.

Prestel gives telephone users direct access to potentially limitless banks of computer-stored information via a TV set. It brings together two pieces of domestic equipment — the telephone and the television — and enables a user to "dial" into a number of computers to select information which is then displayed on the TV screen.

Computers for school children

Canberra Primary school children will soon be able to learn the basics of computing, following the purchase of two microcomputers by the Canberra Branch of the Australia Computer Society (ACS). The computers will be used at the Campbell Mathematics Centre to teach computing to children in classes 4 to 8. Children will be taught an elementary programming language, and given simple problems to solve on the computer.

The computers are Tandy TRS-80, Level II BASIC machines. Each consists of a keyboard, screen, and tape cassette unit. Schools in the Canberra district wishing to borrow the machines should write to the Branch Secretary, Post Office Box 446, Canberra City, ACT 2601.

Telefunken invests in solar power

West German electronics giant Telefunken is building a pilot plant at its Heilbronn facilities to produce terrestrial solar cells. The goal is to find a technology that by 1985 will result in mass-produced 1-watt solar cells costing less than 50 cents.

With these, Telefunken plans to develop generating plants with outputs of up to 100 kilowatts by the mid-1980s. The firm is cooperating in this effort with the silicon producer Wacker Chemitronic GmbH in an eight-year project funded by the West German Government to the tune of $75 million. An additional $20 million is being put up by Telefunken and Wacker.

Light-powered telephone

Scientists at Siemens AG in West Germany are hard at work on a radically simplified light-powered telephone.

Appropriately called the "Optophon", the new telephone uses a so-called "optical microphone". The microphone, incorporating a thin, mirrored membrane, uses the voice to modulate the laser light directly. The transmitter does not need the transducer and modulator of the more conventional fibre-optic link, in which the transducer converts the voice to an electrical signal and the modulator electrically modulates the light source.

What is more, the Siemens handset will not even have a light source. Instead, the light source, a laser, would be housed in the central exchange and the light sent to the handset over the optical cable.

At the receiver end, the modulated light strikes a photoelectric detector that converts the light impulses into electrical signals. These are then fed to an electromagnetic earpiece of the kind used in an ordinary telephone to produce sound.

Video disc player at CES

Universal Pioneer Corporation (UPC), a joint venture between Pioneer and MCA Inc of the USA, recently commenced mass-producing its newly developed optical video disc player with laser pick-up for industrial use. The product is targeted at the US market and initial production is set at 500 to 1000 units per month.

Notable features of the player are its small size, light weight and integrated player/control functions. It has been designed to be mass-produced, and can record and reproduce as many as 54,000 still pictures, all of which can be contained on a single disc side. This means that the information contained in an entire set of "Encyclopaedia Britannica" can be put onto three discs!

Playing time is some thirty minutes per side for video programming.

However, if the system is used for audio signals only, then more than ten hours of continuous play is possible per disc side. A remote control unit controls such functions as forward/reverse, fast forward/reverse, slow motion and random access. And since no contact is made with the disc, its playback life is virtually unlimited.

Pioneer showed the new video disc player at the Consumer Electronics Show held in Sydney last July. However, no details of a possible Australian release are yet available.

Solid-state car instrument displays

Solid-state car instruments displays with no moving parts — that's the latest development being researched by Smiths Industries Ltd, a British car accessory manufacturer. In the picture below, a technician checks a conductive coating etched onto a glass substrate, the basis of car instrumentation of the future.

Various forms of display are in existence, but the system most likely to be adopted uses a laminated glass construction pattern enclosing phosphor patterns. When a direct current is passed through the phosphor the molecular layer in immediate contact with the conductive pattern in the glass emits light.

The most highly developed phosphor is zinc sulphide which emits a predominantly yellow light. Display thickness is just 12mm and, subject to the conductive pattern, the information can be displayed in either digital or analog form, and as horizontal, vertical, curved, circular, expanding or contracting patterns.

Video tuning IC from NS

A monolithic integrated circuit designed for use with digitally tuned television receivers is now being offered by National Semiconductor Corporation.

The 16-pin device, known as the LM1019N, identifies a valid picture in the digital tuner's "search" mode and sends a stop signal to the tuner. According to Chris Mason, Field Applications Engineer for NS Electronics (Australia), the device is set by means of a comparator to the desired AFC voltage.

The LM1019 also features a noise gated sync separator. The video input's positive going sync pulses are fed through a low pass filter to prevent signal noise from being mistaken for sync pulses, and are then fed through a sync separator which gives a positive signal output during the sync period. If the voltage at pin 9 exceeds 0.7V, the noise gate feature inhibits the sync separator.

Live TV coverage for shuttle flights

Live TV coverage of orbital flight activity aboard the NASA Space Shuttle will be transmitted to Mission Control and other NASA facilities — and will be made available for public viewing — via an RCA American Communications, Inc domestic satellite.

During orbital flights, expected to begin in 1980, a closed circuit TV system will permit astronauts and Mission Control personnel at Johnson Space Center near Houston to maintain visual contact with satellite ejection operations, cockpit operations and conditions in the cargo bay.

RF signals will be received at NASA's ground stations and will be carried between NASA facilities by RCA Americom's dedicated earth stations. This Shuttle TV network also can be used to provide high quality signals to television broadcasters, thereby allowing the public to see and hear the Shuttle astronauts in action.

NS reports record profits

National Semiconductor Corporation, California, has announced its strongest year ever with a record fourth quarter for fiscal 1979, which ended May 31. Fourth quarter revenues totalled $US200.5 million, up 51% over the same quarter of the prior year. Net earnings were $US9.6 million, 52% ahead of the fourth quarter of fiscal 1978.

Full fiscal year revenues reached $US718.8 million, while net earnings for the year were $US34.3 million.

Electronic heartbeat monitor

Housed in a plastic baton measuring 280 x 38mm, this new electronic gadget provides instant readout of heartbeat rate. Called "Insta Pulse", the device runs off a small internal battery said to have a life of over 100,000 readings. It works by the user gripping two metal bands firmly in each hand. Tiny electrical voltage differences between the two hands are then converted into a highly accurate heartbeat rate and displayed on a digital readout. Enquiries to Tobanna Pty Ltd, GPO Box 323, Sydney 2000.

KEYBOARDS

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MOS Encoded Communication Keyboard 53SD5-2

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- Familiar Model 33 array.
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NEWS HIGHLIGHTS

POS terminal for supermarkets

A complete family of Datachecker POS (point-of-sale) products has recently been demonstrated by National Semiconductor Corporation.

A key element of the family is the Datachecker Bar Double X Scanner, which uses a laser to read the UPC (Universal Product Code) code now found on approximately 80 per cent of grocery products in the USA. This system eliminates key entry of prices and product information, making checkout time faster and more accurate.

The Bar Double X Scanner is capable of reading the UPC symbol at speeds in excess of 40cm per second and from almost any angle. As a further benefit, the system produces a descriptive receipt and can update stock records in a central data system.

6kW gas laser makes deep welds

A 6kW carbon dioxide axial flow laser, developed by Britain's Welding Institute, is to be made and marketed by BOC Industrial Power Beams, Daventry. The new laser is said to be the most powerful commercially available in Europe.

Using axial gas flow rather than the US cross-flow technology results in a longer laser, but has the advantage that a cleaner mode is produced together with the ability to focus finely. The new 6kW unit can produce a spot of less than 05mm in diameter, which means it can make deep penetration welds while causing minimum workpiece distortion.

The welds are similar to those produced by electron beam welding, but there is no need to operate in vacuum.

Of particular interest is the ability to produce welds in far thicker steel than previously. Tests have shown that the equipment can weld mild steel to a depth of 12mm, while aluminium or titanium alloys and stainless steel can be welded to a depth of 10mm.

Space drugs could cure diabetes!

A medical laboratory in space that may be able to provide a cure for diabetes and other diseases is the goal of a team of engineers and scientists at McDonnell Douglas Corporation in St Louis, Missouri, USA.

One of the areas under investigation is that of processing pharmaceuticals in space, says Erwin F. Branahl, Vice President and General Manager of McDonnell Douglas Astronautics Company. Testifying at recent congressional hearings on space industrialisation, Branahl said McDonnell Douglas is doing extensive experimental work on a process called electrophoresis.

This process separates materials in solution by subjecting them to an electrical field. Electrophoresis is seriously limited on Earth because gravity affects the process, increasing impurities and limiting output.

One application that has the potential for great impact involved pancreatic beta cells. Thoboucells, which cannot be effectively separated from impurities on Earth, could help millions of insulin-dependent people who suffer from diabetes.

Space processing by electrophoresis might make it possible to obtain enough pure beta cells to allow a diabetic's own liver to begin producing "natural" insulin. This could eventually mean a single injection cure for diabetes.

Other space processed drugs could potentially be used to treat haemophilia and anaemia.

Concern over electrical safety standards

In the Feburary issue of "Electronics Australia", a statement appeared in which the New South Wales Minister for Energy, Mr Pat Hills, appealed to the popular electronics section of the electrical industry to increase their awareness and observance of electrical safety standards.

He indicated, that, particularly in the popular electronics area, there seemed to be a marked lack of appreciation of these standards and of the relevant legislation throughout Australia.

A follow-up press statement recently issued by the Regulatory Authorities Approvals Committee (NSW) deals with some of the relevant safety issues in more detail. In particular, the statement points out that, under legislation which is uniform in all states, electrical articles may be "prescribed" and, if so prescribed, may not be lawfully sold, hired or displayed unless they have been approved by one of the State regulatory authorities.

Articles which are not prescribed are not required to be approved prior to sale, but they are required to comply with the safety standards when connected to public electricity mains.

The statement goes on to say that the regulatory authorities in some states have found a number of shortcomings in the safety features of some items of popular electronic equipment on sale, or in the hands of the public. These have included:

- The use of prescribed accessories or components which do not comply with the specifications and have not been approved;
- Flexible cords of unsuitable types in use;
- Equipment not provided with suitable cord anchorage, resulting in damage to flexible cord and stress on terminals;
- Exposed metal parts of equipment not earthed or not effectively earthed;
- Live low voltage (above 32V) parts exposed to inadvertent contact or inadequately guarded;
- Extra-low voltage (below 32V) wiring or parts not effectively insulated, spaced or segregated from parts energised at higher voltages.
- Double wound transformers, and particularly extra-low voltage transformers, having inadequate insulation and/or segregation between windings and parts at different voltages.
- Electronic circuits and equipment such that a fault occurring in an electronic component could result in a dangerous voltage being impressed on accessible metal parts or attachments (such as microphones, etc).

The regulatory authority in each State operates an advisory service dealing with approvals and the safety of electrical equipment. Should any doubt arise in these matters, your authority would be glad to assist and advise you.

NEWS HIGHLIGHTS

Business Briefs:

Inmark Pty Ltd has moved to new premises at 167 Roden St, West Melbourne (telephone 03 329-5433). The company is well known for its comprehensive range of Japanese transistors, diodes and ICs, as well as CB spare parts. It is also Australian distributor for the Sawtron 880 UHF CB transceiver, the "New Generation" SBE 27MHz transceiver, and the NDI 2-metre and Belcom 430-440MHz amateur transceivers.

The Dindima Group Pty Ltd has moved to a new factory and office building located at 10 Argent Place, Ringwood, Victoria 3134 (postal address — PO Box 106, Vermont, Victoria 3133). The move will enable the company to expand production of the Arlunya video equipment range, and provide increased storage space for the range of advanced systems and instrumentation that the company imports.

Melbourne's first **"Home and Small Business Computer Show"** will be held at the Exhibition Buildings on September 27-30, 1979. The show will be similar to the enormously successful "Home Computer Shows" held recently in Melbourne and Sydney, but will place greater emphasis on small business and professional systems marketed by the larger computer companies.

For further information, call Alan Schwartz at Australian Seminar Services on (03) 267 4311.

Dwell Pty Ltd has expanded its operations beyond the wholesale/retail CB trade. The company is now handling Plessey-Foster speakers, hifi speaker kits, a comprehensive range of consumer electronic equipment, and car sound systems. Microcomputers also now form a major part of the company's operations, and items currently handled include: Ohio Scientific Challenger, Rockwell AIM-65 microcomputer with printer and display, dot matrix printers from Integral Data Systems, and Micropolis 128mm disc systems for 8080 and Z-80 microcomputers.

For further details contact Dwell Pty Ltd, Cnr Edgeworth-David Ave and Palmerston Rd, Hornsby, NSW 2077. Telephone 487 3111.

Plessey Components at Villawood (NSW) has been appointed Australian Distributor of Hitachi Semiconductor Products. The product mix includes integrated circuit memories equivalent to such popular types as the 2716 UV-erasable ROM, 2114 static RAMs and 16K dynamic RAMs. Also on offer are TTL ICs, Schottky TTL HD74S Series and Schottky TTL HD74LS Series ICs, and HMCS 6800 microprocessor chips.

The A & R — Soanar Electronics Group has opened a new branch office and store at 611 Hay St, Jolimont, Western Australia 6014. The new branch is headed up by Mr Barry Slocum, and will be marketing the full range of Arlec brand equipment and Soanar electronic components.

BWD Electronics Pty Ltd, Mulgrave, Victoria, has won a contract to supply 50 BWD 880 Powerscopes and 55 BWD 603B Mini-Labs for use in the education system in Sweden. According to BWD, over 100 Powerscopes have now been sold in Europe since November, when the instrument was exhibited in Munich and Milan. The company regularly receives orders from over 20 countries for its range of oscillators, signal generators, oscilloscopes and other instruments.

R. H. Cunningham Pty Ltd has moved to larger premises at 146 Roden St, West Melbourne 3003. The phone number remains the same as before: (03) 329 9633. The move follows the company's recent decision to concentrate all its efforts on the professional audio market.

New electronics data system

A brand new electronics data system — on microfiche — has been introduced to Australia by Technical Indexes Pty Ltd.

The new service, known as the "Australian Electronics Data System", contains catalogs and data sheets from hundreds of Australian and overseas manufacturers. These are comprehensively indexed through the "Australian Electronics Directory", which is one of the most comprehensive and authoritative guides ever published on the Australian electronics industry.

Technical Indexes is no newcomer to microfilm. It has operated microfilm information services in the UK for over 10 years now and its US parent company, Information Handling Services, is the world's largest microfilm publisher.

For further information contact Technical Indexes Pty Ltd, 4 Kembla St, East Cheltenham, Victoria 3192.

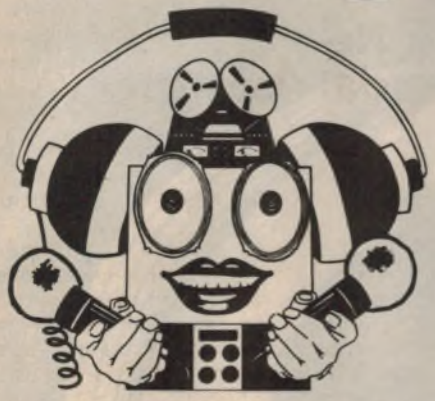
Australia displays aerospace capabilities

Australia's aerospace capabilities went on display at this year's Paris Air Show, held at Le Bourget Airfield from June 8 to June 17.

The Australian stand was backed and funded on a shared basis by the Department of Trade and Resources. The participants were six leading Australian companies involved in the aerospace industry — Amalgamated Wireless (Australasia) Limited, Commonwealth Aircraft Corporation, the Government Aircraft Factory, Hawker Pacific Pty Ltd, Hawker de Havilland Australia Pty Ltd, and Interscan Australia Pty Ltd.

Centrepiece of the Australian stand was the Interscan microwave landing system, recently adopted by the International Civil Aviation Organisation as the basis for all future airport landing guidance systems. Other equipment on display included AWA's very successful Doppler VOR ground beacon, a range of VHF aeronautical communications equipment, a new DME (distance measuring equipment) beacon, and T-Vasis visual approach aircraft landing equipment.

A NEW WORLD OF SOUND



Audio Shows 79

The 1979 series of *Australian HI-FI Audio Shows* will be bigger and better than ever. Designed to let *you and your family* hear and experience the joy of good music. Many of the most famous specialist manufacturers will be represented and demonstrating the widest-ever range of exhibits — record players, amplifiers, cassette and tape recorders, speakers, accessories, in fact everything related to hi-fi.

Special emphasis will be made on *FM stereo radio equipment to allow more people to receive transmissions from the 20 new FM radio stations recently announced.*

If you like music in your home be sure to visit the Audio Show nearest to you — and remember, bring all the family, admission is FREE!

Make a note of the dates and venues:

MELBOURNE, Southern Cross Hotel:
Friday, 7th September, 1979 (12 noon to 10 pm)
Saturday, 8th September, 1979 (10 am to 10 pm)
Sunday, 9th September, 1979 (10 am to 6 pm)

ADELAIDE, The Town House, Hindley St.
Friday, 14th September, 1979 (12 noon to 10 pm)
Saturday, 15th September, 1979 (10 am to 10 pm)
Sunday, 16th September, 1979 (10 am to 6 pm)

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Storekeepers need PET for inventory control. Engineers use it for complex calculations. Professional men can maintain their records. Graziers can control stock and feed statistics. Real estate agents can catalogue property profiles, and in the home, PET can help you relax with entertainment programmes including chess, backgammon and space games. It also incorporates teach-yourself programmes for subjects such as mathematics and languages. Whatever the job, you will have a need for PET at work and at home.

Dealer enquiries invited

For further information or a demonstration call the Business Equipment Division.

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The Personal Computer Revolution!

A revolution is under way. Computers are shaking off their traditional image as remote, vastly expensive juggernauts, and invading our homes and workplaces in desktop form. In the guise of the mild-mannered "personal computer", they are taking their place alongside the telephone, typewriter and calculator as an accepted part of everyday life.

by JAMIESON ROWE

Digital computers have been around for just on thirty years — they're hardly new. But for the first fifteen or so years, they were big, clumsy, incredibly expensive and needed a flock of white-coated boffin types to keep them going. Only big corporations could afford them, and they soon acquired an image of remoteness and complexity. They impinged very little on the lives of most people, except for the odd bill from a power company or a premium notice from an insurance company.

The story only started to change around the mid-1960's, when early minicomputers appeared. These were much smaller — no larger than a family-sized refrigerator. They didn't need a whole team of boffins to drive them, either — just an intelligent engineer or scientist. But although the price was much lower than the big computers, they still weren't cheap: to buy one complete with a teleprinter to communicate with it would set you back a cool $50,000 or so.

The effect of the minicomputer development was to extend the uses of computers down into the laboratory and factory. But they were still relatively esoteric devices, too expensive and too complex to be of much interest to small businesses, doctors, dentists, solicitors and accountants. Only the most wealthy of private schools and colleges could afford to buy one, in order to give their students the opportunity to learn how computers worked and could be used.

It was around 1970 that things started to change more dramatically. the semiconductor industry came up with the microprocessor, a large-scale integrated (LSI) circuit which squeezed all of a computer's "central processor unit" (CPU) into a single tiny chip of silicon. It also became possible to squeeze the other main part of a computer — its memory circuits — into a small number of similar chips.

Suddenly a complete computer could be made up from little more than a few of these LSI circuits on a printed circuit board. The "microcomputer" was born.

For the first few years after they were developed, microprocessor chips and the other LSI circuits were quite expensive due to manufacturing problems. But as the problems were solved, prices began falling. Microprocessor chips dropped from around $300 each down to less than $100, then dropped even more dramatically down to less than $10 in quantity.

At the same time, the semiconductor makers found it possible to fit more and more memory capacity into the LSI chips, while still lowering device costs. So the cost of providing a microcomputer with memory fell even more dramatically than for the CPU section.

Despite these dramatic changes, it took a while for the microcomputer to make much impact outside the

LEFT: The Commodore PET, shown in a typical file management application. Note its inbuilt cassette tape deck.

ABOVE: The Apple-II Plus, shown together with a TV receiver and some peripherals. Note the "3D" graphics plot on the TV screen.

RIGHT: The Compucolor II machine, which comes complete with 30cm colour video monitor and a mini-floppy disc drive.

electronics industry itself. The first microcomputers to appear were in the form of "evaluation kits" and "development systems", intended to help engineers become familiar with the new devices and help them design them into products.

Then so-called "hobby computers" sprang into being, many of them marketed in kit form by enterprising electronic kit suppliers. Intended mainly for the dedicated enthusiast and the professional computer programmer who wanted to "have a computer of their own", most hobby computers were supplied with little software. It was largely up to the hobbyists to develop their own.

Although some hobby computers found their way into small business and industrial applications, this was mainly the result of individual hobbyists taking their hobby to work. On the broad scale progress was relatively slow.

Part of the problem was software. This took quite a while to appear, as most of it had to be written in machine language. And there was a chicken-and-egg problem with price: the potential market for purely "hobby" computers was small, keeping production runs down and preventing much economy of scale. Hence prices could not be lowered much until the market was expanded, and vice-versa.

In the last few years, many of the original hobby computer makers have been able to provide their systems with the appropriate software and supporting hardware, and expand their market upwards into the business and industrial area. This formed the embryo of the growing "professional microcomputer" market, nudging up against the established minicomputer market and to some extent overlapping it.

But much more dramatic than this has been the appearance and rapid growth of a rather different type of microcomputer: the so-called "personal computer". The first of these

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What you should know about Personal Computers . . .

appeared little more than two years ago, but since then quite a few others have joined the field and all are enjoying remarkable market growth.

Now personal computers are popping up all over the place, in almost every area of human activity. You'll find them behind the reception desk in doctors' and dentists' surgeries, helping to manage patient records and accounts; in solicitors' offices, being used as "word processors" to speed the preparation of wills, deeds and other legal documents; in accountants' offices, looking after clients' accounts; in small manufacturing and sales firms, keeping track of inventories and staff payrolls; in schools, being used to give remedial work to students with problems; and in the home, helping to balance budgets, work out tax returns and even amuse the kids.

In short, the computer revolution is finally under way. Thanks to the "mild mannered" personal computer, computers have really began to have a direct impact down at the grassroots level of our society. In a remarkably short time they have established a firm place for themselves alongside the telephone, the typewriter, the tape recorder and the calculator, as an accepted part of everyday life.

Just what is a personal computer? Well, it's a compact desktop unit with a TV-type display screen and a keyboard similar to that on an electric typewriter. In its basic form, it generally uses a familiar cassette tape recorder for external storage of its programs and data. Some models have the recorder built right into the computer case.

Most importantly, a personal computer is programmed in easy-to-understand "high level" language, rather than the difficult and tedious machine language. Most personal computers are programmed in one version or another of BASIC, which is one of those acronyms loved by computer people. It stands for "Beginners' All-purpose Symbolic Instruction Code", and was developed in 1963 by John G. Kemeny and Thomas E. Kurtz, at Dartmouth College in the USA.

Basic was actually developed for large time-sharing computer systems, and for quite a while was only available on such large systems. But it was intended especially for the person with no previous experience with computers, and enables almost anyone to write programs within a few hours. So the fact that personal computers have been provided with this facility is a tremendous breakthrough.

The third thing to note about the new personal computers is that they're relatively cheap. You can buy a basic machine for as low as $800, while $5000 can buy you expanded system with a larger memory, a line printer and a magnetic "floppy disc" unit for high-speed external storage. Ten years ago a computer of similar capabilities would have cost 20 times as much!

Needless to say, a basic machine costing $1000 or less won't give you all the facilities needed for a lot of serious applications. For that sort of money, you get only a modest amount of internal memory to store your programs — typically around 4096 "bytes" of storage or "4K" in the popular jargon (see Understanding the Jargon).

Similarly you only get a cassette tape recorder for external storage of your programs and data. This is OK while you're still learning the ropes and writing your first few short programs, but it can be far too slow and unreliable for serious business use.

The other main limitation of a basic machine is that it can't produce "hard copy": results printed out on paper. The only readable output is displayed on the screen. So you can't have it print out invoices, mailing labels, inventories or other documents, at least as it stands.

TANDY TRS-80: This is the basic 4K "Level 1" machine, which comes with 30cm monochrome video monitor, cassette recorder and power supply. It also has an extremely well-written user's manual.

SORD M203 MARK II: This is the "bigger brother" of the M100 ACE-1 system described in the text, shown here with a Centronics printer. The M100 machine is similar, but has only one disc drive.

Still, a machine in this basic form is just the thing for learning how computers work, and getting valuable "hands-on" experience at low cost. Then, when you're ready for more serious things, you can generally expand it into a more pretentious and businesslike system.

Most personal computers are in fact designed with this sort of expansion in mind. Typically you can increase the size of the internal program memory considerably, making it capable of running larger and more ambitious programs. You may also be able to upgrade the inbuilt "interpreter" (see Understanding the Jargon) program, so that the computer will run a more powerful version of BASIC.

Then you can generally add any of a

variety of optional "attachments", ranging from low cost items like a second cassette recorder up to expensive high speed printers and very-high capacity hard disc memories.

Of course like any other computer, a personal computer must have software — the programs which tell it how to do the jobs required. Without software, a computer is about as useful as a gramophone without records.

It must be admitted that at this stage of development, some of the personal computers are very limited in this respect. If you want to play games, most are provided with programs for variety of these. But when it comes to programs for business applications, the field narrows considerably. A further problem is that some of the business software that is available has been written in the USA, and is not directly suitable for local business and accounting practice.

Still, a few of the machines are reasonably well supported already, and things are improving all the time for many of the others.

In fact the software situation is improving rapidly, with an ever-growing number of programs being marketed in cassette tape or floppy disc form ready to feed into your computer. Many of these programs have been written by pioneering users of personal computers themselves, initially to solve a private problem not covered by existing software. Then when other users have expressed interest, they decide to market them as a spinoff — to help pay for the development cost.

THE EXIDY SORCERER: Shown here with expansion unit, TV monitor, dual mini-floppy disc drive, cassette recorder and line printer. Also visible at front right are the plug-in ROM PAC modules.

Many of these pioneering users have found the response to their software so good that they have abondoned their earlier businesses, and started writing software full time. Hundreds of little software companies have started up in the USA over the last year or so, and they're already starting to pop up in Australia.

Well then, enough about personal computers in general. What about the particular machines and systems currently available in Australia? Let's look at the most well-known and representative models, dealing with them briefly in turn. You'll find a large table at the end of this article giving the salient features of each, and allowing broad comparisons.

THE APPLE II PLUS: The latest version of one of the more established personal computers, made in California by Apple Computer Inc and marketed in Australia by Computerland Australia Pty Ltd, 55 Clarence St, Sydney.

The basic machine has an inbuilt 53-key ASCII keyboard, and circuitry to connect to either a standard TV receiver or a video monitor. It also comes with colour video circuitry as standard, so that colour display and graphics are available simply by using a colour TV or monitor.

The Apple II Plus has a built-in loudspeaker and eight "slots" to plug in various options for expansion. Available hardware expansion options include additional RAM (to 48K), a plug-in card with UCSD PASCAL interpreter in ROM, single or multiple floppy disc drives, serial and parallel interface cards for high-speed printers, a graphics input tablet, and a voice recognition module.

Unlike the earlier Apple II, the "plus" model comes with 16K of RAM

Just what is a computer?

Basically a computer is a little like a player piano. Both are machines which are capable of doing a variety of tasks, or "playing a variety of tunes", under the direction of a suitable sequence of step-by-step instructions — the "program" or music roll, respectively.

In the case of the computer, a program is not fed in every time the computer is to "play" that particular "tune". Instead, it is fed in and stored in the computer's "memory", in its entirety, before being "run". Because all of the program is thereby accessible, the computer is able to make decisions and "jump" to different parts of the program in the light of those decisions, to produce different results.

Once a program is stored in the computer's memory, the computer can perform the corresponding task any number of times simply by running the program again and again. To have the computer perform a different task, a different program must be fed into the memory and the computer directed to run that program instead.

A basic computer consists of only two main parts. There is the **processor**, a calculator-like section which is capable of performing any of a variety of simple arithmetic and number-manipulating jobs, in response to instructions; and there is the **memory**, a storage section which holds not only the program telling the processor what to do, but the numbers and other data which the processor needs to do the tasks concerned.

Connected up to this basic processor/memory combination may be a number of **peripheral** devices, whose main function is to allow the computer to communicate with the outside world. Typical peripherals are a terminal with a keyboard and video screen, for communication with the operator or user; a magnetic tape deck or magnetic disc unit, for external storage of programs and data; and a printer unit for printing out results of calculations, etc. Some personal computers have a number of these built into the basic computer case, to form a compact and self-contained package.

In operation the processor section of the computer methodically fetches an instruction from the program in memory, and performs the simple task it directs. It then fetches the next appropriate instruction, to execute this in the same manner. And so on, step by step, ultimately performing the job that the program has been written to perform.

Of course someone has to write the program in the first place, just as someone has to prepare the punched music roll for a player piano. In the case of the computer program, that someone has to carefully analyse the job to be done, and then work out the sequence of basic computer steps which will achieve the desired result.

This can be quite a tedious job, and can take a considerable time. But once the program is finished, and fed into the computer, the job can be done incredibly fast compared with the speed at which a human can work. A typical personal computer can execute its basic "machine language" instructions at the rate of around 200,000 per second, and some are considerably faster.

What you should know about Personal Computers . . .

memory for user programs, and has a 10K "Applesoft Extended BASIC" interpreter resident in ROM memory, along with a 2K monitor program.

A fair amount of applications software is available for the Apple II Plus, and it has become established in business, professional and educational applications.

Prices for the Apple II Plus start at around $1600 for the basic machine, with monochrome or colour TV receiver/monitors extra.

THE COMMODORE PET: Claimed to be the first personal computer to be announced, this took a while to finally reach the market but is now firmly established, particularly in the USA. It is made there by Commodore Business Machines, and is distributed here by Hanimex Pty Ltd, 108 Old Pittwater Rd, Brookvale NSW 2100.

The basic PET has an inbuilt 23cm monochrome video monitor, and also a cassette tape deck. The 73-key keyboard has a slightly unorthodox layout and uses calculator-style keys, although other models in the same range have a conventional ASCII keyboard, with moulded keys.

On the software side the PET comes with a fast and fairly powerful 8K BASIC interpreter in ROM, together with a 6K monitor program. It provides 8K of RAM for user programs, with space for optional expansion to 40K.

A reasonable range of applications software is available for the PET in the USA; some of this is available here, and suitable for local requirements. Price of the basic PET starts at around $1400.

THE COMPUCOLOR II: This is a relatively new machine in the personal computer market, but one which offers impressive facilities. It is manufactured by Compucolor Corporation in Georgia, USA, and marketed here by Anderson Digital Equipment, 6 Angas St, Meadowbank, NSW 2114.

The basic machine is rather more pretentious than many of the others, with an inbuilt mini-floppy disc drive for high-speed program and data storage as well as a 30cm colour video monitor. It also comes with 16K of user RAM as standard, and the option of expanding to 32K.

On the software side, the Compucolor II comes with an extended Disc BASIC and disc monitor, in 16K of ROM. Floppy discs are available with a variety of games, a text editor and an assembler for the 8080 processor used in the machine. Other applications software for the machine is at present rather limited.

Price of the basic Compucolor II is around $2000, inclusive of the colour monitor and floppy disc drive.

THE EXIDY SORCERER: A fairly recent entry into the personal computer market, but with some interesting features. It is made by Exidy Incorporated in California, and marketed here by Dick Smith Electronics Pty Ltd, 24 Carlotta St, Artarmon NSW 2064.

The basic machine has an inbuilt ASCII keyboard together with a numeric keypad; 79 keys in all. It does not include a video monitor, but will work with any normal video monitor or a modified TV receiver. It includes interfacing circuitry for connection of two cassette recorders for program and data storage, also both parallel and serial ports for interfacing to printers, etc.

The basic Sorcerer comes with either 8K or 16K of RAM for user programs and a 4K monitor program in ROM. Also supplied is a "ROM PAC", which plugs into a slot in the side of the case. The ROM PAC contains an 8K Standard BASIC interpreter. Other ROM PACs are available, one with a word processor program and another with an assembly language development package. A user programmable EPROM PAC is also available.

Applications software for the Exidy Sorcerer is at present very limited. The price of the basic 8K machine is around $1100, not including video monitor or cassette tape recorder.

THE SORD M100 ACE-1: A fairly recent entry in the personal computer market, but again one with impressive features. It is made by Sord Computer Systems Inc in Japan, and distributed in Australia by Mitsui & Co (Australia) Ltd, 140 William St, Melbourne 3000.

The basic machine comes with an inbuilt ASCII+numeric keyboard (76

About computer languages

Computer programs are said to be written in various "languages", according to the form they take. There are three basic types or "levels" of programming language, as explained below.

MACHINE LANGUAGE: This is the form in which a program must be presented to the computer in order to be "run". It is the only language actually understood by the computer's hardware. Strictly speaking it takes the form of a sequence of binary numbers; but for human convenience in handling, the binary numbers are often represented by the equivalent octal (base-8) or hexadecimal (base-16) numbers. Although machine language is the most basic and flexible form of programming language, it is extremely tedious to write.

ASSEMBLY LANGUAGE: Rather than use machine language itself, it is considerably more convenient to write programs in so called assembly language, where each machine language instruction is represented by an easily remembered mnemonic word like "ADD" or "JMP". When written the program is then translated into the equivalent machine language form by the computer itself, under the direction of a utility program called an "assembler". Quite often the assembler is also capable of performing other functions additional to the translation, with the idea of making the programmer's task less tedious. Most utility software programs are written in assembly language, because like machine language, it is very flexible.

HIGH-LEVEL LANGUAGES: Even more convenient than assembly language, from the programmer's point of view, is writing programs in a so called high level language. Here the program is written in a form which may bear little relationship to the computer's own machine language, and is designed to make it easier for the human programmer to plan and write his or her program.

Like programs written in assembly language, those written in a high level language must be translated into machine language before they can be run. As before this translation is done by the computer itself, under the direction of a suitable program.

Two different types of translation program may be used with many high level languages. One is a **compiler**, which works in a similar fashion to an assembler in that it simply translates the original program into an equivalent machine language form (or "object code"), capable of running by itself at a later stage.

The other type of high level language translator is an **interpreter**, which is designed to both translate and run the user's program simultaneously. It does not produce a separate machine language version of the program, and must re-translate the program every time it is to be run. Needless to say this means that the interpreter must always be present in the computer's memory along with the user's own program. It also means that high level programs tend to run slower when an interpreter is used than if they are translated with a compiler. However, there is one important advantage: with an interpreter, you can write your high level program and immediately run it. If it has a bug, you can change it and try again. The computer and the programmer can effectively "communicate" in real time, in the high level language.

Just about all personal computers are designed to be programmed mainly in a high level language, using an interpreter program which is stored permanently in read-only memory (ROM). Generally the high level language provided is a version of BASIC, which was developed at Dartmouth College in the USA in 1963. BASIC is an easy to understand, logical language which allows quite complicated programs to be written with a minimum of fuss.

Other high level languages which you might read about in personal computer literature are FORTRAN, ALGOL, COBOL, PASCAL and PL/I.

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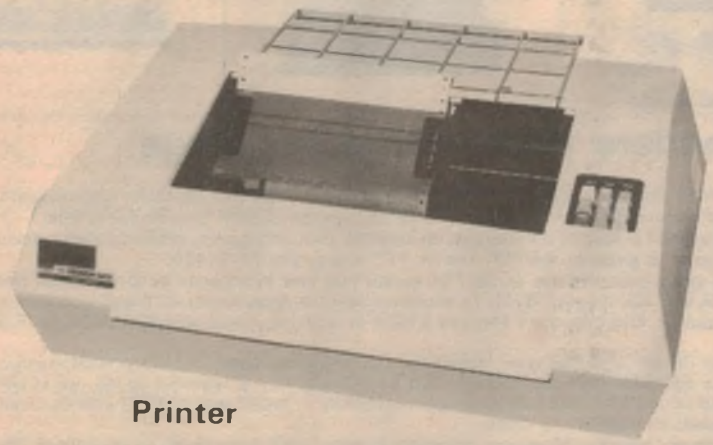

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The PET — A low cost, completely self-contained micro-computer. The PET 2001-8 (picture 1) features a calculator type keyboard, built-in cassette player/recorder for storage of programs and data, built-in Video Display Unit, and 8k of RAM (expandable to 40k) — in fact, everything needed to get you going. A large range of programs are available on cassette, including games, teaching and business programs, and even a program to teach yourself how to program the PET. The 8k PET is available for $1499.

The CBM's — (picture 2) These contain the same main features as the PET except that they incorporate a full typewriter size keyboard and have larger internal memories of 16k and 32k bytes of RAM. To accommodate the larger keyboard there is no built-in cassette deck, but this is available separately if required. Prices for the CBMs are $1829 for the 16k model, and $2199 for the 32k model.

The Floppy Disk — (picture 3) The 2040 Dual Drive Floppy Disk is an "intelligent" peripheral that uses none of the RAM memory of the controlling computer. A total of 360k bytes are available in the two standard 5½in disks. This is achieved by the use of two microprocessors and 15 memory ICs built into the disk unit. Only two connections are necessary — an AC lead and PET interface lead. This unit is available for $1729. This unit is an ideal partner for the CBMs.

The Printers — Last but not least are the printers. These are 80 column dot matrix printers, with forms handling capabilities. The printers are programmable, allowing them to format print for: width, decimal position, leading and trailing zeros, left margin justified, lines per page, etc. They will print both upper and lower case ASCII and the full PET graphics set. There are two types of printers available: the 2022 (picture 4) is tractor feed printer at $1829, and the 2023 which is a friction feed printer at $1499.

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keys), a 30cm monochrome video monitor and a single floppy disc drive. It also comes with an audio cassette recorder, both serial (RS-232C) and parallel I/O ports, a Centronics printer interface, an analog signal converter with control joystick, and a 2-octave music generator with speaker.

The ACE-1 comes with 48K of RAM memory, and runs a powerful "Level IV" disc BASIC interpreter loaded from disc. It also has provision for plug-in ROM packs of 6K capacity.

Apart from the Level IV BASIC, the ACE-1 also comes with a FORTRAN-IV compiler and a relocatable assembler on discs. There is also a range of applications software both on discs and in ROM packs, including games and business systems. However at present the range is fairly limited compared with some other personal computers.

The price of the basic Sord M100 ACE-1 is around $2700.

THE TANDY TRS-80: Probably the most established of all personal computers at present, and until very recently the cheapest in its most basic form. Made by Tandy Corporation in Texas, USA, and marketed here by Tandy Electronics, 280-316 Victoria Rd, Rydalmere NSW 2116.

The basic version of the TRS-80 comes as a keyboard/computer unit with a matching 30cm monochrome video monitor, a power unit and a cassette tape recorder. The keyboard is a full ASCII type, with 53 keys. The video monitor displays 16 lines of 64 characters, or graphics in a 128 x 48 point matrix. No special graphics characters are provided, but text and graphics may be mixed.

The lowest-cost version of the TRS-80 is the 4K Level I, which comes with 4K of RAM memory for user programs and a relatively modest but quite useful Level I BASIC interpreter in 4K of ROM.

DICK SMITH SYSTEM 80: Shown here with optional TV monitor, in basic form. A recent entry in the personal computer market, it offers full compatibility with Tandy TRS-80 Level II software.

There are two possible ways of building on this lowest version: you can add more RAM, or change to a more powerful 12K Level II BASIC, or both. In fact the next identifiable version of the TRS-80 is that with 16K of RAM and the Level II BASIC — the basic "Level II" machine.

With either basic version of the TRS-80 the only I/0 interfacing provided is for the cassette tape recorder, to store programs and data. However there is an expansion connector, and this mates with an optional expansion unit which is used for all further expansion. The expansion unit has interfacing for up to four mini-floppy disc drives, a Centronics-type printer, dual cassette recorders, an extra 16K or 32K of optional RAM, an RS-232C serial port and a real-time clock.

If you elect to add floppy disc drives, Tandy has available a disc operating system (DOS) and a disc BASIC overlay for the Level II BASIC in ROM. A wide range of applications software is available for TRS-80 systems, from games through to business packages. Much of this originates in the USA, but a considerable amount has been adapted for Australian use.

Price of the basic 4K/Level I TRS-80 is around $800, with the basic 16K/Level II machine costing around $1350.

TANDY LINE PRINTER: This is the tractor-feed line printer marketed by Tandy to suit their TRS-80 systems.

DICK SMITH SYSTEM 80: This is a very recent addition to the personal computer field. It is made in Hong Kong for Dick Smith Electronics, who are marketing it in Australia. One of its features is full compatibility with Tandy TRS-80 "Level II" applications software, a shrewd move by the designers to ensure that the new machine would have adequate software support.

Physically the System 80 looks rather different from the TRS-80. It has an ASCII keyboard with 51 keys, alongside which is an inbuilt cassette tape deck for program and data storage. The power supply is also built in. The machine is also provided with both a direct video output, for a monitor, and a modulated RF output for a normal TV receiver. Like the Level II version of the

Tandy machine, the video display format may be changed from 16 lines of 64 characters to 16 lines of 32 double-width characters, for better readability on a TV receiver.

The basic system 80 machine comes with 4K of RAM for user programs, which may be expanded internally to 16K. It also comes with a 12K Level-II BASIC interpreter, in ROM along with a monitor program. It has interface and control circuitry for a second (external) cassette recorder, and a 48-pin expansion connector.

The expansion connector mates with an optional S-100 interface card, which plugs into an expansion unit to provide five slots for S-100 modules, for S-100 expansion modules.

Price of the basic System 80 with 4K of RAM is around $600, making it the cheapest personal computer currently available here. This price does not include the video monitor, however.

TEXAS INSTRUMENTS TI-99/4: At the time of writing, this unit had only just been released on the US market, and was not yet available in Australia. However news of it has reached here, and from the details that are available it seems likely to become a particularly popular system.

The basic machine consists of a computer unit with a keyboard providing 40 calculator-type keys, together with a 33cm colour video monitor and loudspeaker unit. There is also a separate power module.

The TI-99/4 comes with 16K or RAM for user programs, together with 26K of ROM containing a powerful extended BASIC interpreter, monitor and graphics controller. In addition the machine has a slot for plug-in ROM modules, and Texas Instruments are marketing a wide range of these modules containing games, business system programs and other applications packages.

The machine also has a five-octave music generation circuit, capable of producing three tone outputs and a noise output simultaneously. This allows the machine to be used for programmed music synthesis and composition.

Texas Instruments has announced that optional peripherals for the TI-99/4 will include remote controls for games, a speech synthesiser using their "Speak-N-Spell" technology, an RS232C interface for printers, etc and a dual cassette recorder interface.

Retail price of the TI-99/4 in Australia is expected to be around $1600 for the basic machine, including the colour monitor.

Well, those are the majority of machines currently available in Australia, or shortly to become available, which fit into the true "personal computer" category. But

Understanding the Jargon surrounding Personal Computers:

ALPHANUMERIC: A contraction of alphabetic and numeric. It means information which may consist of alphabetic letters (A-Z), numerals (0-9), punctuation symbols or any combination of these.

ASCII: The American Standard Code for Information Interchange. The most widely accepted standard for encoding alphanumeric information, using binary code numbers.

ASCII KEYBOARD: An input keyboard which has a full set of alphanumeric keys, like a typewriter, and conforming to ASCII standards. Most personal computers have an ASCII keyboard or one which is very similar.

ASSEMBLER: A utility program which, when running, allows a computer to translate a program written in assembly language into its own machine language (see the box explaining languages).

BAUD: A unit used in describing the speed at which information is transmitted. Strictly the rate in baud is the number of level changes per second; but the term is often taken to mean "bits per second".

BINARY: The number system based on powers of 2, rather than 10. It has only two numerals: 0 and 1. Most computers handle numbers in binary form, even though they are arranged to accept them from, and deliver them to, the external world in decimal.

BIT: A single Binary digIT. The smallest piece of information which may be imparted, as it simply conveys a decision between two possibilities: 1 or 0, true or false, or yes or no.

BYTE: A group of bits, usually 8, which are handled together. Most personal computers handle both data and instructions in byte-sized chunks. Hence for convenience it is usual to rate a computer's memory size in terms of the number of bytes it can store (see Kilobytes).

CENTRONICS INTERFACE: Strictly, an output interface circuit to allow the computer to communicate with one of the printer units made by the Centronics company of the USA. But generally the term is used to describe a parallel-type printer interface intended of communicating with any printer of this general type.

CPU: The central processing unit, or "processor" part of a computer (see Processor).

COMPILER: A utility program which, when running, allows a computer to translate a program written in high-level language (such as BASIC, FORTRAN, etc) into its own machine language (see box on languages).

DATA: Whatever information is presented to a computer as "raw material", for processing. Generally it consists of either numbers or strings of alphanumeric characters (see Strings), or both.

DISC: A memory device which stores information magnetically on a rotating disc. The most common type used with personal computers is the floppy disc (see below).

DOS: A contraction of Disc Operating System. A program which, when running, allows the computer to transfer both data and other programs to and from a magnetic disc memory.

FILE: An identifiable block of information, usually as stored on a memory/storage medium such as a cassette tape or floppy disc. May consist of either data or one or more programs.

FIRMWARE: A utility program or a number of such programs which are stored permanently or "resident" in the computer, in read-only memory (ROM) devices.

FLOPPY DISC: A memory or storage device which uses thin discs of magnetic material as the storage medium. Currently two sizes of floppy disc are used: the standard or 8in (205mm) size, and the "mini floppy" or 5in (128mm) size. In both cases the disc of magnetic material is permanently enclosed in a sleeve.

GRAPHICS: The ability to generate graphs, diagrams and other pictorial information on a display screen or printer.

HARDWARE: The actual equipment which makes up a computer system, as opposed to the software or programs which run on it.

INSTRUCTIONS: The individual commands which make up a computer program. Each instruction is a direction to the computer to perform a single specific task.

INTERFACE: An electronic circuit or device which is used to connect the computer up to a peripheral device such as a printer, a floppy disc, etc. It may allow communication in either one direction only, or in both directions.

INTERPRETER: A utility program which, when running, simultaneously translates a high level language program into machine language and runs it as well. Most personal computers use an interpreter to translate and run BASIC programs.

I/O PORTS: Short for Input/Output ports, or the sets of connections provided on a computer to allow it to communicate with and/or control peripheral devices.

KILOBYTE (K): An accepted unit for measuring the size of a computer's memory. One kilobyte or 1K is equivalent to 1024 bytes, the nearest multiple of two to a metric kilo. Most personal computers have a basic memory size of from 8K to 64K, made up of both RAM and ROM memory devices.

MEMORY: Apart from the processor or CPU, the memory is the other main part of a computer. In it are stored not only the program which directs the computer how to do its tasks, but also the data involved.

MONITOR PROGRAM: A program which permanently resides in a computer's memory, and when running controls the operation of other programs, the interaction of the computer with the human operator, and its communication with peripheral devices.

PERIPHERALS: Those pieces of equipment which are connected to the basic computer, and whose function is generally to allow it to communicate with the outside world.

PROCESSOR: The calculating or "number crunching" part of a computer. Along with the memory, it forms the heart of the computer. In most personal computers the processor is implemented in a single integrated circuit — a "microprocessor".

PROGRAM: A set of instructions which, when followed in sequence, direct the processor section of the computer step-by-step in order to have it perform the desired task.

RAM: Random-access memory. Usually the term also means read-write memory devices, which are used to store all programs and data which is not stored permanently in ROM devices.

RESOLUTION: Of a graphics display or printout, is the degree to which the display can reproduce detail. Usually expressed in terms of the total number of dots or other graphic elements which the display is capable of showing, in the horizontal and vertical directions.

ROM: A read-only memory device. Used for storing programs and data which are required to be permanently stored, or "resident" in the computer's memory.

RS-232C: A standard method of transmitting information over a single pair of wires in each direction, in serial fashion. Often used for the connection between computers and peripheral devices such as video display units and printers.

S-100 BUS: A standardised interconnection system used to connect between the various parts (processor, memory, etc) of many hobby type microcomputers. Some personal computers are provided with interface circuitry to allow them to be connected to additional memory boards and other expansion facilities which conform to the S-100 standard.

SERIAL INTERFACE: An input/output port on a computer which is designed to communicate in "serial" or bit-by-bit fashion with a peripheral device, using a single pair of wires in each direction.

SOFTWARE: The programs which are fed into a computer's memory and run in order to get it to perform the desired tasks. Although they may appear less tangible than the hardware, they are just as important if the computer is to do anything useful.

STRINGS: Are sequences of characters, usually alphanumeric, which the computer is arranged to treat purely as a "string" of characters. For example if a group of numerals occurs in a string, it is treated purely as such and not as a number.

SUBROUTINE: A sequence of instructions within a computer program which is arranged so that control is switched temporarily to it from a variety of places in the main program. This avoids the need to duplicate the sequence wherever it is needed; the one sequence is used over and again.

TTY: Short for teletypewriter or teleprinter. An electromechanical terminal which in the past has often been used to communicate with computers, using serial interfacing. Similar to an electric typewriter, except that the keyboard and printer sections are not directly connected.

VDU: Video display unit. An electronic terminal used to communicate with a computer, and having a keyboard and TV-type display screen.

VECTOR GRAPHICS: A graphics display facility which is capable of displaying point-to-point lines or "vectors" automatically in response to a single command.

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NUMBER OF DRIVES:	FIRST DRIVE	2ND DRIVE	3RD DRIVE	4TH DRIVE
MINI DISK DRIVE (Cat X-3230)	$379.00	$379.00	$379.00	$379.00
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WIRING HARNESS (Cat X-3232) (Connects up to 4 disk drives)	$49.50 (Or do it yourself)	N/A	N/A	N/A
DOS DISKETTE (available from Tandy)	$19.95	N/A	N/A	N/A
TOTAL COST OF DICK SMITH SYSTEM	**$508.45**	**$379.00**	**$439.00**	**$379.00**
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What you should know about Personal Computers . . .

TOP: The Vector Graphic Memorite professional word processing system, based on the same firm's System B microcomputer system.

BOTTOM: The Southwest Technical Products /09 system complete with CT-84 intelligent video terminal and PR-80 intelligent 80-column bidirectional printer.

there are other microcomputers and systems available which although not strictly in this category, are also likely to be of interest to the small business or professional user.

Some of these are closer to a hobby computer than a true personal computer, and although similar in price require the user to have a background in either electronics or computers. Others are a little up-market from the personal computer level, and intended for use by professional system designers. Here are some representative machines and systems from this area, to round off our survey:

OHIO SCIENTIFIC CHALLENGER SERIES: A series of machines which starts from the hobby level and extends right up into the minicomputer area, made by the Ohio Scientific Corporation in Ohio, USA. The local distributors are Systems Automation Pty Ltd, of 26 Clarke St, Crows Nest NSW 2065, while some of the machines are available from outlets like Looky Video.

At the bottom of the range is the Superboard II, a stripped-down personal/hobby computer on a single unpackaged printed circuit board. This has an ASCII keyboard and a video interface for use with a TV monitor or receiver, with 4K of RAM and an 8K BASIC interpreter in ROM. It sells for around $385.

The same machine is available in a case with power supply, for around $480, as the Challenger 1P.

At the top of the range is the Challenger III, which has up to 48K of RAM, and dual 21cm hard discs giving up to 74 megabytes of memory. It is available with a full range of professional-quality peripherals, and supported by a considerable amount of powerful applications software. The price of a fairly elaborate system can be around $15,000.

VECTOR GRAPHIC SYSTEMS: A range of professional-quality microcomputers, generally supplied as ready-to-operate or "turnkey" systems complete with fully developed applications software (much of it locally developed to ensure its effectiveness). The hardware is made by Vector Graphic in the USA; the systems are marketed here by A.J. & J.W. Dicker Pty Ltd, of 24 Woodfield Blvde, Caringbah NSW 2229.

The System B comes with 48K of RAM and two dual-density mini floppy disc drives providing further 630K of memory; also a 30cm video terminal. Basic software provided includes C/PM disc operating system, CBASIC2 compiler/interpreter business BASIC, a program development system and assembler. A full range of printers and other peripherals are available. Prices start from around $6400.

Also available in the Vector Graphic

range is the Memorite, a professional grade word processing system based on the same hardware as the System B with a Qume high-quality 55 character/sec printer. The word processing software is permanently resident in ROMs, with the dual floppy discs used for data storage; this makes operation particularly simple and reliable. The Memorite can also perform all the data processing functions of the basic System B configuration.

ALTOS SUN SERIES 8000: A range of professional-grade systems made for business and scientific applications by Altos Computer Systems in the USA, and marketed here by the Dindema Group Pty Ltd, 415 Canterbury Rd, Surrey Hills, Vic 3103. The basic ACS 8000 machine has two 21cm floppy disc drives and 32K of RAM, and is supported by a powerful software package including CP/M disc operating system, CBASIC2 extended business BASIC, PASCAL, COBOL, a FORTRAN-IV compiler and a macro assembler.

A range of terminals and other peripherals is available to suit the Altos series. Prices start from around $4700.

SOUTHWEST TECHNICAL PRODUCTS SYSTEMS: A range of systems which range from hobby-level machines available in kit form, up to professional level systems complete with multiple floppy discs and/or a hard disc, high speed printers and multiple intelligent video terminals. The systems are made by Southwest Technical Products Corporation in Texas, USA and marketed here by SWTP Australasia/Paris Radio Electronics, of PO Box 380, Darlinghurst, NSW 2010.

In the packaged machines and systems area, SWTPC has an /09 machine which features 56K of RAM and a serial interface. This can be obtained with their CT-84 intelligent video terminal for around $2400. There is also a larger S/09 machine with 128K of RAM, which may be obtained complete with dual 21cm floppy discs, a 16 megabyte hard disc, and three CT-82 terminals for around $12,000. Three different printers are available for the systems in the range, at prices from $950 to $2500 each.

THE VERSATILE RANGE: A range of small business microcomputer systems

THE ALTOS SUN 8000: A professional-type system which comes with two inbuilt 21cm floppy disc drives and 32K of RAM. A full range of peripherals is also available.

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Personal computers . . .

EXAMPLES OF APPLICATIONS SOFTWARE produced by independent firms, and sold on floppy disc or tape cassette. (Courtesy Paris Radio)

made by Computer Data Systems in Delaware, USA and marketed here by Microprocessor Applications, Maskells Hill Rd, Selby, Victoria 3159. The 3B system comes with 24K of RAM, inbuilt 23cm video display and keyboard, an inbuilt mini-floppy disc drive and interface for a serial printer. It also comes with a set of applications and system software on floppy discs.

The larger Versatile 5 system comes with 32K of RAM, dual disc drives and the option of adding up to four additional drives. Two different printers are available for use with the Versatile series of systems.

Well, I hope that gives you a fair idea of the sorts of machines and systems that are currently available. But what if you want to know more about computers and their operation, before you plunge in — are there any courses you can take?

At this stage there aren't many, particularly if you want practical understanding rather than a full academic course in computer science. But we are aware of a couple of firms offering this kind of help:

PITT ST MICROCOMPUTER CENTRE in Sydney runs short courses at nights in their lecture rooms, 2nd floor, 373-375 Pitt Street, Sydney. There are currently three courses available: Introduction to Microcomputers (eight weeks, $150), Small Business Low Cost Computers (eight weeks, $150) and Basic Language Programming (four weeks, $80). The same firm also markets applications software for the Tandy TRS-80, some of it imported from the USA and some written by themselves specifically for local requirements. Further information from PO Box 105, Marrickville, NSW 2204.

FORBES DATA SYSTEMS, also in Sydney, has commenced a new series of Microcomputer Appreciation and Programming courses, directed particularly towards the businessman but also likely to be of value to students and hobbyists. The courses are conducted by experienced teachers and future hands-on experience with TRS-80 machines. Four different course modules are available, with fees ranging from $60 for one module to $390 for all four. The courses are portable and can be presented at outer suburban locations for clubs and business associations, if there is sufficient interest. Further information from FDS at 1 Lister Avenue, Seaforth, NSW 2092.

Finally, a word of advice. With the advent of personal computers, we're really entering an exciting era where computers can be used to help us run our businesses and homes more effectively. But before you rush out and buy one, look around and become familiar with a few of the competing models.

Most importantly, try to see them running the sort of programs you're likely to need — and take a hard look. Don't be dazzled by the technology; remember that without the right software, it could be an expensive pile of impressive junk.

The crucial question is this: will it do the jobs you really want done?

REPRESENTATIVE PERSONAL COMPUTERS COMPARED

FACILITY	APPLE II PLUS	COMMODORE PET	COMPUCOLOR II-4/5	EXIDY SORCERER	SORD M100 ACE-1	SYSTEM 80	TANDY TRS80 LEVEL 1	TANDY TRS80 LEVEL II
PROCESSOR/SPEED	6502/1.023MHz	6502/MHz	8080A/1.5MHz	Z80/2.1MHz	Z80/2.5MHz	Z80/1.7MHz	Z80/1.7MHz	Z80/1.7MHz
USED RAM MEMORY SUPPLIED	16K	8K	16K/32K	8K/16K	48K	4K/16K	4K/16K	4K/16K
MAXIMUM RAM AVAILABLE	48K	40K	32K	32K	48K	16K (EXTERNAL TO 48K)	16K (EXTERNAL TO 48K)	16K (EXTERNAL TO 48K)
SYSTEM FIRMWARE ROM SIZE	12K	14K	17K	4K + ROM PACKS	ROM PACKS	12K	4K	12K
ADDITIONAL ROMS?	YES (4K)	—	YES — UP TO 8K	YES — UP to 20K	—	(VIA S-100 EXPANSION)	YES — UP TO 12K	—
DISPLAY	TV OR MONITOR	INBUILT 23cm MONITOR	INBUILT 30cm MONITOR	MONITOR	30cm MONITOR	MONITOR OR TV (INBUILT MODULATOR)	MONITOR	MONITOR
COLOUR DISPLAY?	YES	NO	YES	NO	COLOUR OPTION	NO	NO	NO
KEYBOARD SIZE & TYPE	ASCII, 53 MOULDED KEYS	MODIFIED ASCII + NUMERIC 73 FLAT KEYS	ENHANCED ASCII 71 MOULDED KEYS	ENHANCED ASCII + NUMERIC 79 MOULDED KEYS	ENHANCED ASCII (+ NUMERIC) 78 MOULDED KEYS	ENHANCED ASCII 51 MOULDED KEYS	ASCII (+ NUMERIC) 53 MOULDED KEYS	ASCII (+ NUMERIC) 65 MOULDED KEYS
CHARACTERS/LINE LINES ON DISPLAY	40 24	40 25	64 16/32	64 30	64 24	64/32 16	64 16	64/32 16
UPPER/LOWER CASE CHARACTERS	UPPER ONLY	BOTH	UPPER ONLY	BOTH	UPPER ONLY	UPPER ONLY	UPPER ONLY	UPPER ONLY
SPECIAL GRAPHICS CHARACTERS?	(SOFWARE GENERATED)	YES — 64	YES — 64	YES — 64 (+ 64 PROGRAMMABLE)	YES — 32	NO	NO	NO
GRAPHICS RESOLUTION	280 x 192 (5 COLOURS) 40 x 48 (15 COLOURS)	320 x 200	128 x 128 (384 x 256)	512 x 240	(OPTION: 320 x 256 MONO, 160 x 256 COLOUR)	128 x 48	128 x 48	128 x 48
MIXED GRAPHICS & TEXT?	YES (FIXED FORMAT)	YES	YES	YES	(YES)	YES	YES	YES
CASSETTE TAPE(S)?	YES	YES — 1 INBUILT (ANOTHER 1 OPTIONAL)	NO	YES: 2 (+ 1)	YES	YES — 1 INBUILT (ANOTHER 1 OPTIONAL)	YES	YES
TAPE TRANSFER RATE (BAUD)	1500	1000 (2:1 REDUNDANCY)	—	300/1200	300/1200	500	250	500
CONTROL OF CASSETTE MOTOR(S)	NO	YES	—	YES	NO	YES	YES	YES
EXPANSION BUS	CUSTOM	CUSTOM (S-100)	50-PIN BUS	50-PIN (S-100)	(S-100)	48-PIN (S-100)	CUSTOM	CUSTOM
FLOPPY DISC(S) INTERFACE	(OPTION)	(OPTION)	YES: 1 INBUILT ANOTHER 3 OPTIONAL	(OPTION)	YES: 1 INBUILT ANOTHER 2 OPTIONAL	(OPTION)	(OPTION)	(OPTION)
OTHER FACILITIES	8 SLOTS FOR I/O CARDS BUILT-IN SPEAKER	CASSETTE FILE NAMES 8-BIT PARALLEL PORT REAL TIME CLOCK	VECTOR GRAPHICS SOFTWARE 30 I/O PORTS STANDARD	CASSETTE FILE NAMES OPTIONAL S-100 EXPANSION UNIT	2-OCTAVE MUSIC GENERATOR, REAL TIME CLOCK	CASSETTE FILE NAMES OPTIONAL 6-CARD S-100 EXPANSION UNIT	OPTIONAL CUSTOM EXPANSION UNIT	CASSETTE FILE NAMES OPTIONAL CUSTOM EXPANSION UNIT
SERIAL, PRINTER INTERFACES	PLUG-IN CARDS RS232C, CENTRONICS, ETC	(IEEE-488 INTERFACE)	RS 232C, UP TO 478 I/O PORTS	RS232C, 8-BIT PARALLEL PORT	RS232C, CENTRONICS PORT	(OPTIONS)	(OPTIONS)	(OPTIONS)
SYSTEM SOFTWARE	10K BASIC 2K MONITOR IN ROM EXTENDED BASIC, PASCAL, ETC)	8K BASIC + 6K MONITOR IN ROM	DISC BASIC IN ROM TEXT EDITOR DOS, ASSEMBLER	4K MONITOR, 8K BASIC, WORD PROCESSOR DEVELOPMENT SYSTEM	DISC BASIC LEVEL IV FORTRAN, ASSEMBLER	LEVEL II BASIC MONITOR	LEVEL I BASIC (DISC BASIC, DOS, ETC)	LEVEL II BASIC (DISC BASIC, DOS, ETC)
APPLICATIONS SOFTWARE AVAILABILITY	BROAD RANGE (MAINLY US ORIGIN)	BROAD RANGE (US ORIGIN)	LIMITED AT PRESENT	LIMITED AT PRESENT	LIMITED AT PRESENT	USES LEVEL II TANDY SOFTWARE	BROAD RANGE (MAINLY US ORIGIN)	BROAD RANGE (MAINLY US ORIGIN)
PRICE RANGE	$1600 UP (MONITOR EXTRA)	$1400 UP	$2000 UP	$1100 UP (MONITOR EXTRA)	$2700 UP	$600 UP (MONITOR EXTRA)	$800 UP (INCLUDES MONITOR, CASSETTE REC)	$940 UP (INCLUDES MONITOR CASSETTE REC)
SUPPLIERS (IMPORTERS)	COMPUTERLAND STORES	BUSINESS EQUIPMENT SUPPLIERS COMPUTER HOBBY STORES (HANIMEX P/L)	ANDERSON DIGITAL ELECTRONICS	DICK SMITH ELECTRONICS STORES	SMALL BUSINESS COMPUTER COMPANY (SYD) ABACUS COMPUTER STORE (MELBOURNE) (MITSUI & CO)	DICK SMITH ELECTRONICS STORES	TANDY ELECTRONIC STORES & COMPUTER CENTRES	TANDY ELECTRONICS STORES & COMPUTER CENTRES

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VIDEO BRAIN

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X-1182

VALUE!

'VIDEO BRAIN' COMPUTER KEYBOARD

Full function computer style keyboard with 37 keys, silver plated double sided board, double sided edge connector (0.1" spacing) and high quality computer grade push buttons with interchangeable key tops.

The manufacturer of this quality keyboard went broke and we bought the lot. **You reap the benefit!** This keyboard must have cost twice as much to manufacture as the price we're asking for it! All keys can be individually accessed by cutting PCB tracks. **Come on all you experimenters: you've been asking for this — so here it is!** Cat X-1182

PLASTIC ENCAPSULATED MERCURY SWITCH

By changing the position of this 'movement detection switch' a ball of mercury will run down the internal tube and 'make' with the two contacts. Ideal for any movement detector devices i.e. car burglar alarms.

$1

S-1935 ..... $1.00

Buy 10 or more and pay only 75¢ each!

ZAPP!! ZAPP!! ZIPPY BOX TIME

150x90x60mm
H-2761 **$2.50**
196x113x80mm
H-2762 **$3.75**
130x68x41mm
H-2753 **$1.95**
83x54x28mm
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● Very tough ● Moulded corner posts take self tappers ● Complete with covers ● 4 different sizes ● Ideal for projects

SPECIAL OF THE MONTH FOR TV VIEWERS . . .

Here's good news for anyone who watches TV - and isn't that just about everyone? Improve your picture quality with a Dick Smith Masthead Amplifier kit. Easy to build (uses a single hybrid integrated circuit) and simple to install, the masthead amplifier can turn an unwatchable mess into a brilliant picture. (Yes, we've actually seen it demonstrated!)

WHY PUT UP WITH POOR RECEPTION ANY LONGER: THE DIFFERENCE IS INCREDIBLE!

The masthead amplifier kit is complete (power supply included) and comes ready to assemble with full instructions. And now is the time to build it: **You save nearly 10% for this month only!** Hurry while stocks last.

$22

NOW ONLY $29.50

Cat K-3230

SPACE PROBLEMS?

Not enough room for you hi fi speakers? And you don't want those tiny ones because they're all junk? NOT ANY MORE!

These new mini hi-fi speakers from Dick Smith have to be heard to be believed! Although they measure only a tiny 120 x 120 x 190mm, their performance is right up there with the big guns. And they compare favourably with speakers costing twice and three times as much! So if you are a little pressed for space, have a look and a listen to these. Consider the possibilities:

- Cars
- Caravans
- Boats
- Home Units & Flats
- Demonstrations
- Etc. etc etc

DUE EARLY SEPTEMBER

$99.50

A-2375

SCOOP PURCHASE

SAVE $5.50

WAS $35

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L-5258

SMOKE DETECTOR

Loss of life due to smoke inhalation is increasing each year. **PROTECT YOUR FAMILY NOW** with the Dick Smith Smoke Detector. Simple to install, it requires the placing of two screws (supplied), and runs on a 9V DC battery (supplied). At the first hint of smoke a powerful alarm sounds giving you and your family more time to counter the cause of the smoke. Ideal for office and factory use too!

PROTECT YOUR PROPERTY AND YOUR FAMILY

ASK FOR A DEMO IN ANY OF THE DICK SMITH STORES

AC BRIDGE AND SPOT OSCILLATOR

*HIGH ACCURACY
*MEASURES OVER WIDE FREQUENCY RANGE
*LOGICAL DESIGN ENSURES EASE OF OPERATION
*DETAILED INSTRUCTIONS WITH EXAMPLES

$79.50

Accurately measure inductance (1uH - 111H), Capacitance (10pF - 1110uF), resistance (0.1 - 11.1Mohms), transformer turns ratio (1/10,000 - 1). Mainframe has a measuring frequency of 1kHz and the spot oscillator gives the following external frequencies 120, 300, 1kHz, 3kHz, 10kHz and 30kHz. Dimensions of mainframe 215x135x70mm & spot oscillator 120x80x55mm.

Q-1420 $79.50

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Complete electronics for easy installation into your car, boat or plane. Bright green gas-discharge display. It even has an alarm with solid state buzzer. Instructions include details on conversion of module to read 24 hours, give seconds display & for use as a stopwatch. Accuracy is controlled by a quartz crystal.

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NEW $89

L-5050

INFRARED ALARM

SENSATIONAL NEW ALARM SYSTEM. Infrared photoelectric relay system with projector and receiver in one case. Easy to install - simply stick reflector panel opposite the infrared unit and any person cutting the invisible beam will set the alarm off. The alarm can be a buzzer, siren or lamp connected to the 12V DC 1A (max) output of the infrared unit. Can also be used as a counter - to check number of visitors or count items on a conveyor system. Includes sensitivity control, three position alarm setting and has an effective coverage of 0.8 to 15 metres. Dimensions, 90(w)x145(h)x190(d)mm. Weight 1.55kg.

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AM TUNER MODULE

$5.95

TUNING GANG WORTH $5.95 ALONE !!!!

This SCOOP PURCHASE AM tuner module was used in a complete AM tuner that sold for $58!!!!!

The unit requires only 8V DC power supply and will drive most stereo amplifiers to full output. It can also be used as a portable if connected to a small amplifier. The ferrite rod antenna is mounted onboard for ease of installation in a case. Frequency range of 546 - 1953kHz and a sensitivity of 100uV (100% modulation) top features at a **YOU REAP THE BENEFIT** price! F-4812

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$54.50

34 RANGE MULTITESTER

A must for the serious electronics enthusiast's workbench is the multitester. NOT just any multitester BUT the Dick Smith combined multimeter and transistor tester. ● 100k ohms/V ● 34 ranges ● DCV from 0.5 to 1000V ● ACV from 5 to 1000V ● AC current 10A ● DC current from 10uA to 10A ● Resistance from 20 ohms to 200b (centre scale) ● Decibels —10 to +62dB ● Transistor h_{FE} 0-500 I_{CO} 0-50uA ● Protected movement ● Includes test leads, batteries and manual.

Q-1136 $54.50

TOOLS

for the enthusiast

MINI FLAT NOSE PLIER

Positive grip from the flat nose & a sure grip from the plastic coated handles. Length 100mm.

T-3566 ..... $3.75

$3.75

SLANT EDGE NIPPER

Box joint construction for absolute rigidity. Ideal for all electronic and electrical use. Length 125mm.

T-3210 ..... $5.75

$5.75

COMBINATION PLIER

Sliding type jaw, for firm and positive grip. Every tool box should have one. Length 150mm.

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Precision machined for use with cross Philips screws i.e. front panel work.

Sizes: 0, 1, 1 (large) & 2.

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Famous 'Weller' cordless soldering iron

YES! This top name Weller cordless iron is still at a fantastically low price! In-built re-chargeable cells give hours of soldering away from a power source. A built-in light shows the way in dark corners.

Mains charger and one spare tip included.

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INCLUDES MAINS CHARGER AND SPARE TIP + 12 MONTH GUARANTEE Cat T-1050

RANGE OF SPARE TIPS IN STOCK!

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8 x SPST switches mounted in a single DIL package. Ideal for circuits where parameters may need alteration. Ideal for PCB mounting.

Cat S-1608 **$2.75**

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4 pin version of above. But you'd better hurry: stocks of these are limited!

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Give your projects that real pro look with these smart rectangular leds. Available in red or green.

RED	GREEN
Cat Z-4040	Cat Z-4042
65c each	

(55c each for 10 or more)

OMRON DPDT PCB RELAY

ONLY $3.50

INCREDIBLE VALUE

Cat S-1131

Just look at this superb relay bargain - rated at 12V DC with a coil resistance of 290 ohms and a massive 0.4A contact rating. Mounts directly onto the PC board - ideal for modern circuits requiring a small relay.

LED WATCH

Hundreds of these digital watches have been scoop purchased and now we're selling them for less than $10.00

$9.95

- Full function digital watch
- Shows day, date, hours, mins, secs
- Complete with battery and strap
- Highly accurate

Cat X-1041

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Top quality type MRA 45B meters that will enhance any project requiring a meter. Overall size: 58(w)x52(h)mm. Hole required 44mm.

VU - (0dB = 1mW into 600 ohms) - 1000 ohms
Q-2050 **ONLY $6.90**
0 - 1mA - 120 ohms
Q-2010 **$8.50 each**
Buy 10 or more $7.50 each.
0 - 5A DC - 3 ohm shunt
Q-2030 **$8.50 each**
Buy 10 or more $7.50 each

PARTS/COMPONENTS CASES

Ideal for all of those bits & pieces laying around on your workbench. Large case **(H-2596)** has two tiers of trays plus one extra deep tray (size overall: 290(l)x220(w)x45(d)mm). The smaller case **(H-2594)** has one tier of two lift out trays (size overall: 255(l)x186(w)x40(d)mm).

H-2596 $16.95
H-2594 $12.95

LCD 3½ DIGIT PANEL METER EVALUATION KIT

INTERSIL

ICL 7106 EV Kit
by LCD Systems

$39.50

This evaluation kit contains the ICL 7106 monolithic chip and is presented so that you can make up a very accurate digital voltmeter with automatic zero connection and automatic polarity.

KIT CONTAINS ■ PC board & hardware ■ A/D converter ■ LCD display ■ Resistors ■ Capacitors ■ Wiring diagram ■ Application notes ■ Data sheet

K-3450

HUGE SCOOP PURCHASE!

Dick's done it again – and you reap the benefit.
Yes! Every hobbyist should have some of these incredible bargain electrolytic capacitors in his 'junk box'.
Famous 'Rubycon' brand, 50 volt electrolytics ideal for power supplies and a host of other uses in your choice of 2200uF or 3300uF sizes. Over 75% off normal selling prices!

Brand new, prime spec devices – stock purchase from AWA... Manufacturers please note!

2200uF 50 volt: Cat R-4575 ..... **40c ea** (10 up 30c ea)
3300uF 50 volt: Cat R-4577 ..... **60c ea** (10 up 50c ea)

Grab a few before stocks run out! At this price you'd be mad not to!

SAVE OVER $10!

REAR WIPER KIT

Here's a bargain that will promote safer driving, too: a rear window wiper kit for cars, vans or wagons. Easy to install, easy to use. And now save over $10 on this bargain! Hurry – stocks won't last!

~~$39.95~~ A-8505

$29.50

LOOK!

4PDT RELAY WITH 12 VOLT COIL:

Normal price for these handy relays would be over $3.00. We've made a bulk purchase from an Australian manufacturer of excess their excess stock. Brand new, prime spec relays, already with wiring loom attached (but never used). Be quick for this one! Cat S-7005

$1.00 ea!

Yes! Another superb bulk buy from Dick saving you $$$$$!

NEW KITS
(and new kit components)

Remember parts for most kits in most of the electronic magazines are normal stock lines. So even if a kit isn't listed, we may be able to help you anyway. Call in and ask us!

PLAYMASTER STEREO EQUALIZER (See May EA)

Complete kit including instructions	Cat K-3500	$99.50
UA4136 Quad Op Amps	Cat Z-6105	$1.95
PC Boards (set of 3 high quality boards)	Cat H-8360	$12.95
Slider pots	Cat R-1980	85c
Knobs to suit slider pots	Cat H-3782	50c

9kHz WHISTLE FILTER FOR TUNERS (See Feb EA)

Complete kit, including instructions	Cat K-3496	$19.75

(SEE MORE DETAILS ON OPPOSITE SIDE OF THIS PAGE)

INTERSIL LCD EVALUATION KIT (See Feb EA)

(As used in EA digital voltmeter)	Cat K-3450	$39.50

(See bottom of opposite page for more information on this product)

RF IMPEDANCE BRIDGE (See August EA)

All items in this project are normal stock lines. Not produced as a kit.

MICROWAVE OVEN LEAKAGE DETECTOR (See July ETI)

Printed Circuit Board	Cat H-8619	$1.95
5082-2800 Schottky Hot Carrier Diode	Cat Z-3230	$2.90

All other components are normal stock lines.

50Hz HUM FILTER (See July ETI)

Printed Circuit Board	Cat H-8621	$2.50

IC SOCKETS
leap down in price!

Save with Dick Smith bulk buying power. We've slashed the price of our most popular IC sockets by up to 25%! Don't miss out!
8 pin mini dip. Cat P-4080 was 40c each. Save 25% – **NOW ONLY 30c ea!**
14 pin DIL Cat P-4140. Were selling for 40c. **NOW ONLY 35c EACH!**

NEW! NEW!
DICK SMITH CASSETTES HAVE BEEN UPGRADED

Yes, New packaging, more exacting manufacture – a better cassette all 'round! Try a couple against your usual cassettes and you'll be pleasantly surprised. And just look at our extra-value plus prices.

C60LN Cat C-3350 **$1.50 ea** (10 up $1.00)
C90LN Cat C-3352 **$2.00 ea** (10 up $1.70)
C90UD Cat C-3354 **$2.75 ea** (10 up $1.90)

VALUE!

For computer enthusiasts, experimenters. This calculator keyboard kit with a host of uses, comes complete with screws, PC board, all keys and spring pad. Ideal for combination locks, alarm systems, too. Cat K-2010

$3.75

WHO WANTS A WHISTLE?

Certainly not you if you are trying to listen to a tuner – and all you are getting is whistles from other stations!

The cure: build a Dick Smith Whistle filter and install it in your tuner. Easy to build, easy to install, and it effectively removes inter-station whistles.

$19.75
Cat K-3496

FITS 99.9% OF TUNERS!

LINEAR APPLICATIONS H'BOOK

A mine of information for the engineer, design lab or hobbyist. Hundreds of circuits (including values) for popular NS linear IC's. Great reference book!

Cat B-4030 **$6.95**

WATCH THIS SPACE

AND FIND OUT WHAT YOU MISSED

Each month all of our stores feature an outstanding special which is actually BELOW COST! N.B. Specials are strictly while store stocks last.
Don't miss out!

LAST MONTH:

COLORAY TV ANTENNA
Was $34.50 — now $15.20

SAVING $19.30

LCD CLOCK MODULE 12.50

INCREDIBLE ACCURACY!

Scoop purchase! Tens 6 date modules ideal for phone timers. Liquid xtal disp. buy direct from the importer and save. Battery included! Incredible value.

X-1039

INCREDIBLE KIT BREAKTHROUGH

An induction balance (discriminator) metal detector now available in **kit form** at a bargain price!

Yes! It's been a long time coming, but it was worth the wait! This incredible induction balance detector is the equivalent of detectors in the hundreds-of-dollars price bracket. And you can make one of these for less than fifty dollars!
All electronic components, meter, box, coil wire, etc. supplied; all you supply is some dowell for the shaft and a former for the coil.
Presto! A quality metal detector – ready to find you a fortune.
Complete kit (as described) Cat K-3100

ONLY **$35.50**

SAVE $20.00 ON TAPE READERS!

Be quick! Easy-to-build paper tape reader kit for all computer enthusiasts. Hurry! NOW

$75.00!
Cat K-3486

NEW! The best metal detectors IN THE WORLD

Yes – in response to YOUR requests, we now stock what we believe to be the finest gold and precious metal detectors available anywhere in the world: WHITE'S, superb USA manufactured treasure hunters. The results speak for themselves – and with the price of gold these days (approx $300 per ounce!) you could easily pay for one of these on your first trip out with a little luck!

White's

Cat X-1070 **$425.00**

Model 5000D: The best!
This is the one with exclusive 'ground exclusion balance' detection system. Incredibly sensitive to metals, you can even use it in water (search head is water-proof). Thousands of these are in use throughout the world. Expensive? Yes – but to get the best performance you have to pay a little more. White's 5000D is extremely good value for money. Cat X-1070

OTHER WHITE'S MODELS AVAILABLE:

Model CG3 – Beachcomber
Ideal for beach treasure hunting or low-level detection.
Cat X-1066. Rec. Retail: $166.00. Our price: **$89.00**

Model 1DB – for the semi professional
And look at our value price. Recommended retail $177.00.
Cat X-1068 ..... **$109.00**

CONVERT YOUR GUITAR TO ELECTRIC!

Yes, it's so easy to convert your acoustic guitar to electric type – then you can play it through an amplifier. Just clips onto the sound board, plug it into an amplifier and away you go! Has its own volume control, too.

Cat F-3080 **$9.75**

Works with any amp!

DON'T SHOUT:
INTERCOM INSTEAD!

Install a Dick Smith intercom and save energy – yours! Why shout from room to room, or get up and waste precious time when you can install an intercom and have instant communication wherever you want it! Ideal!

2 station to 5 station sets

Think of how a professional quality intercom system can help YOU – in business, in the home, factories, etc etc. Far cheaper than installing a PABX system – and just as useful.

Features:
- 'Hands Free' reply from any station
- Wall or desk mounting
- Up to 300m range between units
- Inbuilt batteries or external 6V DC power
- Quality switches that won't get noisy with

TC-3 master (as illus)
Up to 3 station system, used in conjunction with TC-PR remote unit.
Cat F-1230 **$35.00**

TC-PR (remote unit)
Use with master units TC-3 & TC-4M. Masters can call remotes, but remotes can't call one another.
Cat F-1201 **$12.50**

TC-4M 5 station master
Up to 5 'all master' stations when used with other TC-4M's, or can be used with TC-3's for master/slave. Has privacy switch, too.
Cat F-1240 **$45.00**
Great quantity discounts avail.

$35.00 ea.
(Or only $28.00 each for five or more units.

OOPS!

Last month we advertised push-button telephone diallers to convert conventional rotary telephones to push-button operation. Unfortunately, they proved so popular stocks were sold out before the advert appeared!

Now for the good news:
They're back in stock (or at least they were when this advert went to press! So if you missed out last time, hurry in before they run out again! Cat X-1175 ..... Only **$49.95**

Make PROFESSIONAL panels and labels.

Using the incredible Scotchcal™ process anyone, even you, can make top quality aluminium front panels at home with no special equipment. Give your projects a really professional look – easily and at low cost. Try Scotchcal™ – you'll like it.

DEVELOPER: Suits both aluminium sheet and exposure film, simply wipe over with cotton wool. That's all! Enough developer to process many sheets of Scotchcal products. Cat H-5696 **$1.00**

ALUMINIUM SHEET: Your choice of red or black. Pre coated 0.13mm self-adhesive aluminium with ultra-violet sensitive emulsion. Expose through suitable film (negative or positive) and you will have a negative of original once developed. A sheet of polyester base material is included with each aluminium sheet to use as your artwork base.
RED: Cat H-5692 **BLACK:** Cat H-5694
250 x 300mm sheet only **$6.00 each**

EXPOSURE FILM: Clear plastic base with orange UV sensitive emulsion, idea for making negatives from original art. Exposes in similar way to aluminium, same developer. Also supplied with sheet of polyester base material for you to do your artwork on. 250mm x 300mm sheet. Cat H-5690 **$3.90**

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	30 Grose Street,	PARRAMATTA	Phone 683 1133
	263 Keira Street,	WOLLONGONG	Opening soon
ACT	96-98 Gladstone Street,	FYSHWICK	Phone 80 4944
VIC	399 Lonsdale Street,	MELBOURNE	Phone 67 9834
	656 Bridge Road,	RICHMOND	Phone 428 1614
QLD	166 Logan Road,	BURANDA	Phone 391 6233
SA	203 Wright Street,	ADELAIDE	Phone 212 1962
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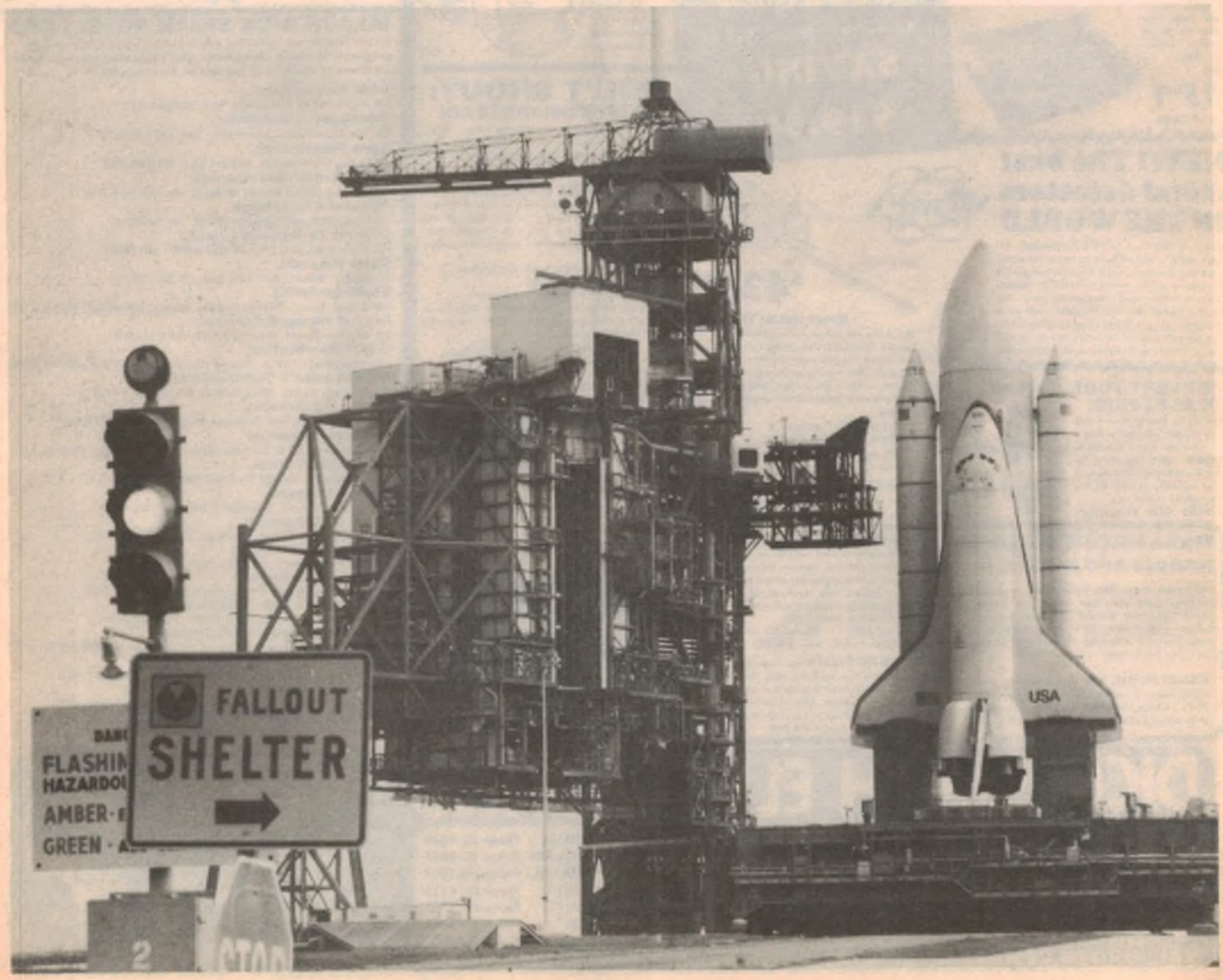
MAJOR DICK SMITH RESELLERS

Listed below are re-sellers who stock a large range of our products. However, we cannot guarantee that they will have all items in stock or at the prices we advertise.

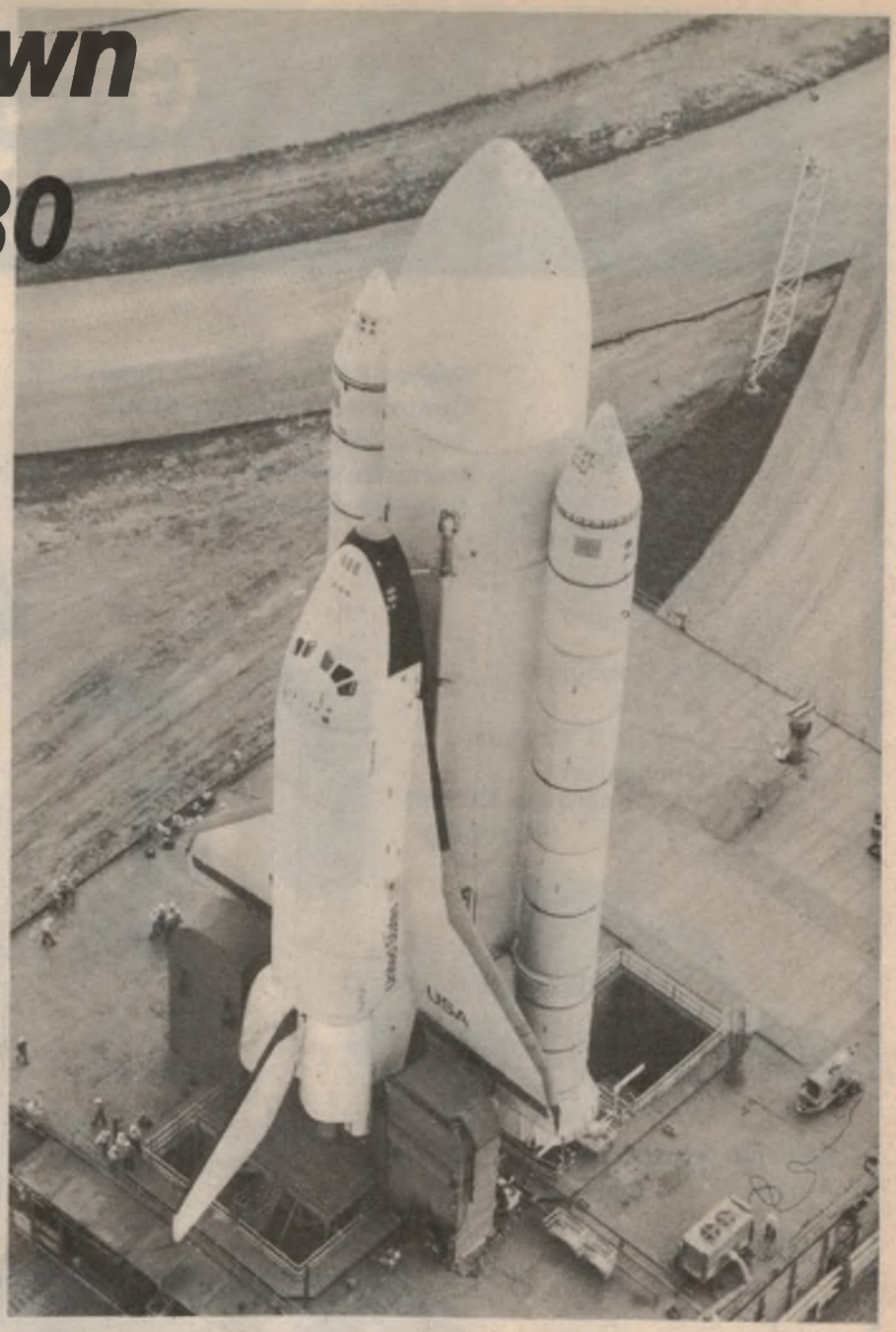
A&M Electronics
78 High Street, Wodonga, Vic. Ph 244 588
Advanced Electronics
5a The Quadrant, Launceston Tas. Ph 317 075
Aero Electronics,
123a Bathurst Street, Hobart Tas. Ph 348 232
Peter Brown Electronics
9 Doveton Street North, Ballarat Vic. Ph 323 035
Coastal Electronics
43 Vulcan Street, Moruya NSW. Ph 742 545
Crystal TV Rentals Pty Ltd
66 Crystal Street, Broken Hill NSW. Ph 6897
Delta Electrix
67 Queen Street, Ayr, Nth Qld. Ph 831 357
Elektron 2000
44 Brown Road, Broadmeadow, Newcastle NSW. Ph 691 222
Fred R Hayes Electrical
28 Station Street, Bowral NSW. Ph 611 861
D & M Harrington,
6/1 Machinery Drive, Tweed Heads South, NSW. Ph 364 589
Hutchesson's Communications
6 Elizabeth Street, Mt Gambier SA. Ph 256 404
Keller Electronics
218 Adelaide Street, Maryborough, Qld. Ph 214 559
Lismore Kitronics
Cnr Magellan St & Bruxner Hwy, Lismore NSW. Ph 214 137
M&W Electronics
48 McNamara Street, Orange NSW. Ph 626 491
Power & Sound
147 Argyle Street, Traralgon, Vic. Ph 743 638
Stevens Electrical
135 Goldsmith Street, Mackay, Qld. Ph 511 723
Sumner Electronics
95 Mitchell Street, Bendigo, Vic. Ph 431 977
Sound Components
78 Brisbane Street, Tamworth NSW. Ph 661 363
Tomorrow's Electronics and Hi Fi
68 William Street, Gosford NSW. Ph 247 246
Trilogy Wholesale Electronics
40 Princes Hwy, Fairy Meadow, Wollongong, NSW. Ph 831 219
Tropical TV Services
249 Fulham Rd, Vincent, Townsville Qld. Ph 791 421
Variety Discounts
113 Horton Street, Port Macquarie NSW. Ph 835 486
Wellington Electrical Services
110 Lee Street, Wellington NSW. Ph 325

SPACE SHUTTLE

America's Space Shuttle is about to open up a new era in manned space flight. As big as a DC-9 jetliner, the Shuttle will blast off vertically and, at the completion of a mission, will return to Earth and land like an airplane.



countdown to a 1980 launch



Orbiter 'Enterprise' on the launching pad

America's Space Shuttle, dubbed by NASA as the "space transportation system of the next decade", will fly in space early next year. This follows the successful completion of a series of low-altitude flight tests to verify the aerodynamic and flight control characteristics of the first Shuttle Orbiter, named "Enterprise".

With the Space Shuttle, the rather large stable of launch vehicles in use today — both civilian and military — will be greatly reduced. The Shuttle will be used to place almost all satellites from Western countries into orbit and, more importantly, it will have the capability to retrieve malfunctioning satellites and repair them in orbit or return them to Earth. This capability assumes particular importance with the predicted growing future requirements for additional weather, Earth resources, communications and navigational satellites.

No longer will it be necessary to write off a multi-million-dollar satellite due to a malfunction following launch.

The Space Shuttle will also be capable of carrying the European Spacelab into orbit. Spacelab, carried in the Shuttle cargo bay, provides a shirtsleeve, pressurized environment for scientific and technical investigators to work in space. Airlocks and a pallet external to the pressurized area will be available for experiments that require direct access to the space environment.

For lunar and planetary missions, the Shuttle will be capable of carrying rocket stages into Earth orbit. These stages will be able to propel probes and satellites into outer space, or can be used to place satellites into high geosynchronous orbits.

The Space Shuttle flight system is composed of three main elements — the Orbiter, two solid rocket boosters, and an external fuel tank which feeds the Orbiter's three engines.

The Orbiter, workhorse of the Space Shuttle program, is designed to be used a minimum of 100 times. It is as big as a commercial jetliner (DC-9); its empty weight is 68,000kg; it is 37.2m in length; and it has a wingspan of 23.8m.

The Orbiter is attached to the back of the fuel tank and the solid boosters are attached to each side of this external tank. The solid boosters will be recovered and reused, but the external tank will be permanently discarded after the propellant is depleted.

The Orbiter's three-level, pressurized crew compartment will normally carry a crew of three or four, but can accommodate up to ten persons under emergency rescue conditions. The upper section is the flight deck, which contains seating for four crew members, two sets of forward-facing controls, and three other control stations used for various handling and monitoring tasks in relation to the payload, or cargo.

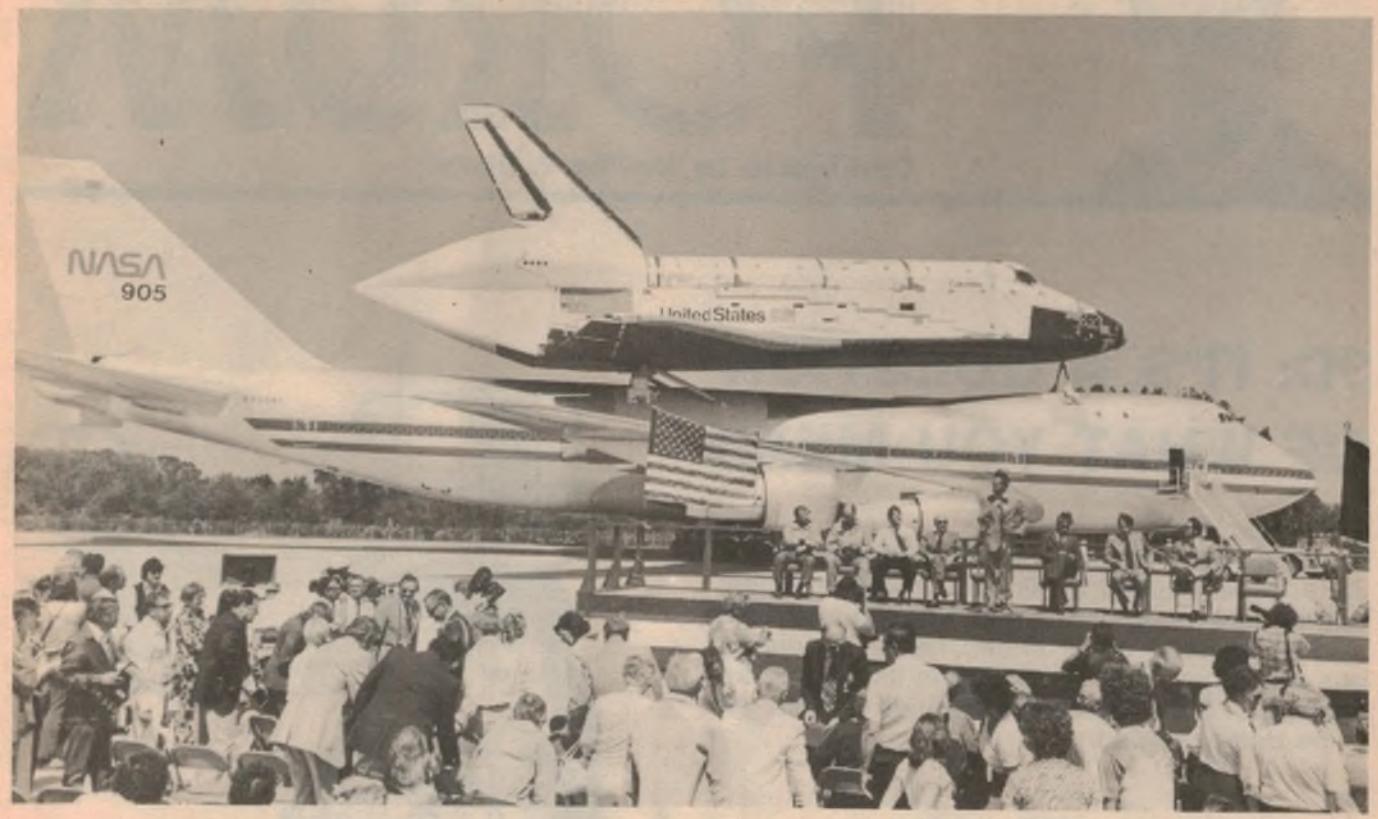
Passenger seating and living areas are located in the mid-section. The lower section houses environmental control equipment.

Lift-off of the Space Shuttle is similar to that of a conventional launch vehicle.

The solid rocket boosters and main engines of the Orbiter are activated simultaneously at lift-off to provide the powerful thrust necessary for initial ascent. The boosters burn for two minutes, and at an altitude of about 45 kilometres are separated from the Orbiter and external tank by 16 separation rockets.

The boosters descend on parachutes

Space Shuttle: the new era in space exploration



Shuttle Orbiter 0V102 "Columbia" atop a 747 transport plane, Kennedy Space Center, March 24, 1979.

and land in the ocean about 280km from the launch site, where they are recovered by ship.

Meanwhile, the Orbiter's three main propulsion engines continue to burn for another six minutes or so, after which time the propellant in the external tank is expended and the tank falls to the ocean after separation from the Orbiter. After tank separation, the Orbital Maneuvering Subsystem (OMS), which incorporates two rocket engines, takes over to provide thrust for orbit insertion and circularization at a height of about 250km.

A modified Boeing 747 Shuttle Carrier Aircraft (SCA) was used as a ferry aircraft and airborne launch platform for the Orbiter test flights. For "Enterprise", the first flight came on August 12, 1977. The flight lasted just over five minutes, and ended with a successful touchdown on the 4570-metre long paved runway at Edwards Air Force Base, California.

"Enterprise" won't be the first Shuttle Orbiter to fly in space however, despite being the first built. That honour will go to the Shuttle Orbiter "Columbia", the second such vehicle to be built. In all, six "orbital flight tests" are scheduled to demonstrate the Orbiter's capabilities in Earth orbit before the start of Shuttle operational flights.

Provided there are no last minute hold-ups "Columbia", with astronauts John Young and Bob Crippen on board, should blast off from the Kennedy Space Centre, Florida, early in 1980. That blast off will initiate a new era in manned space travel.

Above is a general view of the control room at the Johnson Space Center, Houston, Texas. Launch will be from the Kennedy Space Center in Florida.

First flight "Columbia" crewmen Robert L. Crippen (right) and John W. Young during a simulated flight at the Johnson Space Center, Houston, Texas.

FORUM

Conducted by Neville Williams

3D: IT'S A QUESTION OF WHAT YOU MEAN

Predictably, our discussion of 3D television in the June issue, caused a fair amount of comment but, to date, none of it has undermined what we said in that issue. It has tended, rather, to confirm our classification of 3D television as a technical teaser, but a commercial proposition that has yet to be demonstrated.

"It's very realistic," he says, "if you wear special 3D glasses!"

One reader did, in fact, set out to contradict conventional theory and treated himself to a mental image of our "technically orientated staff" simultaneously inhaling their guffaws and swallowing their pride. I admit that it might have been a sight to behold but it didn't happen.

Just before quoting the letter, it is necessary to point up a problem of semantics, which has emerged.

In the original article, we attached to the term "3D" traditional connotations derived from the classical stereoscope, from a large body of literature, and from widely publicised 3D films which provided complementary images. It was also the term used to describe experimental transmissions on Italian television in 1978, referred to later in this article. (See "Wireless World", May 1979, p 73). We suggested "depth enhancement" as a more appropriate term to describe approaches which did not provide complementary images.

Another school of thought prefers "3D" as a general term, applicable to any method which seeks to increase the subjective perception of depth. The complementary image technique is one such method which can be distinguished, if necessary, by the term "stereoscopy. (I hate to admit it but there's currently a good deal of support for this opinion!)

A third, and emerging, group insists that the only truly three-dimensional (3D) technique is one which can produce an image able to change its perspective with movement of the observer — in short, holography. The fact that holography is, as yet, in a primitive stage of development is beside the point.

So take your pick but be prepared to find, not only those who insist on certain definitions, but others who freely intermix them!

In the meantime, here's the letter to which we referred earlier:

BUT IS IT A FACT?

In your article you say, "Behind such a reaction is a question of fundamentals, rather than mere technical bias of rigidity. Human stereoscopic vision relies on the fact that our eyes are separated by 7 or 8cm, so that each receives a slightly different version of the object or scene being viewed."

But is this a fact? In a few seconds one can check whether it is true or false. Close one eye and what difference do you notice? Certainly no diminution of the third dimension. There is a noticeable reduction in the width of the visual field, but that is all.

Having to work with one eye bandaged for several days, due to an accident, I found the only handicap was this reduction in the width of field, not the loss of depth or 3D. It would seem the slight "range finder" effect was quickly compensated for by the brain.

To my way of thinking the idea of juggling with the mixed "in and out" focussing detracts rather than assists the 3D in the final product. I have in front of me some very good examples of Swiss photography on a calendar. They are sharply focussed to about 75% of their depth; mountain and town scenes in colour. Looking at any one of these with one eye at approximately the same distance as the focal length of the taking camera — also angle — the 3D is there without question. That is for me, of course. With two eyes my result is about three quarters of the excellence of one.

My first aquaintance with this method was about 50 years ago. Swain's in Pitt Street, near the GPO had many fine large tinted and B&W photos on show. In front of one particularly good shot of a desert scene, was a notice enjoining one to do just this, with quite astounding results. It was a talking point in the city and papers for some time.

After chatting to numbers of people, I have come to the conclusion that the ability, or whatever one would call it, varies with different people.

This brings another factor into the

discussion. Scientists working in the field of optical ability in young babies state that at an early age, the world appears to them in two dimensions only; and it's only with the gradual accumulation of experience that they gradually teach themselves there is such a thing as depth or distance between them and the different objects around them. This raises the question again: do individuals differ in the skill they have gained from this period in their lives?

It seems to me, that whether the scene is scanned with one or more lenses, each one receives the required amount of data, including 3D to be processed by the brain to assemble a complete 1, 2, 3D picture. The finished result, I suggest, depends largely on the quality and training of brain and mind of the observer.

I.B. (Port Macquarie, NSW).

In so lightly dismissing the differential images received by separate eyes or separate lenses, I.B. puts himself at odds with a mass of accumulated theory and practice. A paper in "Scientific American" (July 1979, p 143) notes that the importance of differential images was appreciated at least as far back as Leonardo da Vinci. Much later, it was the subject of a pioneering scientific submission to the Royal Society in 1838 by British physicist Sir Charles Wheatstone. Research, continuing to the present time, is revealing how the brain can process two "flat" retinal images to deduce depth information from the disparity between them.

I.B. can defend his point of view to the extent that he wants to, but his further observations about one-eyed vision do not contradict anything we said. In fact, one-eyed vision was one of several matters which we consciously omitted from the discussion to conserve space.

While our Forum article attached the accepted importance to complementary images, it also laid a lot of stress on what we called "other clues"; some of them were specifically mentioned in the first paragraph on page 26 of the June issue. They, too, have received a fair amount of coverage in the literature, including recent studies of speed and distance information apparently deduced from the changing size and position of images on the retina.

In ordinary real-life situations, all the visual clues concurr, to give an unambiguous impression of distance (3D): ocular convergence, focus, size, perspective, shadowing, colour saturation, etc.

A "purist" 3D visual re-creation would seek to satisfy all the criteria and, the closer the exercise got to the ideal, the more convincing would be the 3D illusion.

A normal photograph, a magazine illustration, a poster, a photographic enlargement or a painting all have the potential to suggest or emphasise depth by exploiting what we referred to in June as "other clues".

However, when one views any such presentation in the ordinary way, the visual clues do not concurr. Certain properties in the picture may, indeed, suggest and emphasise depth, but ocular focus and convergence (particularly the latter) insist that you are looking at a plane surface so many metres (or centimetres) away!

Now cover one eye and what happens? There is no convergence and the observer is robbed of a vital facility in judging distance. Thus deprived, he/she is more responsive to "other clues" in the picture. The impression of depth may appear to be enhanced.

Having observed the effect many times myself, I believe it's as simple as that. But it is important to realise that it is not a means of simulating 3D but, rather, an action which curtails one's ability to judge what is not 3D! There's an important distinction between the two.

Which brings me logically to certain points, mentioned earlier, as having been omitted from the June article. The first is simply a repetition of what I have just said:

- It is possible to enhance the apparent depth of some pictures by covering one eye. (The Airforce scene on our July cover is an excellent example). As a way of looking at things: interesting but unacceptable, personally and socially.

- When a scene is large enough and far enough away (eg in a wide-screen cinema) convergence and focus are both approaching "infinity", offering less contradiction to the "other clues". It is for this reason that some wide-screen scenes, viewed normally, convey a quite startling sense of depth, particularly with movement of the image. Whether the average cinema audience would respond to further depth enhancement may be open to debate.

- When viewing 3D movies, this writer

According to a report in "New Scientist", British patent application 2 000 605, on behalf of Sony, describes a refinement of the Pulfrich effect. The viewer wears spectacles with differently polarised lenses: plus and minus 45 degrees from vertical. A filter in front of the TV screen changes polarisation at the field rate, in response to signals included in the transmission. The images are processed at the station to take advantage of Pulfrich effect, which gives a dimensional sensation based on image movement. The 3D effect would therefore be controlled rather than random. Viewers without 3D facilities see a normal picture, because the system does not involve differential images.

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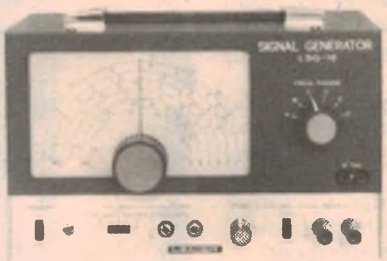

Frequency Range
100kHz to 100MHz up to 300mHz on harmonics.
Output voltage
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Modulation
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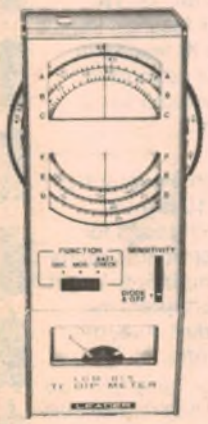

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FORUM: 3D — a question of what you mean

has always been conscious of the plane of the screen, as revealed by unencoded light resulting from grain and other imperfections in the system. The visual effect is of action taking place either behind or in front of a slightly opaque glass window. This could be a basic weakness of double-image 3D.

I agree with I.B. that effects like these are highly subjective, as witnessed by the fact that they have been the subject of argument (sorry, discussion) between my confrere Phil Watson and myself. In fact, I can foresee that these observations will signal another round!

Sufficient to say that the "Scientific American" article mentioned earlier noted how the loss of one eye is a serious handicap to some; others have been able to carry right on with exacting tasks requiring precise judgement of both distance and relative speed. They quote Wiley Post, the well-Known aviator, who carried right on flying and landing aircraft, relying only on monocular faculties.

Following publication of the report which triggered our own June article, Mr Keith Ring of Elsternwick, Vic, wrote to "The Age" newspaper suggesting that one didn't need a lot of paraphernalia to see 3D television. He said that the London "Sunday Times" had suggested to its readers that they try watching TV while wearing a pair of ordinary sunglasses from which one lens had been removed. Mr Ring said that it took a few minutes for the eyes to adjust but the 3D effect was certainly apparent, particularly with action on the screen.

Commenting on this, Philip Adams, the leading proponent of 3D in Australian TV, identified the "Sunday Times" suggestion as the "Pulfrich effect". He said that it "works by causing a temporal displacement between the two halves of the brain"; further, it was apparent only when there was movement on the screen, in a particular direction to suit the viewing situation. With action in the reverse direction "you get inside-out 3D — a giddying and unpleasant situation".

I'll take Philip Adam's word for it but I think it probably boils down to what we were talking about earlier: just one more way of defeating or confusing that in-built convergence or "range-finder" facility we have, which insists that flat pictures are what they are — other evidence notwithstanding!

On the subject of "stereoscopic" 3D television, two recent experiments have been brought to my notice.

During several Sunday evenings, last year, a number of 5-minute 3D telecasts were arranged by RAI, the State Broadcasting Company of Italy.

The report is not very clear but, apparently, mirror optics in front of a standard television colour camera provided complementary images of the scene intercepted from points 8cm apart. Each image involved a different portion of the spectrum so that, by wearing spectacles with corresponding filters, home viewers were able to discern the two separate images which, between them, presumably contained the full range of hues. This was the basis of one speculation on page 26 of the June issue.

The second method was outlined to me in a fairly lengthy telephone conservation. The caller indicated that he had been researching a system, both in Justralia and overseas, which depended on liquid crystal type polarising filters.

At the transmitting end, complementary images would be produced by twin cameras or twin optics, and selected on a field by field basis by liquid crystal filters, modulated at the frame rate. The transmitter would thus radiate left/right views on alternate fields.

At the receiving end, a large filter would cover the screen and, being again modulated at the frame rate, would polarise each successive field vertical and horizontal. The viewer would wear polarised spectacles and would therefore see separate full colour images, hopefully in exact synchronisation with the left/right images from the transmitter.

The caller said that the idea was not new but has not been exploited to date, because, the switching time of suitable liquid crystal filters has been much too long. He claims to have solved this problem to the point where the scheme can now be fully developed.

He admitted that the picture would be non-compatible — fuzzy for those not fitted up for 3D reception, but his enthusiasm for 3D television was unbounded. Look at the huge acceptance of television itself and the universal acceptance of colour.

Provide true 3D and history would be repeated — by simple analogy.

I countered with: "Look at the huge acceptance of mono records and the universal acceptance of stereo. What happened to quadraphonic?"

Er, well . . .

I doubt that either had convinced the other!

One last point: A paragraph in the British "Television" magazine for July 1979 indicated that Philips have been researching three dimensional colour TV at their Eindhoven laboratories. It is a long-term project, however, based on the assumption that the practical introduction of such a system — if at all — would be ten years away. It may be coupled with other basic improvements such as an increase in the number of lines, higher definition, etc, which could well involve a change in basic transmission standards.

Introducing

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Nakamichi 580
2 Head Cassette Deck

The Features

The 580 is designed with a thoughtful selection of features which make the deck more convenient and enjoyable to use.

Motor-Controlled Head Assembly

The Direct Flux Erase Head

The Crystalloy SuperHead

Pause/Cue Feature

Timer Operation

Remote Control

$599 recommended retail price*

The Transport

The 580's Diffused–Resonance transport is basically a 2-motor system: one phase-locked-loop DC servomotor drives the flywheels/capstans, and a second DC motor is used for the fast-wind functions. There is, however, a third motor in the 580's transport; it replaces the solenoid which is commonly used in logic-controlled transports. The use of a motor to govern head assembly movement makes the 580 an extremely quiet machine. More importantly, head insertion is far more gentle than with solenoids, so critical alignments are less likely to be disturbed.

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- Dolby Noise Reduction System
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These days, choosing the right cassette deck is at best a difficult task. With so many sizes, shapes and features, it's hard to tell which combination will best suit your needs. And, if you rightly place performance ahead of gadgets, the choice is no less difficult because there is as much fiction as there is fact in published specifications.

Unless you are a technical wizard, it is nigh impossible to make meaningful comparisons on the basis of printed information alone. The answer, perhaps surprisingly, is Nakamichi who has uncovered new magnetic head technology, new transport technology and new electronic circuit design techniques, all of which combine to make startling improvements in reproduction accuracy — improvements which are not necessarily reflected in the published specifications or the price.

Nakamichi 580
2 Head Cassette Deck

For additional information, direct all inquiries to:

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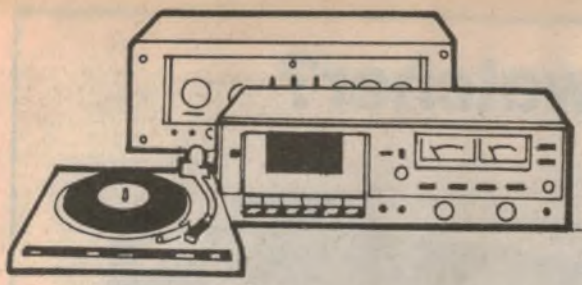


Hi Fi Topics

TRUE HIFI SOUND FROM A HALF-SPEED CASSETTE

In a recent brief visit to Sydney, Mr Eddie Nakamichi, President of the Nakamichi Corporation, demonstrated his company's latest and most impressive advance in compact cassette technology — full, hifi music from a tape operating at a speed of less than 25mm (1 inch) per second.

Mr Nakamichi was accompanied on the visit by his company's Executive Director, Mr S. Takai. The units which they demonstrated came with them on the same plane — early production samples of equipment which will be available to Australian buyers within the next couple of months.

Those present at the hurriedly convened gathering were mainly representatives of the technical press. Mr Nakamichi explained that, over and above making cosmetic and peripheral changes to compact cassette equipment, Japanese manufacturers had had to make judgments on the long-term future of the audio cassette market. Their judgments had differed markedly.

Some had accepted that the most effective way to revolutionise the cassette concept would be to sponsor an entirely new format based on standard ¼-inch tape operating at 9.5cm/sec — twice the speed of the compact cassette. But the resulting "Elcaset" had failed to win a significant market share, partly because of cost and partly because it came on the scene too late. By the time it appeared, evolving tape and head technology had boosted the potential performance of the original and solidly entrenched compact cassette.

Another line of thought had been to produce cassette decks with a double-speed option, which would offer an almost automatic improvement in frequency response and signal/noise ratio, at the expense of reduced playing time and a doubling of tape costs. Quite a few manufacturers have offered decks with the double-speed option, responding mainly to pressure from the American market.

The wisdom of this particular move has been rendered questionable by the recent emergence of metal particle tape, which makes possible at least equivalent advantages without any increase in tape speed. For the price of two premium-grade oxide coated cassettes, one could record the same program on a single metal-coated cassette, achieving similar quality at equivalent cost.

This seemed like a clear pointer to a yet further option.

Mr Nakamichi said that his company had been experimenting with metal particle tape for two years or more. During this time, manufacturers had been trying to solve the considerable problems of producing a tape that would be reliable and consistent. Particular difficulties had been encountered with drop-outs and oxidisation, and this had required the development of a completely new binder. Manufacturers had also had to seek common ground in regard to magnetic properties.

Despite these hassles, Mr Nakamichi said that he had reached the conclusion that metal coated tape held the key to a whole new era in cassette technology. His company had decided, therefore, to concentrate on up-grading its already impressive technology relative to the existing cassette concept. In this way, Nakamichi customers would be able not only to exploit conventional oxide cassettes to the limit, but also to meet their most exacting further re-

THE VERY LATEST from Nakamichi — High Com II Noise Reduction System (top) mates with a conventional, top ranking cassette deck to provide 20dB noise reduction across entire audio spectrum. Superb new model 680 cassette deck immediately above can play both oxide and metal coated tapes, and features full or half speed operation, fluorescent metering, touch controls, and both Dolby and High Com II noise reduction.

The ultimate weight watcher?

Perhaps not the first such move, but in what is possibly the most significant, Ortofon have recently announced an ultra light weight cartridge system for phono pickups.

More than 20 years ago, Ortofon introduced the plug-in headshell that spawned a virtual industry standard — a 4-pin bayonet fitting, with locking ring and cartridge mounting holes ½-inch apart.

Ortofon admit that early headshell and cartridge combinations weighed something like 30 grams although, at the time, no one seemed to be overmuch worried. It certainly did not prevent them from becoming the first choice of many audiophiles.

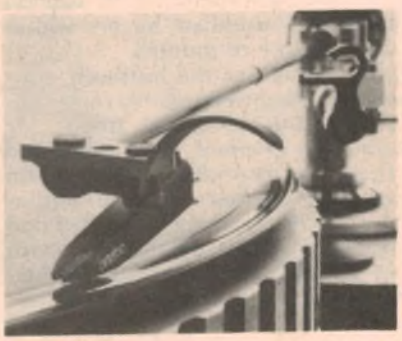
Over the years, the original design has been fined down until it is now a mere skeleton of its former self in lightweight metal or plastic, although with the same bayonet plug and the same mounting holes. Cartridges, too, have lost weight, so that the original 30 grams has typically been cut by a figure of 2 or 3 times.

Ortofon engineers maintain, however, that these figures are still higher than desirable. They call for a corresponding counterweight and a sufficiently rigid and rugged support arm. The stylus assembly needs to be stiff enough to overcome the total resulting inertia if the head is to follow the irregularities of a typical record surface.

By further reducing the mass (and inertia) of the cartridge, headshell (if any), arm and counterweight, it would become possible to design for a higher stylus compliance, therefore better tracing capability of the groove modulation.

This is the thinking behind Ortofon's latest low-mass magnetic cartridges in which they have managed to trim the weight of the basic cartridge to 2.6 grams, or 6.5 grams all-up when mounted in the special droop-nose plug-in headshell, as illustrated. It is not hard to see where the name "Concorde" comes from!

Pictured here, considerably larger than normal size, the tiny new Ortofon lightweight heads can be plugged into a matching headshell (top) or arranged to mount in a conventional lightweight type (bottom). Below is a still further option.



The basic cartridges are designated Concorde 30 and Concorde 20. Both are conventional magnetic, as distinct from moving coil designs, and both can work straight into conventional phono input systems presenting an impedance of 47k ohms shunted by 400pF.

Ortofon literature to hand mentions, altogether, four versions of the new cartridge, offering nude diamond or tipped styli, which are user replaceable. The LM3OH and LM2OH are recommended for users equipped with a lightweight tonearm with built-in headshell, and capable of accommodating cartridges with very high compliance (35um/mN). The LM30 is for somewhat lower compliance situations (25um/mN) while the LM20 offers the lowest compliance of 15um/mN.

All the cartridges have a rated response of 20Hz to 20kHz and a specimen curve for the LM30 is virtually ruler-flat over this range. Channel separation in all cases is better than 25dB at 1kHz, backed up by impressive performance figures in other respects.

For further information on Ortofon cartridges: Harman Australian Pty Ltd, 271 Harbour Rd, Brookvale. Tel (02) 939 2922.

quirements with metal coated tape.

One objective was to achieve a reliable overall frequency response up to and beyond 20kHz, and this obviously called for still further work on heads.

To cope with the new metal-coated tape, the erase head needed to produce a much higher field and, if this were to be provided simply by an increase in circulating current, head saturation and overheating would both become limiting factors. Nakamichi's answer has been to devise a different configuration for the magnetic circuit itself which has resulted, not only in adequate intensity for metal tape, but also a very deep erase (and hence near virgin-level noise) for re-used oxide tapes.

In the process, Nakamichi engineers also identified and tackled a problem of self-erasure — a tendency for very short wavelengths to undergo spontaneous partial erasure when transversing the erase head gap, even when the head is not being activated. They were able to reduce the effect to the point where it did not prejudice significantly the overall record/replay response.

Entirely separate heads have been provided for record and replay, with the record head also having been redesigned to cope with the higher bias and recording currents needed for metal particle tape.

In the replay head, the gap width has been reduced to 0.6um, requiring exacting precision in fabrication and assembly. It also calls for extreme precision in setting and maintaining azimuth alignment of the record and playback heads — not just in the physical sense, but in terms of their respective magnetic imprints. Adjustment and test procedures are available for in-service checking of these factors.

As noted in our review of the model 580 cassette deck (May '79 page 37)

The new generation of factory-built or kit-set Peerless loudspeakers

It's true most speakers *look* alike and that price alone never tells the whole story. But now the new generation Danish-built Peerless loudspeakers give you a recognizable difference in sound quality–a difference that has set Peerless a notch above the others for over 50 years.

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☐ Peerless crossovers use air-cored chokes for maximum power handling, and special electrolytic capacitors to ensure long term reliability. ☐ All components are mounted on fibreglass printed circuit boards for maximum durability, while coded clip connectors eliminate the need for soldering.

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WT126/79

Mr Eddie Nakamichi, President of Nakamichi Corporation, Japan.

Nakamichi have available a completely new tape transport system involving a control motor and two drive motors, with dual capstans operating with different speeds and diameters to ensure a spread rather than a concentration of mechanical resonances. This resulted in a measured wow and flutter figure for the model 580 of .07% — noted as the best figure encountered to date — and not a bad place to start from with a new model!

In seeking to optimise signal-noise ratio, Nakamichi engineers decided that while provision for Dolby-B was a commercial necessity, its potential for 10dB improvement at the top end only fell far short of what could now be achieved. By comparison, dbx offers 20dB across the whole spectrum but with the danger of some "breathing" due to control action, with music like that of the harpsichord and acoustic guitar.

Facing up to this problem, Nakamichi opted for the "Hi-Com" system of noise reduction on which they had been working for some time in association with Telefunken of Germany. It is rather like dbx, in that it performs a linear 2:1 compression during record and an equivalent 2:1 expansion during replay. However, the circuitry has been concentrated into a special Telefunken-developed IC, which permits a much faster response time to signal transients.

Nakamichi have gone one step further and divided the spectrum into upper and lower segments, each with its own Hi-Com processor. While retaining the effective 20dB improvement in signal/noise ratio, their so-called "Hi-Com II" system makes it possible to better suit the response time to the frequency band, thereby virtually eliminating audible breathing.

At this juncture, Nakamichi engineers realised that they were looking at a potential cassette deck which,

B&O MEASURING INSTRUMENTS

The G.R.D. Group Pty Ltd have announced the release in Australia of a range of Bang & Olufsen test instruments especially designed for testing and evaluating audio products. A brochure to hand illustrates 18 different units, many of which are currently available for inspection.

Pictured above is the RT11, one of three variable mains sources. The WM1 wow/fluttermeter is on the left while the unit below is the RV11 volt-ohmmeter with a frequency range to 1MHz.

Bang & Olufsen, better known in this country as B&O, have been active in the audio/hifi field for over fifty years and have been producing measuring instruments for about twenty years. However, to the average Australian hifi enthusiast, the B&O brand has for long been mentally associated with hifi components having an almost unique slimline, Danish appearance.

B&O hifi components are still available, as intriguing as ever and, if we are to read the signs, will be the subject of increasing emphasis by the local distributors, the G.R.D. Group. They will be associated, amongst other items, with "Peerless" loudspeakers and headphones.

Pictured above is the B&O Wow/Fluttermeter WM1. Described as a "combined wow/flutter, drift and frequency analyser," it operates within the range 1Hz to 316Hz, with inputs from 3mV to 10V and with a measurement capability from 0.03% to 10%. It is referenced to a variety of measurement standards.

Other instruments in this group include a second wow/fluttermeter WM2, an audio monitor AM1, and a wattmeter RWM4 with a measurement range from 0.01uW to 100W.

There are four different analog voltmeters, all apparently styled with a view to being used on a shelf above the test bench. The RV7 is a high-impedance AC/DC volt-ohmmeter with pushbutton range selection. The RV11 is a more ambitious instrument with a sensitivity to 3mV and provision for a range of probes.

Unusual design characterises the RV10 and RV9A, both of which use an analog meter to show the reading but digital circuitry to select and display the range automatically. The RV10 is a volt-ohmmeter with a sensitivity of 1mV AC and DC, while the RV9A is best described as a combined voltmeter and measurement amplifier with a dB range from -50 to +60.

Other items in the range include two variable low voltage power supplies,

three supplies providing adjustable sources up to 250VAC, an RC sine/square wave oscillator, a milliohmmeter, a high voltage probe, a measurement amplifier and an attenuator providing a range 4-60dB from DC to 1000MHz.

For further details: G.R.D Group Pty Ltd, 698 Burke Rd (or PO Box 351), Camberwell, Vic 3124. Telephone (03) 82 1256.

HIFI TOPICS — continued

with metal coated tape, would combine very low wow and flutter with a noise figure of around 80dB and a response to 30kHz. Given low distortion, this would satisfy the demands of the most dedicated hifi buffs. It also suggested the possibility of retaining excellent performance at half the tape speed.

In tipping just such a development in a May '79 review of the 580, we had obviously read the signs pretty accurately!

What we were looking at, in the showrooms of Convoy International, was the practical outcome of all this: the Nakamichi model 680 — a 3-head 2-speed deck with in-built Dolby and Hi-Com II noise suppression and set up for either oxide or metal-coated tape. This, with touch control, and both analog and fluorescent metering, added up to a deck that had to be right at the top of the stack.

Those present were prepared to concede superb normal speed performance but what about half-speed — 15/16ips or 24mm/s? The claimed response was to within plus and minus 3dB at 15kHz and a noise figure only about 3dB below that for normal speed. Yes, but now would it sound?

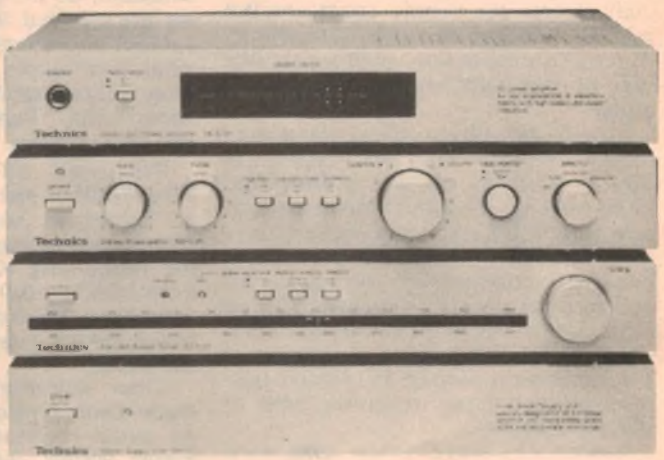
Frankly, it sounded superb, in recordings dubbed from an original tape master and a top quality direct-cut disc.

Far from there being any suggestion that we were listening to poor man's hifi, the impression was rather that it would take a very keen ear indeed to pick that the music was coming from anything but a top quality normal speed cassette. The dynamic range and full-bodied peaks were particularly impressive.

Mr Nakamichi also made a point of playing excerpts featuring percussive instruments — drums/piano/-harpsichord — to demonstrate the attack and lack of breathing of the Hi-Com II noise suppression system. Again, full marks!

The demonstration was relatively brief but it was also very convincing. There seemed little doubt in anyone's mind that metal tape and the half-speed option had arrived.

New Technics hifi system



DISPLAYED at the recent Consumer Electronics Show in Sydney, the Technics "Concise Component System" consists of four components, none of which is more than 5cm high or 30cm wide. They are designed especially for the audio enthusiast who seeks compactness without loss of sound fidelity. The system consists of the SHC01 power supply unit; the SE-C01 power amplifier (50W RMS per channel); the SU-C01 preamplifier; and the ST-C01 AM/FM stereo tuner. Recommended retail price for the complete system is $1200 — the components are not available separately.

Direct-drive turntable

JUST RELEASED by Teac Australia Pty Ltd, the PX-300 direct-drive turntable features an FG (frequency generator) servo-controlled DC motor which, Teac says, provides exceptional speed stability. Hall effect elements are used in the motor to eliminate the commutator and brushes, while the turntable base is composed a "new high specific gravity barium-loaded compound" to reduce problems due to acoustic feedback. Other features include front panel controls, an S-shaped tonearm, and a built-in stroboscope.

At full speed, with metal tape, there is response to spare, which is a startling statement to make about the cassette formula format. The fact is, however, that the 3dB down point is around 30kHz. Nakamichi have opted to roll off the response with a filter set at 22kHz, to ensure that there is no needless contribution to noise by spurious components heterodyned down from the supersonic region.

And what is all this likely to cost?

According to Geoff Matthews of Convoy, about $1200 for the model 680. It will be available within about two months, as also will be Nakamichi's ZX-60 Metalloy cassettes, at about $10 each.

And, if you can't afford that? Then you may be able to afford the new Nakamichi model 480 deck at about $370. It lacks the half-speed facility and some of the trimmings of the 680, but it does offer superb normal-speed performance from either oxide or metal coated cassettes.

For those who already have a top ranking deck which they must continue to use, Nakamichi have released an add-on Hi-Com II noise reduction unit, which will provide about a 20dB improvement in the noise figure.

For further details: Convoy International Pty Ltd, 4 Dowling St, Woolloomooloo NSW 2011. Tel (02) 358 2088.

AM STEREO is apparently still facing hang-ups in the USA. The Federal Communications Commission is apparently not satisfied with the field test data submitted by the NAMSCR (National AM Stereo Radio Committee) and has asked for further testing and information. To add to the uncertainty, the ABC network has elected to conduct tests with the Kahn-Hazeltine system, which was passed over by the NAMSCR. It is the oldest method and uses separate sidebands for each stereo channel. ABC says it believes that Kahn-Hazeltine is the system which will best serve the interests of the public and of broadcasters. Meanwhile, the Australian Minister for Post and Telecommunications, Mr Tony Staley, has announced that his department will be looking at the possibility of authorising Australian AM stations to broadcast in stereo. If this can be achieved, it will improve their competitiveness against commercial FM-stereo broadcasters, which will be licenced in the not too distant future.

AUDIO TALK

by LEO SIMPSON

The illusion of power

Yet again, one of my acquaintances has approached me for advice on buying some new high fidelity equipment. He currently has a stack of equipment, with a four-channel receiver as the mainstay of the system. This receiver puts out about 40 watts per channel (all four of them) and my power-hungry acquaintance wished to substitute two one-hundred watt per channel amplifiers to put more "oomph" into the system.

Well, I had a look at the specs for his present receiver and then at the new equipment he proposed to buy. Then I told him it would be a waste of money. I patiently explained to him why the more powerful amplifier would make hardly any difference — but all to no avail. That was not the answer he was looking for, and he purchased the amplifier anyway. I had wasted my breath!

This being the case, I thought I would retell the story here in this column, where it might be better appreciated.

Well, why is it that quite large increases in amplifier output power make such a small difference in sonic impact? The fault lies not with the amplifier nor, for that matter, with the loudspeakers. The fault, and it is not a fault as such, lies with your ears.

If this was a live telecast I could now perform a suitable theatrical demonstration to convince you of the following facts. Since there is no television camera handy, I must rely on prose.

The fact is that the ear responds to increases in acoustic power in a logarithmic rather than a linear fashion. That means that if the acoustic power radiated by a trumpet player is doubled, the difference in perceived sound level will be only slight. The same applies for any sound source, whether it is the Sydney Opera House organ or an Aborigine's didgeridoo.

If your amplifier or stereo receiver has power meters you can rapidly demonstrate the veracity of my statement. Just feed in a constant tone at a level of a few watts and then double the power. You will notice that, far from doubling the apparent sound level delivered by your loudspeakers, the increase is noticeable but nothing to become excited about. Now do the same test for any piece of music you like, and no doubt the perceived difference will be even less significant.

Now, if you accept the truth of this demonstration, then you must also accept that substituting an amplifier which is twice as powerful for the one you already have, will make precious little difference.

Yet it is surprising just how many people who are fully aware of the above facts will go out and purchase another bigger and supposedly better amplifier in the full and heady expectation that it will make a world of difference.

To make a really noticeable difference, one that makes you cringe and cower in the corner before its acoustic onslaught, your next amplifier will have to produce something like TEN TIMES the power of your present amplifier! Now that is a proposition which is possibly way beyond your means. Besides having to find the considerable price of such an amplifier, you will have to foot the bill for rugged loudspeakers which can't handle this large power.

Most people do not seriously consider the purchase of this large an amplifier. Instead, they upgrade to an amplifier or receiver which is typically twice as powerful.

Some of these people believe that while their new amplifier will not sound much louder, the resulting sound reproduction will be more "effortless" or the amplifier will not be "working as hard", for a given sound level. Sad to say, they are wrong here too. For a start, they are ascribing "animate" qualities to an inanimate object.

It is possible that the more powerful amplifier may have a generally superior performance, with improved bandwidth, less distortion, lower output impedance and so on. But provided the amplifier to be replaced had a good performance in the first place, it is unlikely that the bigger and improved amplifier will have markedly better sound quality, as well as not being noticeably louder.

More importantly, at normal listening levels with typical loudspeakers, a modern high power solid state amplifier will dissipate more power and subject its internal components to more voltage stress than a less powerful amplifier which is still quite adequate for the job.

I have not seen any comparative figures for reliability between amplifiers of high power and those of medium power, but I would bet against the high power unit. Its greater complexity, higher heat dissipation and greater voltage stress must surely tell in the long run. That is a factor which few prospective buyers seem to take into consideration.

For most people, with typically sized living rooms and loudspeakers of modest efficiency, an amplifier with a rating of 30 to 40 watts per channel is more than adequate. If it is not adequate, then I must assume that it is being used in large living or entertainment area and possibly teamed with particularly inefficient loudspeakers.

Some loudspeakers are so inefficient that it may be better to upgrade to more efficient models rather than to buy an amplifier powerful enough to drive them sufficiently hard. After all, amplifiers with more than, say, 150 watts per channel are very expensive, bulky and heavy.

To put it another way, if you can substitute a pair of loudspeakers which are only 3dB more efficient than your present power hungry dinosaurs, the effect will be the same as substituting an amplifier which is twice as powerful.

So before rushing out to buy a more powerful stereo amplifier or receiver, have another look at your situation. First of all, are you kidding yourself that you need more power — or worse, are you one of these selfish people who periodically inflict their neighbourhood with noise pollution?

On the other hand, I concede that perhaps your present system really is inadequate. In that case, remember that increasing the acoustic power can be done by increasing amplifier power, by increasing loudspeaker efficiency (ie, by buying a new set), or a judicious combination of both.

Whichever approach you do take, it will be very expensive, if you are going to make a really worthwhile improvement. As you will soon realise when you start to shop about, amplifiers and receivers with 30 to 40 watts per channel together with matching loudspeakers, usually represent quite good value for money. But above this level, the "law of diminishing returns" starts to operate with a vengeance.

There is a sequel to all this. My acquaintance, mentioned at the start of this epistle, professes to be very happy with his new amplifiers. What am I to say? There is no gainsaying the power of illusion.

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Philips N6330 & N6325 stereo headphones

Philips make a large range of high fidelity equipment, which is made in many countries of the world. Here we review two pairs of Philips "high fidelity international" headphones. One pair uses the electret principle while the others are dynamic, and they are each made in separate countries.

Both headphones use technologies which are well established, but they each have interesting innovations which add to the performance.

Consider the electret model first. The N6325 uses the relatively new electret technology, but with an improvement. Previous electret headphones by other manufacturers have brought an advantage over electrostatic models, in that they dispensed with the need for a high voltage polarising supply; but they still required relatively bulky transformers to step up the voltage drive.

Philips have overcome this problem by making the electret diaphragm unipolar instead of bipolar. This means that it has one electrode instead of two. At the same time, the air gap between the electrode and diaphragm has been drastically reduced, to the point where it is only a few microns.

Reduction of the air gap to this extent raises the efficiency and means that the bulky transformers can be replaced with very small ones in a box interposed in the headphone cord. The resulting impedance and efficiency of the headphones is sufficiently high to ensure that adequate drive can be obtained from the headphone socket found on most stereo amplifiers.

The appearance of the N6325 headphones offers few clues that they use the electret principle, apart from the fact that they are labelled "electret" on the righthand ear piece. They have a padded and adjustable headband which is fairly heavily springloaded. It has relatively small padded earpieces, which are intended to fit against the ear rather than over and around it.

The curled connecting cable runs to the left earpiece and will easily extend to about three metres; it is fitted with a 6.3mm jack plug. Weight of the headset is quoted as 230 grams.

Philips quote the frequency response of the N6325 phones as 20 to 22kHz, with no limits. Distortion is less than 1% and sound pressure level is 104dB (1mW input and 500Hz).

By comparison with the N6325 model, the dynamic N6330 model is larger and more impressive in appearance. It has larger circumaural pads which are removable for cleaning or replacement. And the earpieces themselves freely adjust in all planes, so they readily conform to the contours of the user's head.

As a result, the N6330 are considerably more comfortable than the electret model 6325. While they are basically a conventional dynamic headphone using what is essentially a miniature cone-type loudspeaker, there is an interesting refinement. Usually, this sort of headphone is either close-backed or of the "open-aire" construction as used by Sennheiser. The N6330 uses the latter approach, but also has six "passive radiator" diaphragms to augment the bass response below 200Hz.

On the left, the Philips N6325 electret headphones and on the right, the Philips N6330 dynamic headphones.

Nominal impedance of the N6330 is 600 ohms, which means that it can be easily driven from the headphone socket on most amplifiers. Frequency response is again vaguely quoted at 16 to 20kHz. Distortion is also less than 1%, although the conditions are not specified and sound pressure level is 94dB at 1mW input. Weight is approximately 390 grams.

Both sets of headphones were evaluated on a range of program material. Taking the N6325 set first, we found them particularly efficient, requiring very little drive to produce adequate sound level. Provided they produce a good seal with the ear cavity, their bass response is good although the treble ends tends to predominate. There also appears to be a tendency to emphasise disc surface imperfections.

One drawback is that if they are moved slightly on the head while program material is being reproduced, the resultant severe deflection of the electret membrane causes it to "block" temporarily. In other respects, the sound quality is good with a most impressive ability to produce high sound levels.

We found the N6330 dynamic phones had a very smooth frequency response which is well maintained to below 40Hz. There is just a slight tendency to emphasise the extreme highs but this is easily corrected with a slight adjustment to the treble control. Efficiency is more in line with conventional headphones and signal handling is adquate, without being as generous as that of the N6325.

Overall, we preferred the sound quality of the N6325 and its greater comfort. However we predict that both sets will find ready acceptance with hifi users. Recommended retail price of the N6325 electret phones is $53.11 while the N6330 goes for $88.93. Both prices include sales tax. For further information contact Philips Central Service Division, 443 Concord Road, Rhodes, NSW 2138 or interstate offices. (L.D.S.)

Capture spectacular action shots with this

Sound triggered photo flash

How would you like to be able to take photographs like those spectacular shots of breaking light bulbs and splashing liquids? You can take them with almost any normal camera and electronic flash unit, by using this low cost trigger unit. It's easy to build and offers facilities not found on any other design that we've seen.

by IAN POGSON

To take spectacular action shots of things like glass breaking and water splashing, you need to take the shot at just the right instant and to use a very short exposure time. This isn't as easy as it might sound, because in many cases the timing of the shot has to be accurate within a few milliseconds (thousandths of a second).

The secret is to use an electronic flash, and trigger it from the sound made by the event you're trying to photograph. The flash provides a suitably short exposure time, and the timing is right because it's automatic.

The sound trigger unit described here is designed especially for the job. It takes the signal from a standard medium-impedance microphone, and uses it to produce a trigger signal capable of operating any normal electronic flash unit. And to give increased flexibility, it lets you introduce an adjustable electronic delay into the system, so that you can carefully alter the timing of your shots.

Actually this isn't the first sound trigger unit we've described. We published an earlier design in April 1972, but that was a fairly simple unit with few refinements. And of course it's now a little dated, electronics having progressed rather rapidly in the last seven years.

The new unit doesn't just use newer circuitry — it also offers improved facilities. While retaining basic simplicity, we have been able to produce a unit which has a constantly variable sensitivity over a wide range, together with a constantly variable time delay over a range from about 1ms to about 120ms. We have also provided an "inhibit" switch which prevents the unit from firing prematurely while a final setup is being arranged.

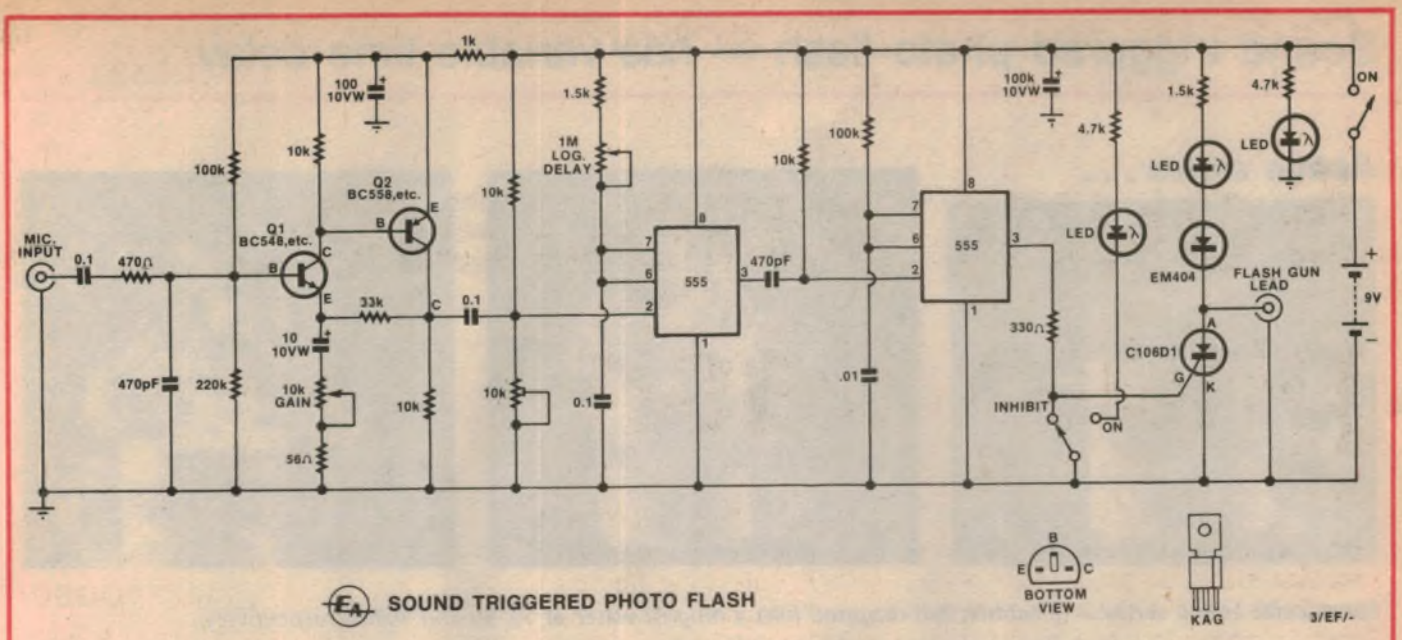
In addition to the above features we have also provided components which prevent the unit from firing again after the initial and wanted flash firing. During development, we found that where a flash unit was capable of firing in quick succession and where an action was accompanied by a succession of sounds, more than one flash occurred with consequent multiple exposures on the one frame. There may be cases where this is an advantage, but more often a good shot could be spoiled.

To avoid this problem, we have added a bleed circuit in series with the triggering SCR, such that when the SCR fired, a "holding" current is established to prevent any possibility of the SCR beging triggered again. The unit can be reset simply by turning off the power switch and turning it on again. We are not aware of this feature being included in any other sound-operated photo flash unit, despite its importance. More will be said about it later on.

After the successful development of the flash unit, we spent an interesting time in our photographic studios taking a number of action shots. Some of the pictures which we attempted include:

(a) a ball dropped onto the trigger of a rat trap, using different time delays,

The prototype provides variable time delays from 1ms to about 120ms. The centre LED comes on to indicate that the unit has fired.



A simple microphone preamplifier, two 555 timer ICs, and an SCR form the basis of this economical circuit.

(b) dropping an electric light globe onto a hard surface,
(c) smashing an electric light globe with a hammer,
(d) dropping an egg onto a plate,
(e) dropping a ball into a cup of water, with various time delays.

Some of the resulting pictures are reproduced in these pages. Apart from a few comments, perhaps they can be left to speak for themselves!

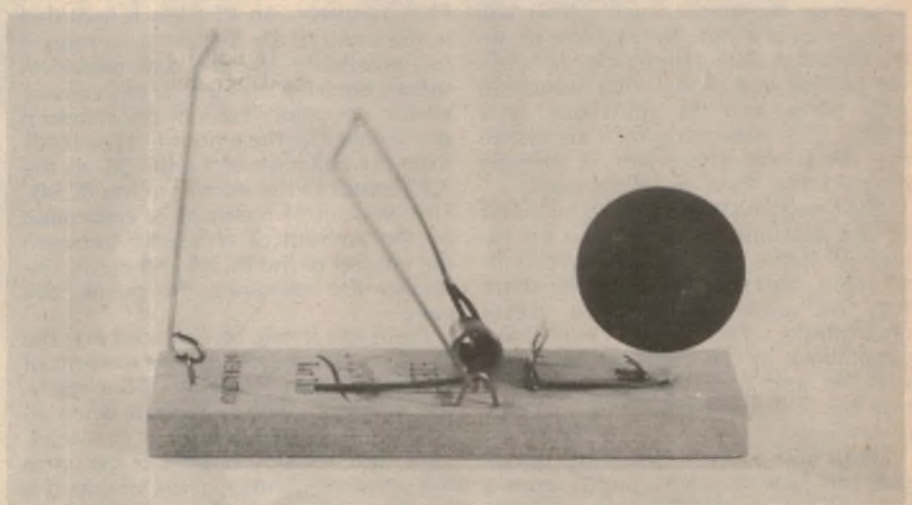
Triggering a rat trap proved to be an interesting subject. The final result depended on where the ball was made to strike the trigger, as well as the time delay used. The picture shown was taken with a time delay of 20ms and the trigger was struck near the end away from its pivot. Other shots of the same subject using a delay of 10ms and striking the trigger a little futher back showed the arm of the trap in a position where it had not travelled as far.

Smashing electric light globes is always an interesting subject. The first time we dropped one onto a table, it bounced! The second effort was successful and the picture on page 55 shows the glass actually disintegrating.

A second globe was struck with a hammer. This produced the impressive shot shown on this page, with the hammer caught just as it entered the bulb. As you can see, the bulb is still intact at this stage, apart from a hole surrounded by small radiating cracks. However, just after the shot was taken, the bulb completely shattered.

Just in case you're wondering, this shot was taken with a delay of about 15ms.

Our next effort was to drop an egg onto a plate and observe its state after a time delay of 10ms. The picture shows this quite clearly.



View at top shows a rat trap caught in mid action after being triggered by a rubber ball. Above shows an electric light bulb 15ms after impact with a hammer.

Sound triggered photo flash — has variable time delay

Action series . . .

Spectacular action series — a rubber ball dropped into a mug of water at 10, 50 and 100ms respectively.

Another quite spectacular series is where we dropped a small rubber ball into a mug of water. The first one shows the situation after a time delay of 10ms, the second one shows what happened after 50ms, and the third one after 100ms. It is interesting to note that in the third one, the water is forming droplets and they are falling back.

The foregoing examples are but a few of the possibilities which may be exploited. While many of them are of little value apart from their novelty, there may be many other more useful applications. The trigger may have possibilities in the study of nocturnal wild life, and also in industry, where it may be of value in analysing machine operation.

Let us take a closer look at the circuit and see how it works. Input from a microphone is amplified by the two stage amplifier consisting of a BC548 NPN transistor, followed by a BC558 PNP transistor. An RF filter is included in the input to the first stage, to reduce the possibility of radio and television signals entering the circuits and causing erratic operation. Gain of the system is determined by the amount of feedback from the collector of the BC558, via the 33k resistor to the emitter of the BC548. The amount of feedback is controlled by the amount of resistance between the emitter of the BC548 and earth. The smaller the resistance, the greater the gain.

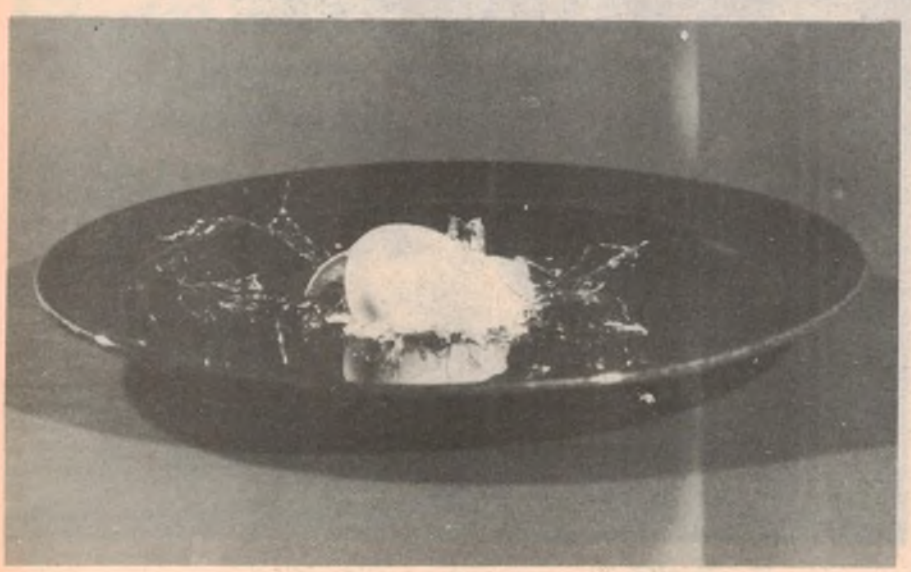
From this it may be deduced that the 56 ohm resistor governs the amount of maximum gain available. Conversely, the minimum gain will occur when all of the 10k potentiometer is in circuit. Thus, the 10k potentiometer becomes the sensitivity control of the system. It is worth noting that the gain may be further reduced by using a potentiometer of about 50k. However, this was not found to be necessary. In fact, the range of control was reduced so that a smoother control could be achieved over a range found to be most practical.

Following the audio amplifier are two type 555 IC timers. These are wired as monostables. Bias to pin 2 of the first 555 is adjustable by means of the 10k trimpot and which is normally set so that the voltage at pin 2 is just above one third of the supply voltage. The 1.5k resistor, 1M log potentiometer and the 0.1uF capacitor form a variable time constant applied to pins 6 and 7 of the first 555.

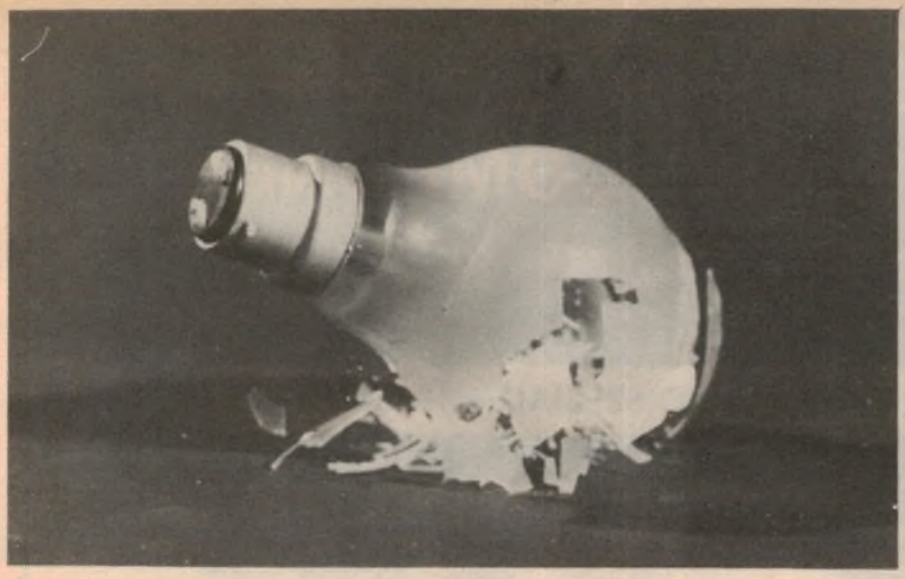
When sufficient level of signal is delivered by the audio amplifier to the first 555, a pulse appears at the output pin 3, with an effective delay determined by the time constant. This pulse in turn triggers the second 555 and a positive going pulse appears at its output pin 3. Provided the "inhibit" switch is open, this pulse will trigger the SCR into conduction. This in turn fires the flash gun.

The idea of the inhibit switch is to inhibit firing while final arrangements are being made in a particular setup. This is particularly useful where near maximum sensitivity is required and where any small sound may be likely to trigger and fire the flash prematurely. The switching incorporates a LED to indicate the state of this function.

The 1.5k resistor, 400V diode and LED between the positive rail and the anode of the SCR are to provide the "holding current" mentioned earlier. When the SCR fires, the current which flows through these components ensures that it remains in conduction to prevent further triggering. The LED indicates that latching has occurred, so that you are prompted to turn the unit off briefly to reset it before attempting the next shot.



A time delay of 10ms was used to capture this action shot.



An electric light bulb disintegrates on impact with a table-top.

Thanks to this facility, you won't get multiple exposures even if your electronic flash recycles extremely fast and you are trying to photograph something which makes a prolonged sound or a series of sounds.

From a constructional point of view, the trigger unit should be simple and straightforward. The components used are readily available, and most are wired on a printed circuit board (PCB) which measures 92 x 51mm. The board is coded 79SF9, and its pattern is reproduced here actual size for those who may wish to etch their own board. Patterns have also been sent to board manufacturers, so that ready-made boards should be available shortly.

As may be seen from the pictures, the unit is housed in one of the now popular "jiffy" boxes. Although we have only provided a small 9V battery, there is room in the box to accommodate a larger battery should this be desired.

Start by assembling the printed board first. Due care should be taken with the whole assembly process, making sure that the job is done in a neat workmanlike manner. All component leads should be kept to a minimum and due regard should be given to all polarities. This applies to all diodes, including LEDs, transistors, electrolytic capacitors, the SCR and the two ICs. Use a small soldering iron, kept clean at all times. Be sure not to overheat components but at the same time, make good soldered joints.

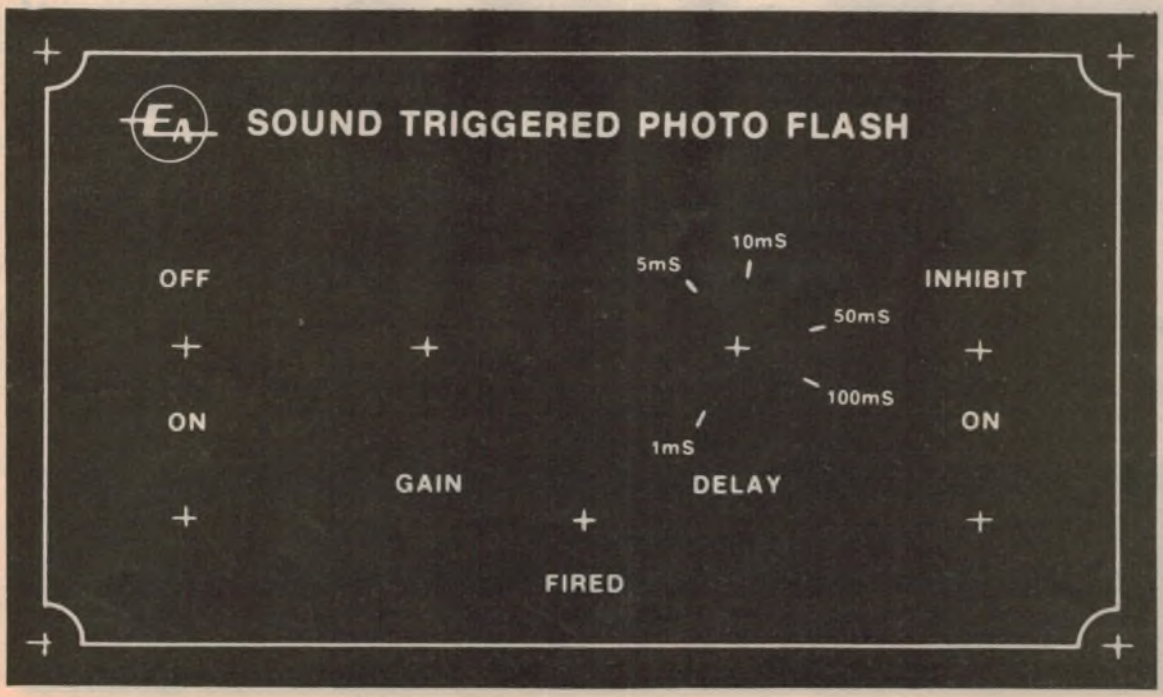
It is always a good idea when assembling printed circuit boards, to start with the small components, such as resistors and diodes and gradually move towards the larger components. The ICs should only be fitted to the sockets when the rest of the assembly has been completed.

When the printed circuit board is finished, it should be checked to make sure that all components are in the right places, that all polarities are correct and there are no bad soldered joints or solder bridges across adjacent points or conductors.

The front panel may be now assembled. Layout is not critical but readers may wish to follow our layout as shown in the pictures. We have produced an artwork for this panel and it is reproduced full size so that readers may use it in one way or another in the preparation of individual panels. Fix the potentiometers, switches and LEDs to the panel. A 5-tag miniature tagstrip is soldered to the back of the time delay potentiometer as may be seen in the picture. The tagstrip is used to mount the 1.5k resistor and the EM404 diode and for interwiring between the strip and other parts of the circuit.

Before doing the final assembly, a number of external leads have to be soldered to the printed circuit board. These include two for the microphone socket; two for the gain control; two for the time delay control; one for the inhibit LED; one for the on/off switch; one for the corresponding LED; one to the earth point on the inhibit switch; one from the SCR gate to the inhibit switch; one to the EM404 diode and one for the negative pole of the battery.

Just where you fix the printed board, the battery and the microphone socket into the box is not really important. However, unless you have reasons for



Actual size reproduction of the front panel artwork.

Sound triggered photo flash — uses two 555 timer ICs

doing otherwise, we suggest that you place them as we have, as may be seen from the picture.

We fixed the board with four ⅛in Whitworth x ½in RH screws, with the heads under the box. Two nuts were run onto each screw to act as spacers and when the board was placed in position, it was then held with four more nuts. The battery is held in place with an L-shaped bracket which we fashioned from a piece of tinplate. One hole was drilled in the bracket to screw it in place. The socket is an item which should be selected to match the microphone which you intend to use.

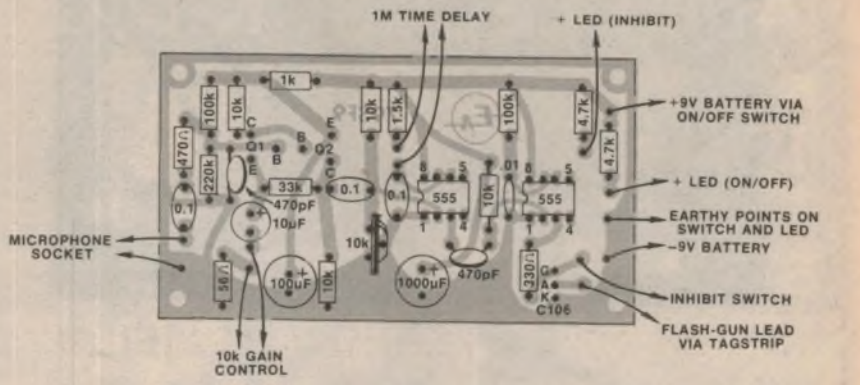
The output lead is actually an extension lead for flash guns and obtainable from photographic stores. The female socket which mates with the lead of your flash gun should be retained. The plug at the other end is cut off and the lead terminated on the tagstrip, taking the outer braid to the centre earthy lug and the centre conductor to the cathode of the EM404 diode. Our lead was two metres long.

On the subject of microphones, a few comments may be helpful. There are many microphones in use in various types of equipment which may be used quite successfully. These could include microphones supplied with tape recorders, amateur and CB gear, etc. Most of these microphones are of the dynamic type, usually of fairly low impedance, about 500 ohms. This is the type which we used. The high impedance type of dynamic microphone (usually about 50k) should also be OK for the job. Although they are less popular now, a crystal microphone could probably also be used.

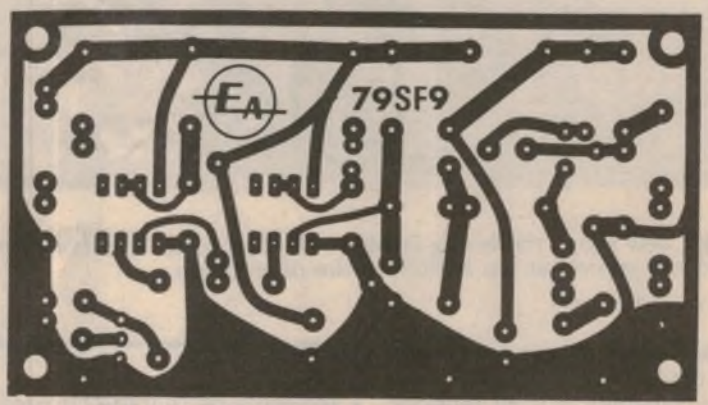
There is only one basic adjustment which has to be made to the unit itself. The 10k trimpot on the board should initially be set to its mid position. It may then be adjusted carefully to give the maximum sensitivity of triggering to sound. It should be noted that if the rotor is turned too far in either direction, triggering will cease.

Instead of the lead of the flash gun being plugged directly into the appropriate socket on the camera, the lead from the flash gun is connected to the output lead from the sound triggered unit. The microphone is plugged into the input of the sound triggered unit. A typical setup would be where the camera is on a tripod and focused on the subject (or the position where the subject will be at the time). The microphone is strategically placed close to the source of sound.

When the scene is ready, lighting is subdued, the sound triggered unit is switched on and its power LED will light. Then before the action is to take



The PCB layout for the sound triggered photo flash. Follow it carefully in conjunction with the circuit diagram.



Here is an actual size reproduction of the PC pattern.

place, the inhibit switch is switched on and its LED will also light. The camera shutter is then opened, action follows and the shutter closed immediately after the flash. When the flash has fired, the third LED lights, indicating the fact. The inhibit switch is switched off and unless the unit is wanted again very soon, the battery should be switched off also. Incidentally, battery current is a little over 20mA so that battery life should be considered.

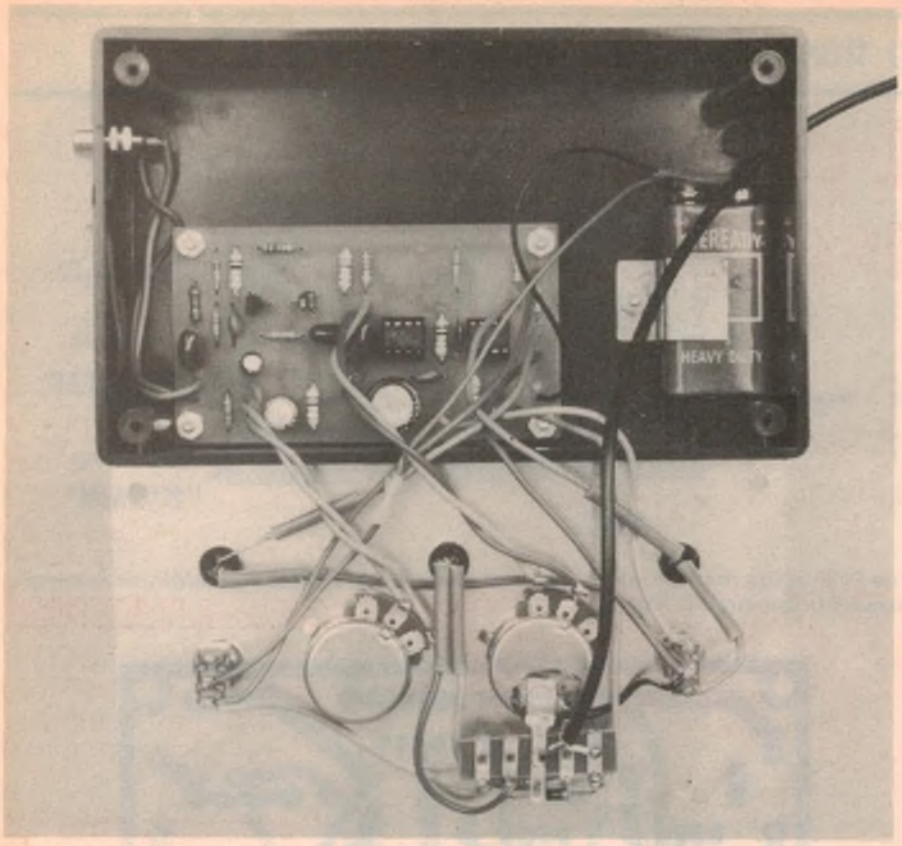
Fairly obviously, some of the movements will need to be rehearsed in order to make adjustments on the sensitivity to be used for the microphone. Also, the time delay and exposure must be determined. How these are to be done, will depend on the circumstances of the particular exercise.

One very important point and one which we have not touched on so far is the matter of flash duration, which obviously ties in with exposure. However, the flash duration is important where high speed action is involved and the duration of the flash must be considered in this light. No pun intended!

It is with some trepidation that I quote figures but they should act as a guide and give a good idea of what we are about. Some years ago, when high voltage electronic flash units were in use, the duration of the flash was of the order of 1/5000th of a second. More recently, low voltage flashes have taken over and the flash duration is somewhere between 1/800th and 1/1000th of a second.

Quite rapid action can be stopped with longer duration flashes of between 1/800th and 1/1000th of a second, but higher speed action requires shorter flash times. Fortunately, shorter flash times can be achieved with all but the simplest flash guns on the market today. A facility is included on most modern flash guns whereby the flash duration can be shortened in response to the amount of flight being reflected from the subject, and this can be exploited where we need to take shots of fast action.

Just how this can be achieved will depend somewhat on the particular flash gun being used. However, there is one "trick" which may be worth considering in setting up a gun to a particular flash duration. Instead of relying



This internal view shows the wiring layout of the prototype. The flashgun lead is soldered to the tagstrip at the bottom of the photograph.

PARTS LIST

1 Utility box 159mm x 96mm x 50mm
1 Printed circuit board 92mm x 51mm, code 79SF9
1 BC548 transistor, or similar
1 BC558 transistor, or similar
2 555 ICs, 8-pin DIL
2 IC sockets, 8-pin DIL
1 C106D1 SCR
1 EM404 diode, or similar
1 10k miniature trimpot
1 10k linear potentiometer
1 1M log potentiometer
2 SPDT miniature toggle switches
3 Red LEDs with bezels
1 Microphone socket to suit (see text)
1 Rubber grommet
1 Miniature tagstrip, 5 tags
1 9V battery, with clip lead
1 Clamp for battery
1 Flashgun extension lead

Resistors (½ watt)

1 56 ohms	*2 4.7k*
1 330 ohms	*4 10k*
1 470 ohms	*1 33k*
1 1k	*1 100k*
2 1.5k	*1 220k*

Capacitors
2 470pF ceramic
1 .01uF greencap
3 0.1uF greencap
1 10uF 10VW electrolytic
1 100uF 10VW electrolytic
1 1000uF 10VW electrolytic

Miscellaneous
Hookup wire, solder, screws, nuts.
Note: Resistor wattage ratings and capacitor voltage ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.

We estimate that the current cost of parts for this project is approximately

$22

This includes sales tax.

on the light reflected from the subject to control the flash duration, which will have many variables, a fixed reflector can be added to the body of the flash gun.

The reflector may be fashioned from a piece of scrap aluminium, or even a piece of cardboard. The idea is to shape the piece so that part of its surface will catch some of the light from the gun and reflect it back into the sensing device on the gun. The distances involved will probably be of the order of 5 to 10cm, between the reflector and the gun lens and the sensing device. Care should be taken to ensure that the reflecting material does not obscure light which is intended for the subject.

The idea of this exercise is to persuade the sensing device that there is more light being reflected from the subject than is actually the case. This results in a shorter flash duration, which is what we are looking for. The amount of light being artificially reflected back into the sensor may be controlled to a large extent by varying the colour of the reflector. All of this is subject to experiment. Incidentally, the reflector may be fixed to the body of the gun with rubber bands or adhesive tape.

By resorting to this or other methods of flash time reduction, we can effectively obtain speeds of 1/2000th of a second; even speeds up to the order of 1/50,000th of a second may well be possible. Some of these figures have been taken from a Sunpak Owner's Manual. With the reduced amount of light from the shortened flash, of course the lens aperture will have to be increased accordingly.

With some of the higher order of flash speeds obtainable, quite high speed action may be successfully photographed. In many cases, the action may appear to be completely "stopped" — so much so that it may even appear to be "faked".

For readers who have been wondering how we took the pictures which we have reproduced on these pages, here are the relevant details. The camera was loaded with Ilford Pan F film ASA50, with the camera aperture set at f5.6. A Sunpak Autozoom 2000 flash gun was set up at the front to one side, and 90cm from the subject. The light output was set to 1/16 of available output, which would give a flash duration of the order of 1/50,000 of a second. A similar and second flash gun was set up for back lighting, to the back and to one side and fired by a photo-detector "slave" unit.

The use of two flash guns is not essential, but does give more satisfying moulding of the subject and fewer shadows. The easiest way of operating the second flash gun is to use a "slave" trigger, and we hope to describe a simple unit of this type shortly to help you in this regard.

However in the meantime, why not try your hand at basic sound-triggered photography using a single gun? The scope is limited only by your imagination, and the results can be very satisfying.

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Input voltage	24V ± 5%
Current	300mA
Life	MCBF 1 x 10^6 lines
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How about this for a neat application of microprocessor technology? A musical doorbell with a repertoire of 24 tunes which the microprocessor steps through automatically! Each time the front door button is pushed, a different tune is played. The complete circuit uses just five ICs and can be put together inside a couple of hours.

by LEO SIMPSON

Most of our readers are probably already aware that microprocessor-based door chimes have now been available for some time. The first was the "Chroma-chime" manufactured by Chromatronics, of England. We published an article reviewing the kit for this system in April 1978. But while the Chromachime was highly successful, we believe our version, which uses the same microprocessor, is a much better unit. Modest aren't we?

As with our unit, the Chroma-chime had a repertoire of 24 tunes (Notice that subtle shift to the past tense!) but the tune to be played had to be selected by the user, by means of two rotary switches. When you became tired of hearing the one tune played over and over, you lumbered over to the grey box, flipped up the lid and changed the switch settings. All very boring and mechanical.

By contrast, our Autochime has no selector switches at all. Exciting, isn't it? Each time a visitor pushes the button at your front door, the circuit plays a different tune. If your visitor is a Neanderthal type and keeps pressing the button, the circuit will just keep cycling through the whole repertoire, until he removes his great hairy digit from the button!

We agree that it would be better if the Autochime did not respond to these unwelcome primitives, but we had to keep the circuit relatively simple. Still, if you do live in an area where mischievous children or mental defectives abound, their chance interaction is still likely to be more tolerable than if they were to persist in ringing an old-fashioned doorbell.

If you were one of the many thousands who build the Chroma-chime, you can use all the bits, minus the original PCB and switches, to build this new version. Less than six dollars worth of CMOS ICs and few other components are all you will need to build the updated circuit.

We have taken the original Chroma-chime circuit and added four CMOS ICs to perform the automatic sequencing of tune playing. Dick Smith Electronics have obtained supplies of the key component in the original Chroma-chime — that is, the microprocessor — so we have been able to produce a completely new PCB.

Incidentally, other parts suppliers and individual readers can, if they so wish, obtain the microprocessor chip direct from Chromatronics or, as they are now known, CEL Electronics (Harlow) Ltd, Coachworks House, Riverway, Harlow, Essex, CM2ODP, UK.

Now let us talk about the circuit. Ignore the CMOS ICs for the moment, and just consider the microprocessor and associated semiconductors on the left-hand side of the circuit. The microprocessor used is a dedicated version of the Texas Instruments TMS1000. This is a four-bit microprocessor with its own internal mask programmed ROM (read-only memory) with 8192 bits of storage and a 256 bit RAM (random-access memory).

The chip also has four input lines and two sets of outputs making a total of 19 lines. It has been dedicated (programmed) to provide a complete musical door-chime with the addition of a few semiconductors and other components. The entire repertoire of 24 tunes plus the operating procedure are stored in its internal ROM.

The dedicated version of the TMS1000 is labelled as MP0027 and/or CS10701.

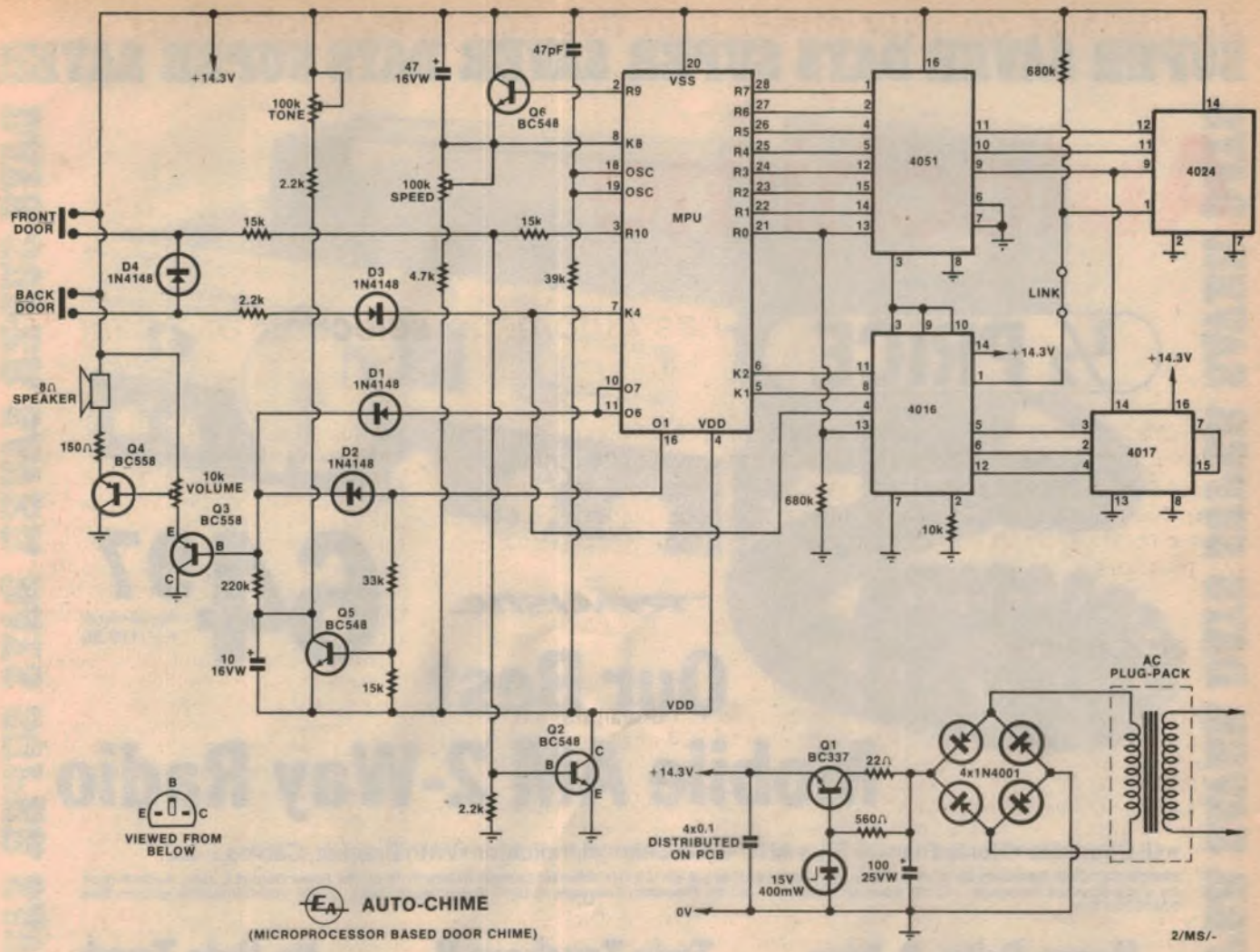
Lest you be a little wary of the fact that this circuit employs a microprocessor, let us reassure you. There is no need to understand the inner workings of this chip. It can just be regarded as a source of logic pulses and audio frequency square waves — the proverbial "black box", if you like.

The best way to describe the operation of the circuit is to detail the sequence of operations which occur after the front door pushbutton is pressed. Before this occurs, the circuit is quiescent and consumes very little power.

The Repertoire

1 *Oh Come All Ye Faithful*
2 *Oranges And Lemons*
3 *Westminster Chimes*
4 *Sailor's Hornpipe*
5 *Greensleeves*
6 *God Save The Queen*
7 *Rule Britannia*
8 *Land Of Hope And Glory*
9 *Soldier's Chorus*
10 *Twinkle, Twinkle Little Star*
11 *Great Gate of Kiev*
12 *Red Flag/Maryland/ Tannenbaum*
13 *Cook House Door*
14 *Stars And Stripes Forever*
15 *Beethoven's Ode To Joy*
16 *William Tell Overture*
17 *Mozart*
18 *Wedding March (Mendelssohn)*
19 *Colonel Bogie March*
20 *The Lorelei*
21 *Beethoven's "Fate Kocking"*
22 *The Marseillaise*
23 *Deutschland Uber Alles*
24 *Toccata in D Minor (Bach)*

Note: Tunes 3, 7 and 14 play longer if the button is kept pressed. The back door button plays Tune 21.



4000-series CMOS IC's are used to give automatic tune selection from the 24-piece repertoire of the MPU.

In the quiescent state, Q2 has no forward bias on the base and so is not conducting. Pressing the front door button connects a 15k resistor to the positive supply so that Q2 is turned on. Q2 saturates, pulling the Vdd rail down to 0V. This powers up the microprocessor chip and also automatically resets all its internal registers and logic. Its internal oscillator also starts up and after a short delay, the output at pin 3 goes high and provides forward bias to Q2 via another 15k resistor. This then maintains Q2 in saturation even if the pushbutton is released.

With this initialisation process complete, the microprocessor (MPU) then turns on each of the outputs R0 to R7 (pins 21 to 28) in quick succession. Each time an output is turned on (pulled high), the three inputs K1, K2 and K4 (pins 5, 6, 7) are tested for a direct connection between the appropriate output and one of the inputs. When the direct connection is found, the circuit plays the tune which is associated with that combination.

In the Chroma-chime, this direct connection was provided by a setting of the two selector switches — one with three positions and the other with eight positions. In our Autochime, this switching between the above mentioned inputs and outputs is provided by CMOS logic. But more on that later.

The combination of eight outputs and three inputs means that there are 24 possible direct connections and so there are 24 tunes.

Once the MPU has detected a direct connection between an input and output, it goes into the playing routine. This involves feeding the notes, in the form of bursts of square waves, to the output at pin 10. The audio frequency square waves, ranging between 200 to 500Hz, are amplified by transistors Q3 and Q4 and then fed to a small loudspeaker.

Normally, transistors Q3 and Q4 are non-conducting because Q3 receives no forward bias from the MPU chip. This means that the base of Q3 is held high. Disregarding Q5 and its associated 10uF capacitor, all that Q3 and Q4 do is buffer the output of the microprocessor to the loudspeaker. In other words, they transform the high output impedance of the MPU to the low output impedance necessary for the loudspeaker.

Q3 and Q4 conduct when the output on pin 10 goes low. The volume control for the loudspeaker is provided by the 10k trimpot in the emitter circuit of Q3.

Diode D1 ensures that the base of Q3 is pulled high whenever the output at pin 10 is high and thus holds Q3 and Q5 off.

Q5 provides a system of "sustain" whereby each note of the tune being played can be varied from a brief "chip" to a sustained note. Q5 does this by controlling the voltage level across the 10uF capacitor and in so doing, controls the degree of conduction in Q3 and thus the volume level fed to the speaker.

Just before the commencement of each note, the output at pin 16 goes high momentarily which causes Q5 to turn on and completely discharge the 10uF capacitor. This means that as the note begins, it will be produced at the maximum volume level (set by the 10k trimpot). As the note continues, the 10uF capacitor charges toward the positive rail via a 100k trimpot and 2.2k resistor.

If this trimpot, which is wired as a variable resistor, is set to a low value, the 10uF capacitor will charge up very

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quickly and cut off Q3. The resulting note will be a brief "chirp". On the other hand, if the trimpot is set to a high value, the 10uF will charge quite slowly, so each note will be prolonged.

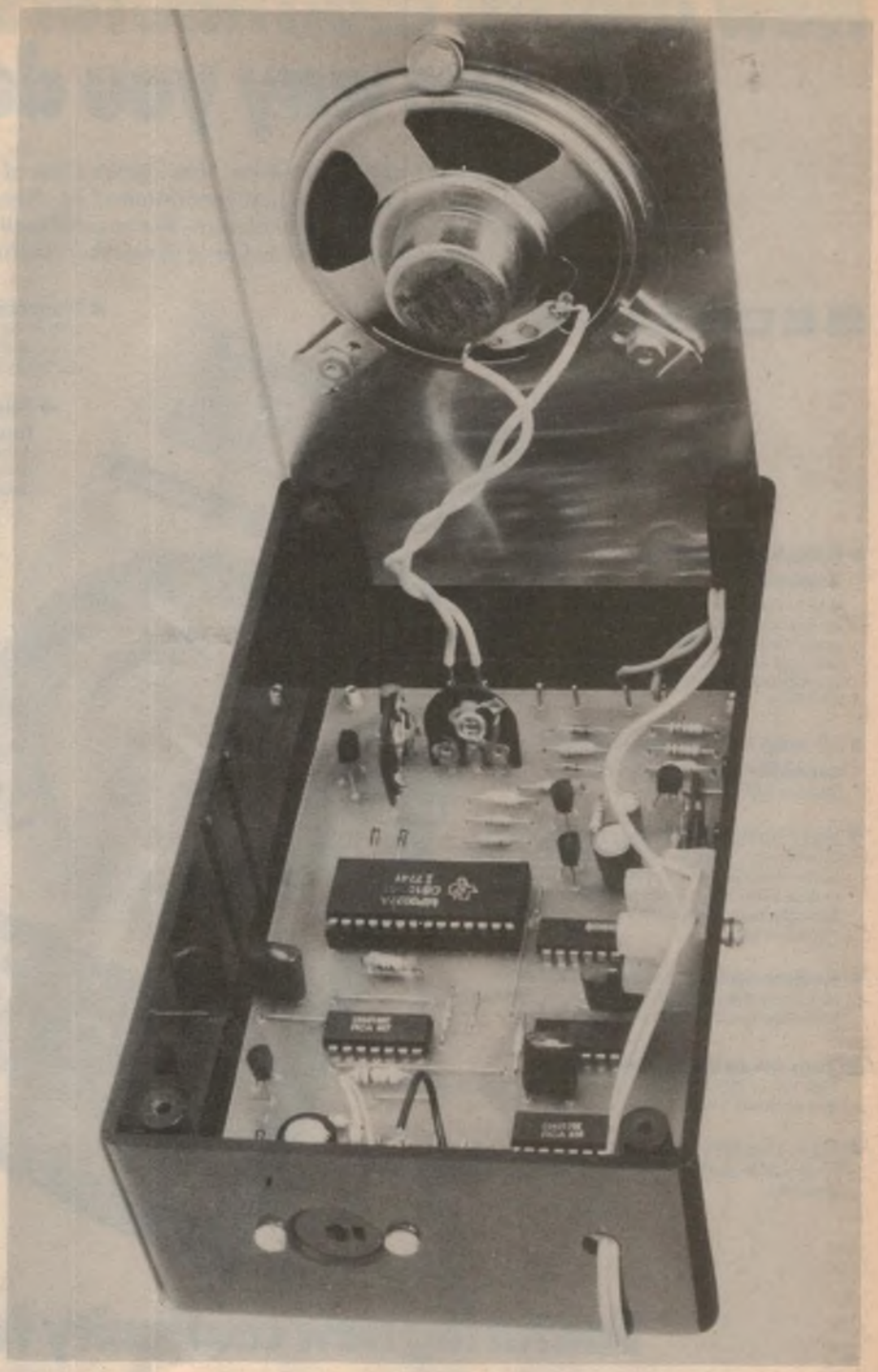
Diode D2 prevents the base of Q3 from being pulled down during the discharge period of the 10uF capacitor. This avoids any objectionable clicks which might be heard between each note.

The microprocessor also has a similar method of tune speed control which involves Q6 and its associated 47uF capacitor. At the beginning of each note, pin 2 turns on Q6 momentarily to completely discharge the 47uF capacitor. This capacitor then proceeds to recharge via its associated 4.7k resistor and 100k trimpot. This means that the voltage at the emitter of Q6 and thus at pin 8, falls.

Once the MPU chip senses that the voltage at pin 8 has fallen below a certain threshold it again turns on Q6 to discharge the 47uF capacitor. This sequence can occur from two to 16 times during each note. So the MPU program uses the time-constant of the 47uF capacitor and associated charging resistance to set the playing time of each note — and in turn, the total time of the tune.

All the foregoing describes the operation of the original Chromachime circuit. Now we need to describe how the four CMOS ICs automatically provide the tune selection.

The CMOS circuitry has to provide 24 separate connection paths between each of three inputs and eight outputs. We have done this by using a 4016 quad bilateral switch to switch the inputs — it is wired as a single-pole 3-position



We used an AC plugback to power the Autochime. You can modify it for manual tune selection if you wish.

PARTS LIST

1 Utility box, 160 x 95 x 50mm
1 PCB, 130 x 87mm, code 79AC9
1 12VAC plugpack, Ferguson PPA 12/500/2 and 2-pin DIN socket and plug

OR

1 small transformer with 12.6V winding. Ferguson 2851, A&R 6474, DSE 2851 or similar plus mains cord and plug, cord clamp, and solder lug
1 small loudspeaker with impedance 8 ohms or higher
$ 28-pin DIL socket
8 PC pins
1 strip of insulated terminal block

SEMICONDUCTORS
1 CS107-01, MP0027 dedicated microprocessor (see text)
1 4016 Quad bilateral switch
1 4017 decade counter/divider
1 4024 7-stage ripple counter
1 4051 8-channel multiplexer
1 BC337 1-amp NPN transistor
3 BC548 NPN transistors
2 BC558 PNP transistors
4 1N4148 small-signal silicon diodes
4 1N4001 silicon rectifier diodes
$ 15V 400mW zener diode

CAPACITORS
1 x 100uF/25VW PC electrolytic
1 x 47uF/16VW PC electrolytic
1 x 10uF/16VW PC electrolytic
4 x 0.1uF metallised polyester (greencap)
1 x 47pF polystyrene

RESISTORS
(¼W, 5% tolerance)
2 x 680k, 1 x 220k, 1 x 39k, 1 x 33k, 3 x 15k, 1 x 10k, 1 x 4.7k, 3 x 2.2k, 1 x 560 ohms, 1 x 150 ohms, 1 x 22 ohms, 2 x 100k trimpots, 1 x 10k trimpot.

MISCELLANEOUS
Screws, nuts, lockwashers, hookup wire, clamps for loudspeaker or epoxy adhesive, solder

NOTE: Resistor watage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may be used provided they are physically compatible.

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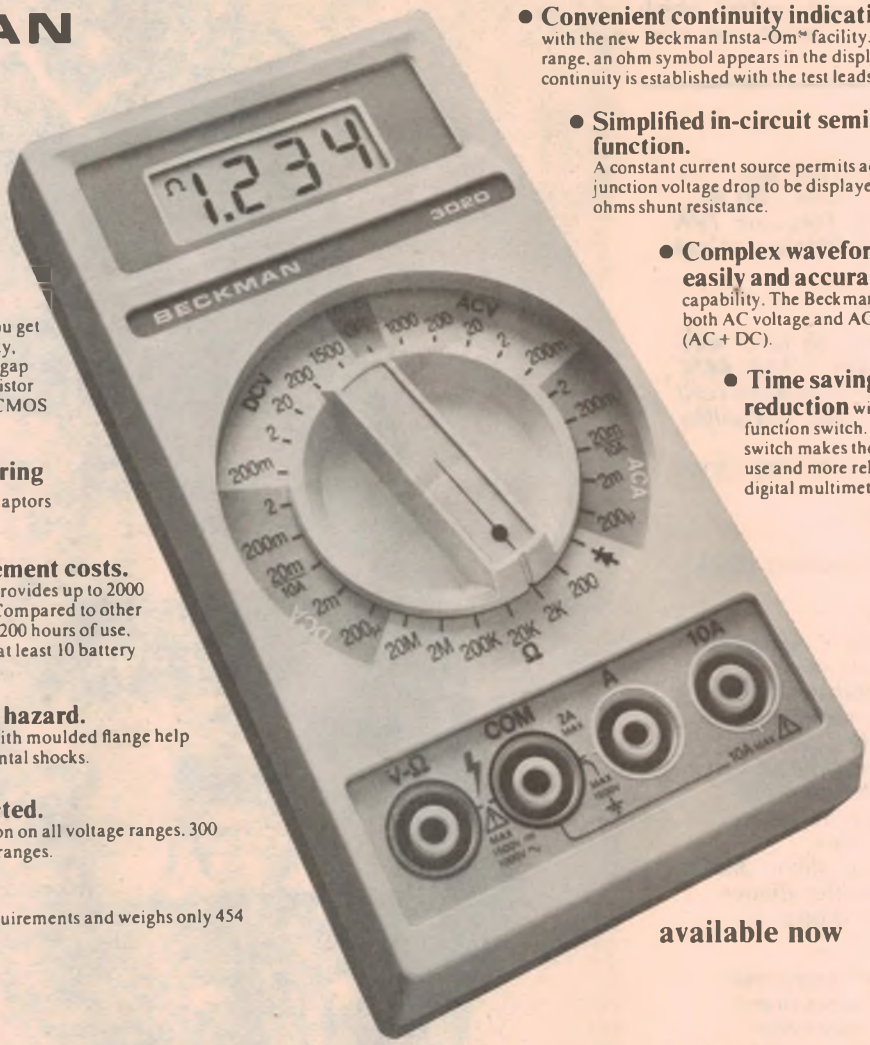

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switch. For the eight outputs we use a 4051 8-channel multiplexer, which is wired as a single-pole 8-position switch.

Both of these switching chips are each controlled by a counter — the 4016 is controlled by a 4017 decade counter while the 4051 is controlled by a 4024 7-stage ripple counter.

Consider the 4024 first. We use it to count the pulse which occurs at the R0 output (pin 21) of the MPU before each tune selection occurs. A spare section of the 4016 chip is used to invert the signal from pin 21 of the MPU to make it suitable for clocking the 4024, which has negative-edge triggering. So the pulse occurring at the R0 output of the MPU advances the 4024 counter by one step, each time the front door pushbutton is pressed.

While the 4024 actually is a seven stage counter we only use the output of the first three stages to control the BCD inputs (pins 9, 10 and 11) of the 4051 to give one-of-eight channel selection. And we use the counter output at pin 9 of the 4024 to clock the following 4017 counter.

The 4017 is a 5-stage Johnson counter with 10 decoded outputs. Here it is wired to reset when it reaches the fourth state (pin 7 connected to reset pin 15) so it only counts to three — actually 0, 1, 2. These three outputs are used to control three switches in the 4016 package.

To sum up the operation of the CMOS circuitry: It consists of two counters in cascade, one dividing by eight and the other dividing by three. The BCD output of the divide-by-eight counter controls of one-of-eight channel selector while the decoded decimal output of the divide-by-three counter controls a one-of-three channel selector, the 4016.

Clocking the counters through their full sequence gives the total repertoire of 24 tunes possessed by the microprocessor.

The combination of the PMOS circuitry of the MPU chip and that of the CMOS chips presents a problem of partial incompatibility. Ideally, the MPU chip should be run at 14 volts or more (typically 18 volts in the Chroma-chime) although it will run reliably down to about 12 volts. By contrast, the maximum operating voltage for the CMOS is 15 volts.

This means that the composite circuitry has a narrow range for the supply voltage, so that it is not very practical to run it from batteries. Accordingly we designed the circuit around a 12.6 volt transformer. This can take the form of an AC plugpack, which simplifies the wiring, or a small mains transformer built into the case.

Bridge rectification of the 12.6V output of the transformer yields about 18 to 20 volts DC which is then fed to a series regulator, Q1. A 15V zener diode provides the voltage reference which means that the output of Q1 is typically 14.3V DC. The 22 ohm resistor in series with Q1 protects it against accidental short circuits.

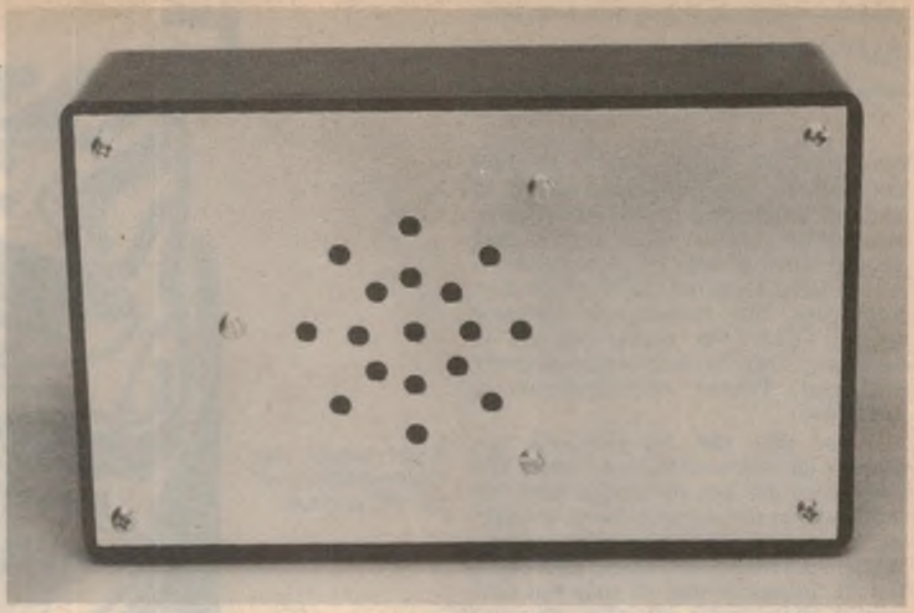
Power is always applied to the CMOS circuit because it has a stored "count" which would otherwise be lost if the power was removed.

One part of the circuit remains to be discussed and that is associated with D3 and D4. These diodes provide for an optional back door pushbutton which only selects one tune. D4 provides the forward bias to Q2 for the initial power-up procedure for the MPU, while D3 forces the K4 input (pin 7) high so that the tune associated with K4 and R0 (pin 21) is always selected when the back door pushbutton is pressed.

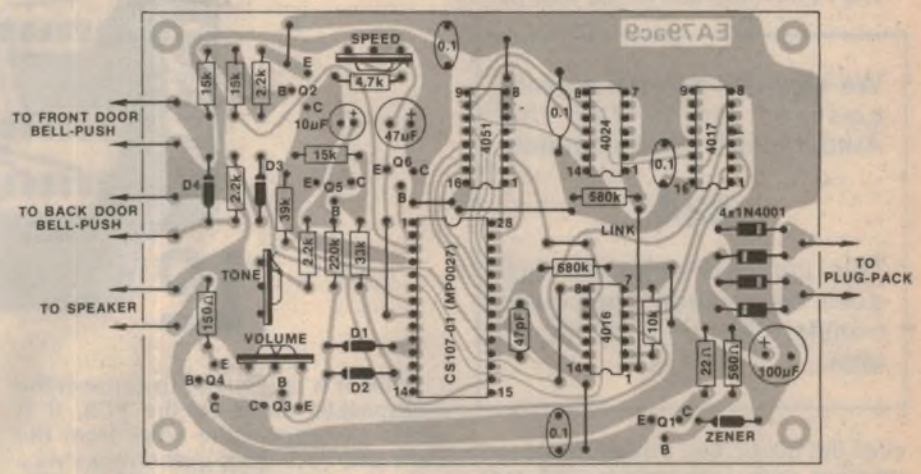
Our printed circuit board is smaller than that for the original Chroma-chime, and in fact, can be just fitted into the Chroma-chime case, if you wish to do a conversion. Dimensions of the PCB are 130 x 86mm and it is coded 79ac9.

We housed the PCB plus the loudspeaker and a length of insulated terminal strip in a plastic utility box measuring 160 x 95 x 50mm. The miniature loudspeaker is mounted on the lid, which is drilled with a suitable pattern of holes to let the sound escape. The PCB is mounted in the case, which may be mounted in a suitable position on the wall in your home. This should be close enough to a mains power point for the plubpack leads to reach.

We powered our prototype with a Ferguson 12V/500mA AC plugpack. As an alternative, it is possible to mount a small transformer such as the Ferguson 2851, DSE 2851 or A&A 6474 at one end of the case (on the end panel). If this approach is taken, fit a three-core mains cord and plug. The earth wire



We suggest you cover the Autochime case with wallpaper or paint it to match the wall so that it merges with the decor.



Mount all the passive components and semiconductors before the IC's. Use a socket for the MPU chip.

(green/yellow stripe) should be terminated to a solder lug which is secured under one of the transformer mounting screws. The active and neutral wires should be terminated to an insulated terminal block which also terminates the transformer primary connections. No mains switch is necessary since the unit is permanently powered. Power consumption is negligible.

If you take the AC plugpack approach, all mains wiring is avoided. We connected the low voltage ac from the plugpack to the Autochime prototype via a two pin DIN plug and socket. While it is a neater and easier approach, the AC plugpack may or may not cost more than one of the above-mentioned transformers. The choice is up to you.

The PCB is mounted on the base panel of the plastic box using four screws, together with lockwashers and nuts. The PCB needs to be spaced off the base panel by the thickness of one nut.

We estimate that the current cost of parts for the Autochime is approximately

$34

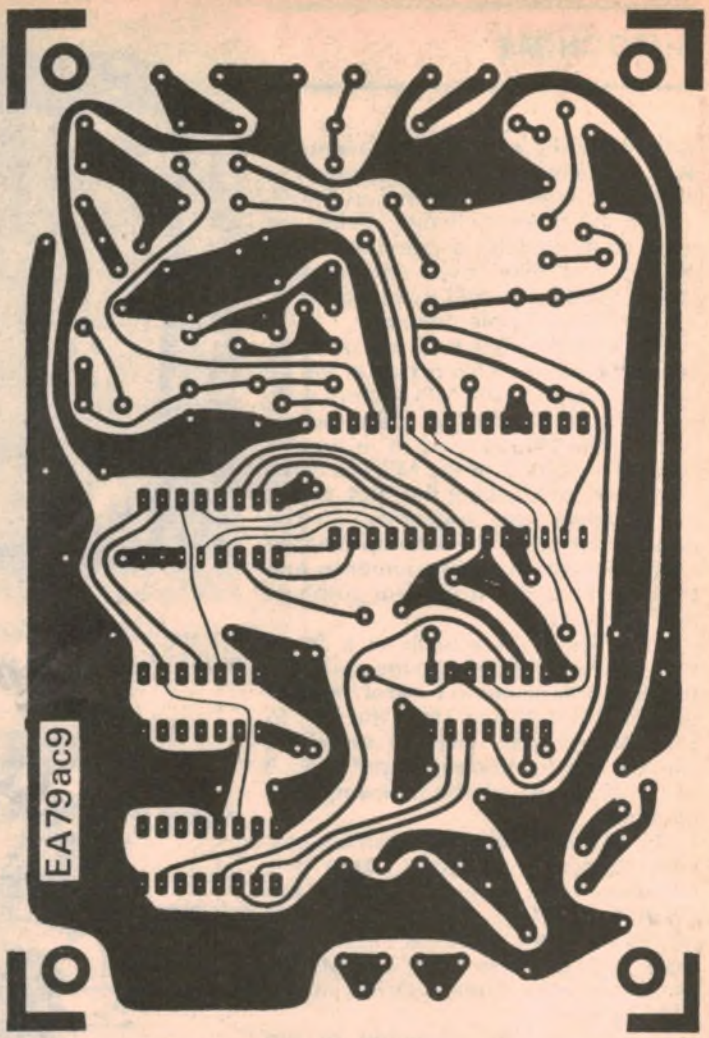
This includes sales tax but does not include the power transformer and pushbuttons.

Some constructors may wish to provide screwdriver access for the three trimpots. We do not think this should be necessary, as once the trimpots are initially adjusted there should be no further need for tweaking.

We used a miniature loudspeaker with a diameter of 65mm and a nominal impedance of eight ohms. Although this impedance is all that is likely to be available as far as small loudspeakers are concerned, the impedance should ideally be as high as possible so that maximum power is dissipated in the loudspeaker rather than in the series limiting resistor.

If you can obtain a slightly larger loudspeaker which will still fit in the plastic case by all means use it. It will probably sound louder.

Attach the loudspeaker to the metal panel of the case by three screws and small clamp strips or washers and nuts. Alternatively, you may wish to fix the loudspeaker in place using an epoxy adhesive.



Right: actual size reproduction of the PC pattern.

While it is satisfactory to connect the loudspeaker direct to the PCB, it is better to connect the wires from the front and back door pushbuttons via a strip of insulated terminal block. The photograph of our prototype shows only the front door pushbutton connected, via a two-way insulated terminal block.

When assembly is complete, check all connections against the circuit and PCB diagrams. Set the Volume and Tone trimpots to midpoint and the Speed trimpot so that the wiper is over towards Q2. Now apply power. There should be no sound from the loudspeaker. Check that the output voltage from the regulator Q1 is within +5% of 14.3V dc.

Now short the wires to the front door pushbutton and check that the Autochime plays a tune. If the wires are shorted continuously, the unit should run through the complete repertoire of 24 tunes. Since the 4024 and 4017 counters are not reset to zero when power is applied, the Autochime can start at any tune within the repertoire and then work its way through.

With these checks complete, make the desired adjustments to the trimpots and the unit is ready for final installation.

Note that there is a possibility of MPU malfunction if the Volume trimpot is set for maximum loudness and the mains voltage or transformer output voltage happens to be low. If this combination occurs, the regulator voltage may drop below the point for reliable operation of the MPU.

When this happens the unit may just emit a few garbled notes, or may not operate at all. In this case, reduce the Volume setting and interrupt and restore the power to the unit. Normal operation should be restored.

There is a modification whereby individual selection of tunes is possible. For example, you may wish to play a certain tune on a particular day. This facility can be provided by cutting the link marked "link" (what else?) on the PCB component diagram and running two wires to a SPST switch. With the switch closed, the Autochime will cycle normally but with it open, the counters will stop.

To select a particular tune, close the switch and short the wires to the front door pushbutton. Let the Autochime run through the repertoire until the tune is reached, and then open the switch. Now pushing the frontdoor pushbutton will play only the selected tune.

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A control unit for windscreen wipers

Add this useful accessory to your car

Based on a low cost 555 timer IC, this intermittent windscreen wiper control overcomes the limitations of conventional wiper systems in a simple and economical way. It features four switchable delay times, is easy to build, and can be fitted to almost all types of cars.

by GREG SWAIN

Anyone who drives a car has experienced situations when it is raining hard enough to need to use the windscreen wipers, but not hard enough to need them on continuously. As a result, one has to constantly reach for the wiper switch, turning the wipers on and off as the need to clear the windscreen arises. This can prove very tiring, and is a distraction from the real job at hand — driving the motor vehicle.

Two-speed wipers do help to alleviate this problem, but cannot cope with all weather situations, particularly when it is only just raining and a wipe every few seconds or so is all that is needed. If you leave the wipers on in these conditions, they will only chatter annoyingly across the dry windscreen, wearing out the rubber wiper inserts.

What's needed, then, is some sort of control system that will stop the wipers at the end of each sweep, and insert an appropriate time delay before the commencement of the next sweep. This time delay should be variable at will, to suit the conditions. The Variable Delay Wiper control described in this article is designed to do just that!

One of the main features of the controller is that it is simple to build and operate, and yet should fit most makes of cars without modifications.

In its basic form, our new controller offers four switch-selectable delay times, is suitable for single and dual-speed wipers and for wound field and permanent magnet motors, including those with dynamic braking.

The second major feature of the design is its inherent safety. When the controller is not being used, the wipers are controlled by the main wiper switch exactly as standard. To use the Variable Delay, the main wiper switch is turned off and the Variable Delay Wiper is turned on. Turning the main wiper switch on overrides the operation of the Variable Delay Wiper, allowing the driver to easily switch between intermittent and normal modes of operation.

The completed prototype, built into a plastic case. It provides four switchable delay times — 3, 6, 10 and 15 seconds — and is simple to use.

The circuit is based on a similar circuit described some years ago in the May 1975 issue. However, this original circuit has been considerably modified in order to simplify construction and to reduce the cost.

Heart of the circuit is the ever-popular 555 timer IC, connected to operate as an astable multivibrator. The 10k limiting resistor sets the minimum delay time between wipes, whilst the 18k, 27k and 33k resistors set the three remaining delay times according to the position of rotary switch S2. The values chosen should give time delays of approximately 3, 6, 10 and 15 seconds.

The selected resistors, in conjunction with the 4.7k resistor between pins 6 and 7 of the IC, set the charge time of the 220uF electrolytic capacitor. This, in turn determines the off time of the relay, and corresponds to the wait between wipes (pin 3 high). You can work out your own delay times, if you so wish, simply by applying the following equation:

$$t = 0.685 (Ra + 2Rb)C$$

where t is the delay time between the start of each wipe in seconds, Ra is the total resistance between pin 7 and the positive supply rail to pin 8, Rb is the resistance between pins 6 and 7 (4.7k in this case), and C is the value of the capacitor (in Farads) connected to pin 6.

The delay times we have chosen should suit most applications, though. But note that the actual delay times can vary slightly from the calculated times due to component tolerances.

Another point to note here is that the

PARTS LIST

1 555 timer IC
1 12V SPDT relay with 5A contacts, E3201 or similar
1 EM401 diode
1 printed circuit board, EA 79W9, 49 x 79mm
1 plastic case with aluminium lid, 130 x 68 x 41mm
1 front panel to suit
1 4-position single pole rotary switch
1 SPDT miniature toggle switch
1 5-way terminal block
1 knob to suit front panel

CAPACITORS
1 220uF 16VW PCB mounting electrolytic
1 100uF 16VW PCB mounting electrolytic
1 0.1uF polyester
1 .01uF polyester

RESISTORS (¼ or ½ watt)
1 x 100 ohms, 1 x 4.7k, 1 x 10k, 1 x 18k, 1 x 27k, 1 x 33k

MISCELLANEOUS
Solder, hookup wire, machine screws and nuts, scrap aluminium for mounting bracket, automotive connectors, etc.

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

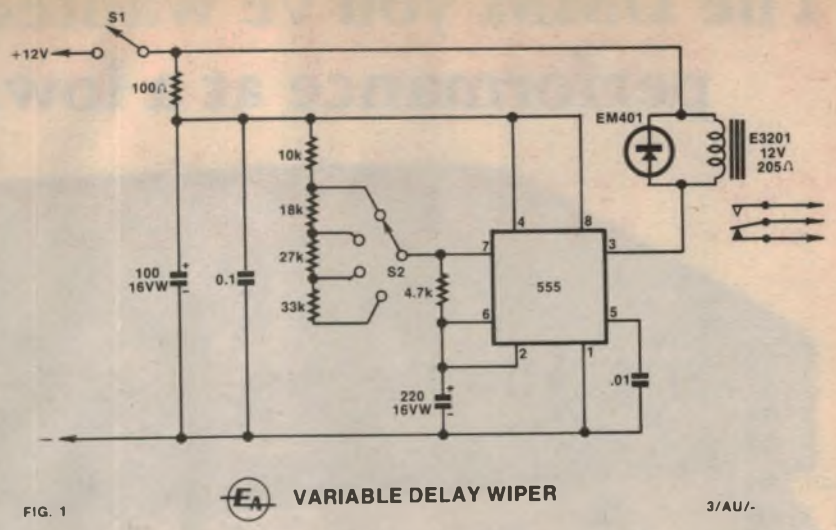
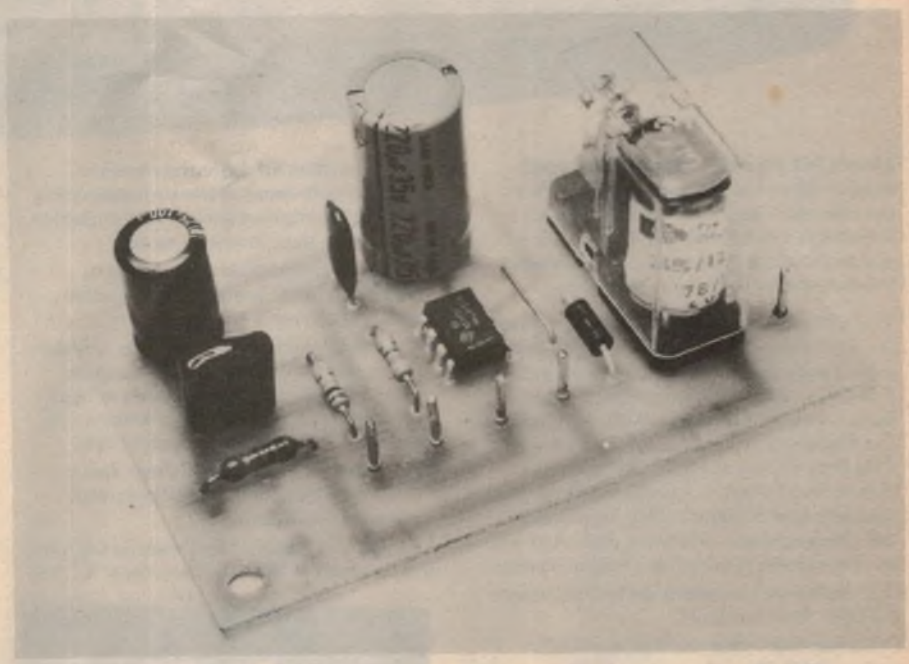


Fig. 1: the circuit diagram for the Variable Delay Wiper control. The use of a relay output stage makes possible the control of most types of wipers.



Larger than life size photo of the assembled PC board.

first delay time after switch-on is slightly longer than subsequent delay times. This is because the 220uF capacitor has to charge from 0V to 2/3 the supply voltage before the first pulse is delivered. After that, the capacitor only has to charge up from 1/3 the supply voltage.

The discharge time of the 220uF electrolytic capacitor is determined solely by the 4.7k resistor, and has been set at 0.7 seconds. During the discharge time the relay is energised (pin 3 low), and this initiates the wipe by moving the wipers off the park position. The discharge time chosen should be long enough to pulse the majority of wiper motors into operation, and yet be short enough so as not to initiate an immediate second wipe when the wipers return to the park positon. In the unlikely event that the wipers do fail to operate correctly, then increase or decrease the 4.7k resistor as required.

The relay is driven directly from the output terminal of the 555 timer. Note that a protective diode is required to prevent the possibility of latch-up due to the inductive spikes produced when the relay is de-energised.

Using a relay as the output device has several advantages. It means that the unit can be used with all types of wipers; it provides isolation between the electronics of the controller and the wiper circuitry; and it ensures that normal operation of the wipers will be possible in the event of a failure in the controller.

In other words, the unit can be regarded as "fail-safe". This last feature arises because the relay, in the unoperated position, does not alter the original wiper circuitry. If the failure is such that the relay remains energised, it is only necessary to turn off the Variable Delay Wiper to de-energise the relay.

There is of course a possibility that the relay could mechanically jam in the operated position, but the chances of this occuring are extremely remote.

It is necessary to filter the supply voltage to the 555 timer, to prevent it from falsely triggering due to ignition transients and surges due to load changes on the car electrics. This is achieved by the 0.1uF and 100uF capacitors in conjunction with a 100 ohm decoupling resistor.

Before describing the construction of the unit, we will digress and give a short explanation of the various types of electric wipers commonly fitted to cars. Table 1 is a list of the more common types, and their identifying characteristics.

The earliest types of motors employed a wound field, and these were characterised by a good self-braking action. All that is required to control them is a simple on-off switch.

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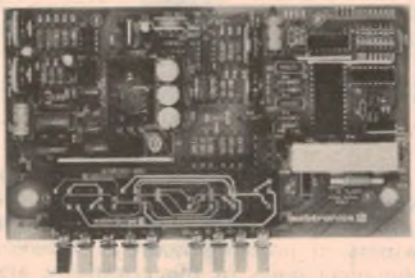

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DC Current: 0.1μA to 10 A in 6 ranges
AC Current: 0.1μA to 10 A in 6 ranges
Resistance: 0.1Ω to 20 MΩ in 6 ranges
Diode Test Current: 0.1μA, 10μA, 1mA
ACV Frequency Response: 40Hz to 40kHz
Input Impedance: 10 MΩ on ACV and DCV
Overload Protection: 1200 VDC or RMS on all voltage ranges except 250 VDC or RMS on 200mV and 2V AC ranges. Fuse protected on ohms and mA ranges
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Self parking is achieved by using a second, mechanically linked switch in parallel, which keeps power applied until the parking position is reached. Fig. 2 is a schematic diagram of such a system.

However, the more recent type of permanent magnet motor does not have the same braking characteristics, and it is necessary to apply dynamic braking by placing a short across the armature. Fig. 3 is a representative schematic circuit for these types of motors.

In the on position, the wiper motor is connected directly to the 12V supply. As the motor rotates, it operates a synchronised change-over switch. In the diagram, this switch is shown in the self-parking position, and it can be seen that there is a short directly across the motor armature.

When the wipers are turned off, the armature is earthed via the "B" contact on the wiper switch, and by the cam-actuated switch, so that the motor continues to operate. However, when the cam-actuated switch operates, it shorts out the armature, bringing the motor, and hence the wipers, to a stop. The cam is arranged so that this occurs at the bottom of the windscreen.

With all types of two-speed wipers, we recommend that the low speed be used for the intermittent mode. This will minimise the current through the relay contacts on switch on, and makes the discharge time (relay energised) far less critical. The relay contacts should have a rating of around 5A.

Construction of the unit should be quite easy. Most of the components are mounted on a small PC board measuring 49 x 79mm, and coded 79W9. The only electronic components not mounted on the PC board are the 18k, 27k and 33k timing resistors. These are, instead, mounted directly on the back of the rotary switch, as shown in the wiring diagram.

Begin by fitting all the low profile components to the PC board. This will include the resistors, diodes, polyester capacitors, and the IC. Don't forget the wire link. The two electrolytic capacitors and the relay can then be added to the board.

We used PC stakes to facilitate external connections to the board, but these can be regarded as optional.

The printed circuit module is installed in a plastic utility case fitted with a light gauge aluminium lid. Its measurements are 130 x 68 x 41mm. Mount the PC board towards the rear of the case, as shown in the photograph, using machine nuts as standoff spacers between the board and the bottom of the case.

External connections to the power supply and wiper circuitry are made via a 5-way terminal block fitted to the back of the case. Fit the terminal block first, then drill five small clearance holes immediately above each terminal to allow wires to pass inside the case. We used short pieces of stout tinned copper wire to make the connections to the terminal block, and terminated the leads from the PC board to these just inside the case.

Fitting the unit into your car will probably be a greater challenge than building it in the first place! A small bracket will have to be made to hold the case to the underside of the dashboard. We have left details of this to the individual constructor, as it will have to be made to suit each individual car and mounting point.

Assuming the car has a negative earth system, connect the negative supply wire to a convenient earth point. It is a good idea to check with an ohmmeter that the point chosen is in fact connected to the main metalwork of the car, particularly in cars using plastic materials for the dashboard.

The positive supply wire must be connected via the ignition switch. If your car has an accessories position, then connect the wire so that the unit will operate in this position. Connections to the vehicle are best made using automotive-type terminals and spade connectors.

Perhaps the most convenient place to

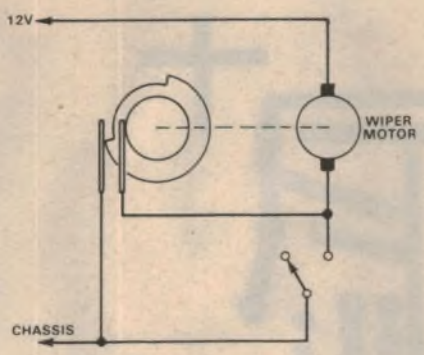


FIG. 2 SELF PARKING WOUND FIELD TYPE MOTOR SHOWN IN PARKED POSITION

Figs 2 & 3: typical wound field and permanent magnet wiper systems.

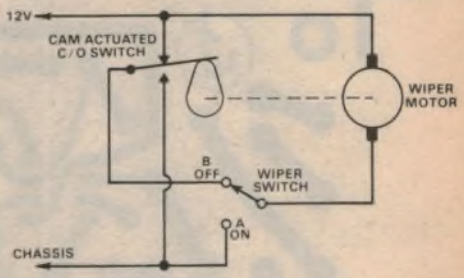
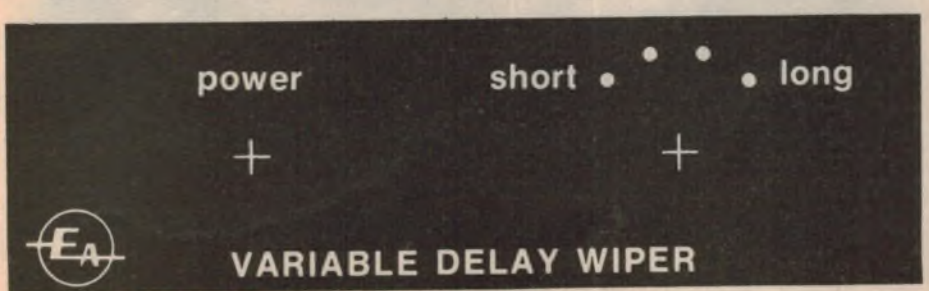


FIG. 3 TYPICAL PERMANENT MAGNET MOTOR SHOWN IN PARKED POSITION

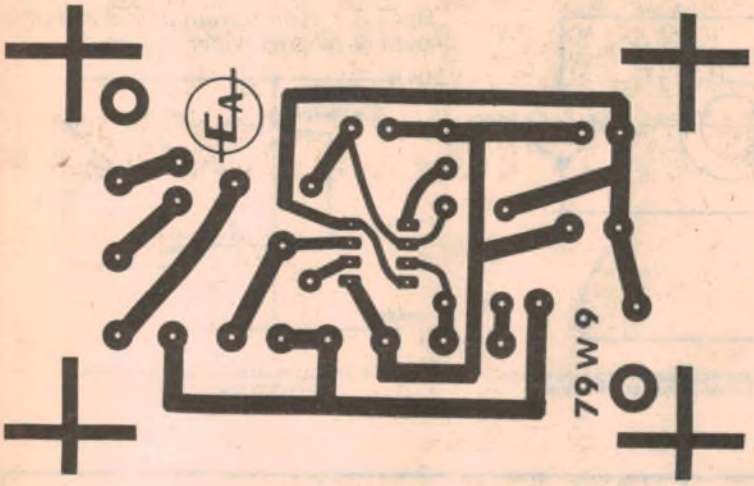
TABLE 1: Windscreen Motor Systems

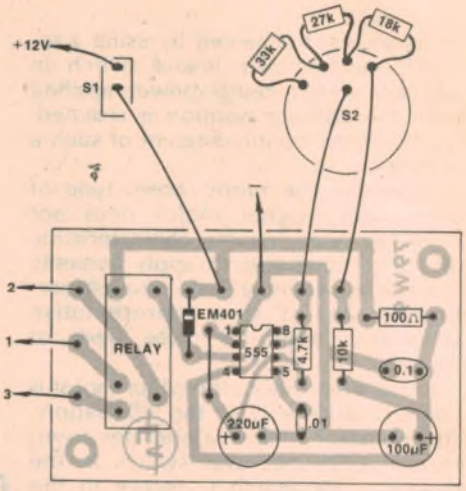
No. of speeds	Type of Motor	No. of wires to switch	System code
1	wound field	2	1
2	wound field	3	2
1	permanent mag.	3	3
2	permanent mag.	4	4
cont. variable	not suitable for use with our timer		



Actual size reproduction of the front panel artwork.

Wiper delay control: has four switchable delay times





Left: actual size reproduction of the PC artwork. At right is the component overlay diagram.

connect the positive supply wire is near the fuses. Take care to connect the wire so that the unit is protected by a fuse. To check this, connect a voltmeter between the proposed take-off point and chassis — when the fuse is removed, the voltage should fall to zero.

If you haven't previously done so, you can now check the operation of the electronics. Turn the ignition on and apply power to the unit. It should be possible to hear the relay operating at set time intervals, depending upon the switch setting.

The next step is to connect the wipers into the circuit. First ascertain what type of wipers are fitted. Table 1 is a list of the more common types. Fig. 4 gives the coding scheme we have used for the relay contacts.

We will consider system No. 1 first. This type is usually fitted to early model English cars, and uses a wound field type motor with self parking facilities. There are two wires connected to the wiper switch, which is a single pole type. Connect the normally open relay contacts (2 and 3) in parallel with the wiper switch.

System No. 2 has a wound field type motor, with two speeds. There are three wires to the wiper switch. Turn the wipers on, and find and mark the wire which stops both fast and slow speeds, and the one which affects only the slow speed. Connect the normally open relay contacts (2 and 3) in parallel with the two marked ones.

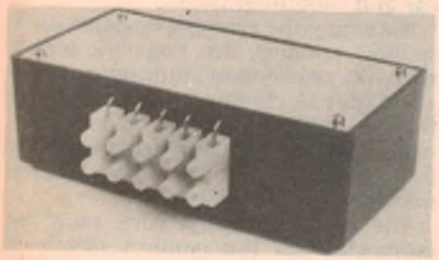
System No. 3 uses a permanent magnet motor fitted with dynamic braking. There are three wires connected to the wiper switch. Identify the ground wire, i.e., the one connected to the car chassis, and mark it "A". Turn on the wipers, and find one of the two remaining wires which does not affect the operation of the wipers. The correct wire is the one which prevents the self parking facility from working. Mark this wire "B".

Cut wire "B", and connect relay con-

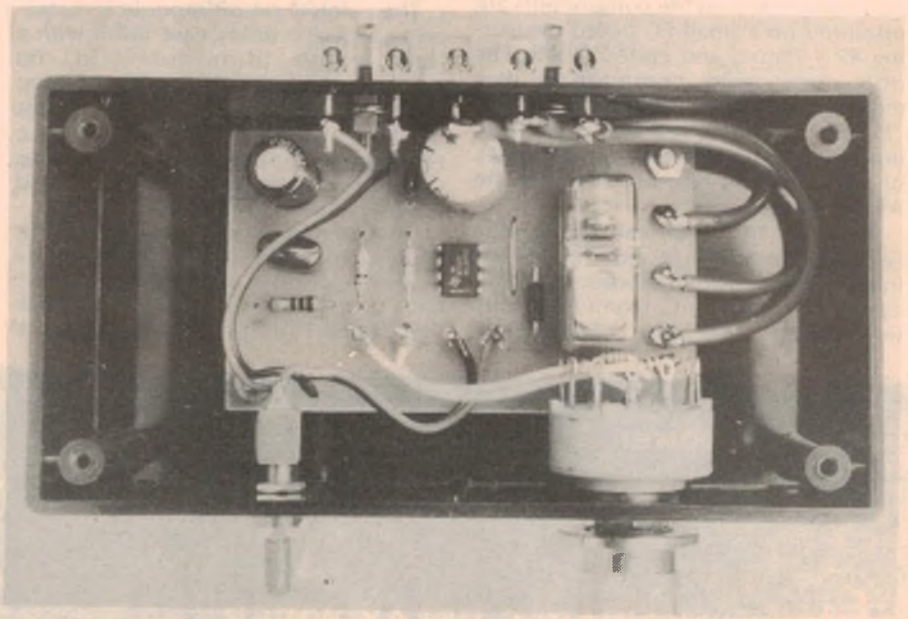
We estimate that the current cost of parts for this project is approximately

$16

This includes sales tax.



This rear view shows how connections are made to the terminal block. Arrange matters so that terminal connections (left to right) are: relay output 1, relay output 2, relay output 3, +12V, and earth.



Inside the completed prototype. Use heavy duty automotive cable to make the wiring connections between the relay outputs and the termir.al block.

tacts 1 and 2 across the break, with contact 2 nearest the switch. Contact 3 is then connected onto the earth wire "A", or to some other convenient earth point. Probably the easiest way of making this earth connection is to run a wire link from relay contact 3 to the negative supply lead at the terminal block.

The last system to be considered is No. 4. This uses a permanent magnet motor with dynamic braking, but has two speeds. The procedure is very similar to that used for No. 3. Identify the earth wire, and mark it "A". Turn on the wipers in the slow speed position, and find one of the three remaining wires which does not stop the wipers but does stop the self parking when disconnected. Mark this wire "B".

Cut wire "B", and connect relay contacts 1 and 2 across the break, with contact 2 nearest to the switch. Contact 3 is then connected onto the earth wire "A" or connected to the negative supply lead at the terminal block, as before.

The prototype was fitted to a mid-70s Holden Torana sedan. This vehicle employs wiper system No. 4, and has the wiper switch mounted on the dashboard. There are four terminals on the back of the switch, marked "1", "2", "3" and "wash". The earth connection is made via the body of the switch.

The wire connected to terminal 3 is wire "B", and must be cut and connected across relay contacts 1 and 2 as indicated above.

The important things to note about Table 1 are these:

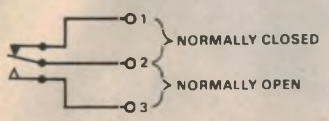


FIG. 4 RELAY CONTACTS SHOWN IN UNENERGISED POSITION

Fig 4: The coding scheme used for the relay contacts (see text for connections).

- if the earth contact is made via the body of the switch, then this counts as an extra wire;
- the wire to the switch from the washer motor (where fitted) is not counted.

Having completed installation, the unit can be given a final checkout. Wet the windscreen, start the engine, and turn the Variable Delay Wiper on. Check that the unit gives the appropriate time delays for the four switch positions, and that the wipers operate normally when the main wiper switch is activated. If these things check out, the job is done.

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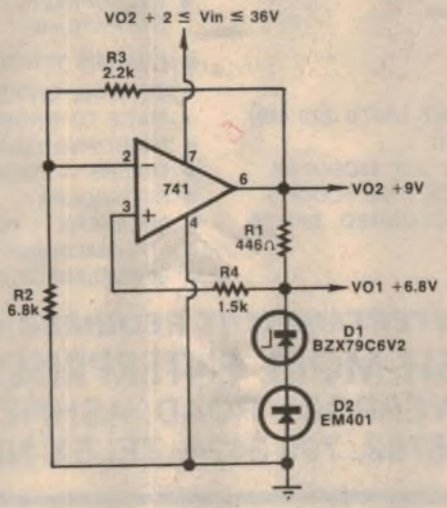
Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used

Simple voltage reference uses op-amp

This circuit uses a 741 op amp and a zener diode to produce a stable reference voltage, which may be used in regulated power supplies or for regulation. An unusual feature of this circuit is that the zener voltage is used by the op amp to define a constant current in the zener diode and thus stabilise its own voltage. To keep the temperature coefficient of the output low, a type EM401 silicon power diode is connected in series with the 6.2V zener diode. At 5mA the BZX79C6V2 has a temperature coefficient of +2.3mV/°C, while the EM401 has a temperature coefficient of -2.2mV/°C approximately. The two tend to cancel each other, giving a low output temperature coefficient.



The output voltage V02, is determined by the values of R2 and R3, while the zener current is set by R1. R4 is included to equalise the impedance at the inputs of the 741 and thus minimise the effect of input offset current drift. The component values shown give V01 = 6.8V, V02 = 9V, Iz = 5mA.

The maximum current drawn from V02 should be 2mA. If a slight variation of the output voltage with temperature can be tolerated, then R4 and D2 can be omitted and R1 and R3 changed to 560 ohms and 3070 ohms, respectively. For different output voltages and zener currents, the component values are given by: V02 = V01 (R2 + R3)/R2 R1 = (V02-V01)/Iz R4 = R2.R3/(R2 + R3) approximately.

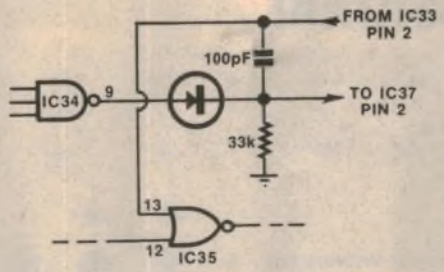
(By Mr R. K. Gibson, 14 Milne Street, Shortland, NSW 2307.)

Automatic line feed facility for EME-1

For readers who have built the EME-1 video terminal, here is an easy method for producing an automatic line feed facility. This is a very desirable feature especially when a stream of data transmitted from the computer or a cassette interface contains no line feeds or carriage returns, as in for example, a typical hex dump from memory.

The modification requires the cutting of copper tracks in three places on the component side of the PCB, adding five jumper wires to the solder side of the board, making use of the unused gates and inverters and adding a diode, a capacitor and a resistor.

Specifically, the steps are as follows: (1) Cut the track leading out from IC35/13 on the component side (just below C15), (2) Cut the track leading out from IC35/2 on the component side, (3) Cut the track leading out from IC54/11 on the component side, (4) Jumper IC57/4 to IC28/5, (5) Jumper IC54/11 to IC28/4, (6) Jumper IC34/2 to IC28/6, (7) Jumper IC33/2 to IC35/13, (8) Jumper IC57/3 to IC37/3 for 64 character mode or, IC37/4 for 32 character mode, (9) Insert a diode (1N914, 1N4148, etc), capacitor 100pF, and 33k resistor as shown.



Basically, a line feed function similar to that produced by the action of the line feed key, or a line feed received from the line, is automatically initiated immediately after the 64th character is entered on the screen. Alternatively, this would occur after the 32nd character, when set to this mode.

(By Mr E. M. Monsour, E. & M. Electronics Pty Ltd, 136 Marrickville Road, Marrickville, NSW 2204.)

Novel method for desoldering IC devices

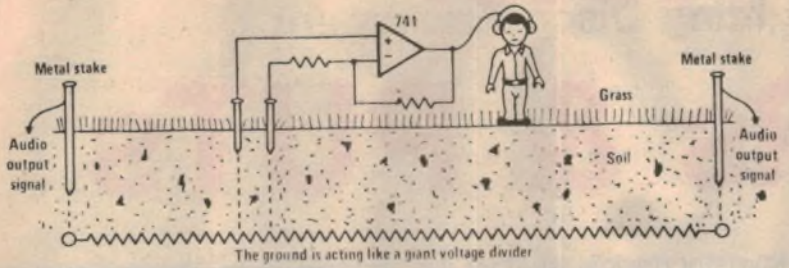
Not long ago, our attention was drawn to a desoldering aid for IC devices using a technique originated by F8CV/F9BL. This consists of a stainless steel hypodermic needle (with point ground down to avoid risk of scratches) forming a thin tube with diameter sufficient to fit over the IC leads.

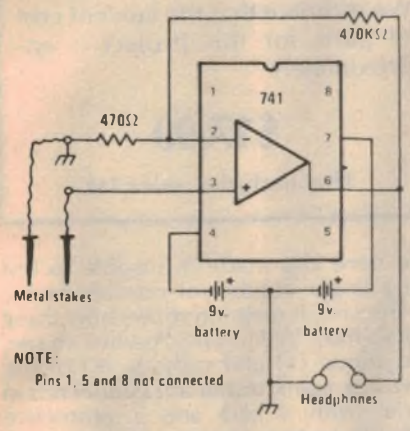
The procedure recommended is to heat and liquify the solder fastening an individual IC pin, using a soldering iron, and then when the solder is molten, the hollow needle is gently introduced while turning it gently between the fingers, until the IC lead is separated from the solder by the wall of the needle. The soldering iron is removed, and since the solder will not "take" to the stainless steel as it cools, the needle can afterwards be withdrawn so that the lead is left free. The process is repeated and all soldered IC leads and the device can then be removed from the PCB.

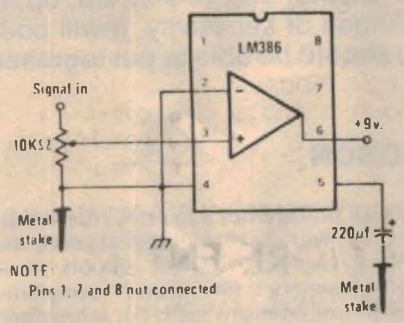
At the time it was not made clear what type and size of needle was used. Brian Castle, G4DYF, has recently tried out this technique and can vouch for its effectiveness. He has also found that in order to find a needle with an internal diameter sufficiently large to fit over a typical IC lead, it needs to be the type normally used in medical practice for drawing up the contents of a phial into a syringe before an injection is made using a finer needle. He reports that suitable needles are known as Leni Sabi, size 21G by 1½in, 40mm 8/10.

(From "Radio Communication".)

Music from your lawn!







Imagine being able to plug a set of headphones into your backyard lawn and being treated to your favourite music. All you need is a high level audio output from your amplifier. Although you may be able to drive your lawn directly from the amplifier output, you would be safer using a buffer amplifier, such as the LM386 circuit shown. The stakes used to connect the amplifier to the lawn can be just about any metal rods you have handy. Copper rod or pipe would be ideal.

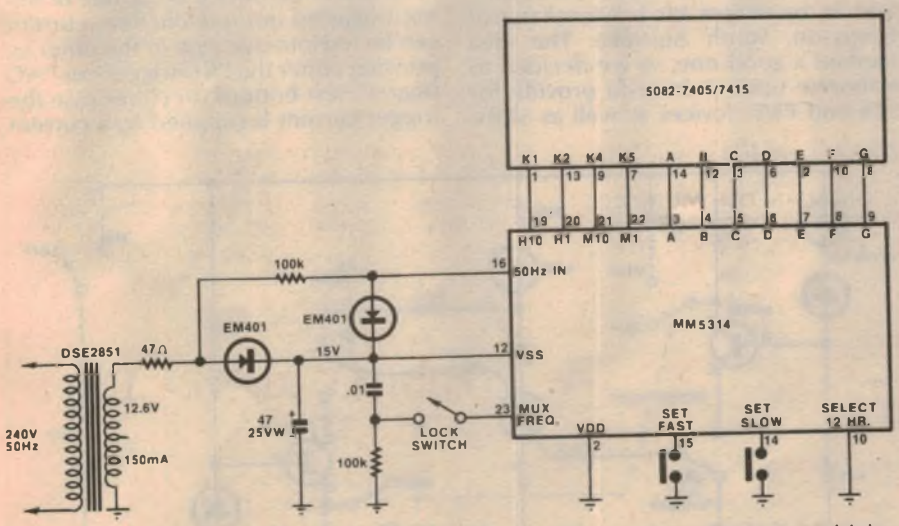
The audio signal impressed in the lawn will be located between the stakes as shown. So, position the stakes at oposite ends of the lawn.

To tune in on the lawn, you will need a set of monaural headphones and a high gain preamplifier such as our 741 circuit. All you have to do then is drive a pair of pickup stakes into the lawn. The volume depends a great deal on the location of the stakes. Generally, the further apart they are the louder the sound. However, since the soil conductivity varies from place to place, moving one stake just a few centimetres can make an appreciable difference.

Overall performance depends on many factors including the gain of the headphone preamp, the distance between the stakes at the input and the output end, ground conductivity, background noise, and the alignment between the two sets of stakes.

(By Jeffery A. Sandler, in "CQ".)

Lock switch for desk mains digital clock



Having built the simple desk mains digital clock from the October 1978 Circuit & Design Ideas, I found it annoying to have to wind the display forward if the clock gained a minute every day or so. The solution was to fit a lock switch on pin 23 of the MM5314. By opening the switch, the time shown could be held for as long as necessary. This facility may also be used to use the clock as a "stopwatch".

(By Mr Brett Shugg, C/- Stratford Post Office, Stratford, Victoria 3862.)

Put it together in an evening:

Simple tester for SCRs & PUTs

Here's a simple tester for any common thyristor device, whether it's an SCR, an SCS or a PUT. It checks whether they're shorted, open or damaged, and also gives a rough idea of sensitivity. It will cost you less than twenty dollars, and you should be able to put together in a couple of hours at most.

by IAN POGSON

It's not easy to test thyristor-type devices with a conventional transistor tester. You can do it, but it usually involves quite a bit of fiddling around. Even then the result can be anything but conclusive.

The same applies with a multimeter. You can use it to test a thyristor in makeshift fashion, but the result will still be rather unsatisfying. You really need a tester that is especially suited for testing thyristor devices — like the little unit described here.

It uses only a handful of parts, all of them easy to get and low in price, and they all fit together in a neat little utility box. Yet with it you can test silicon controlled rectifiers (SCRs), silicon controlled switches (SCSs) and "programmable unijunctions" (PUTs), which are really complementary SCRs.

There's no expensive meter movement, just a low-cost LED indicator. But by flicking a couple of switches and pressing a button or two, you can easily tell if a thyristor is open, shorted, has an open gate or is basically OK — all the basic tests. You can also get a rough idea whether the device is sensitive or not.

Actually the circuit of the tester has been developed from an idea we published in the Circuit and Design Ideas column of the March 1979 issue, sent in by reader Mr L. Murokami of Tennyson, South Australia. The idea seemed a good one, so we decided to elaborate upon it so as to provide for SCS and PUT devices as well as SCRs.

We estimate that the current cost of parts for this project is approximately

$17.00

This includes sales tax.

We have also made it possible to test for a larger number of possible faults.

The circuit diagram shows how these things have been done. As you can see, the anode (A) and cathode (K) of the thyristor being tested are connected in series with a LED and a protective 390ohm resistor across a 9V battery. If the device has a cathode gate (KG), like an SCR or SCS or an anode gate (AG), like an SCS or PUT, these are normally tied to their respective main electrodes by 100ohm resistors. So if the device is normal and not shorted, it should not conduct when the battery switch is turned on.

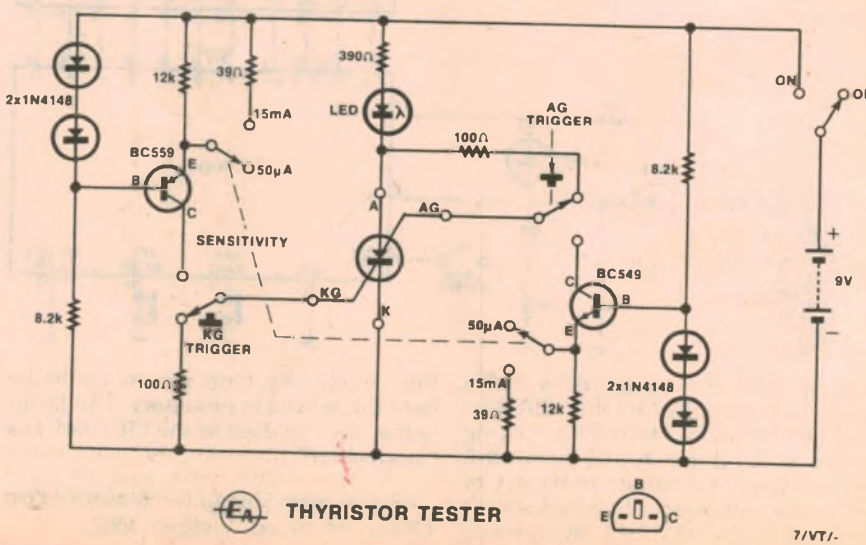
To test if the device is capable of being triggered into conduction, current can be fed into one gate or the other by pressing either the "KG trigger" or "AG trigger" test buttons. In either case the trigger current is supplied by a current

THE PARTS LIST

1 Zippy box 130mm x 68mm x 41mm
1 Front panel overlay 125mm x 62mm
1 SPDT miniature toggle switch
1 DPDT miniature toggle switch
1 Push-button switch momentary single changeover (red button)
1 Push-button switch momentary single changeover (black button)
4 Banana sockets 2-red 2-black
4 Banana plugs 2-red 2-black
4 Crocodile clips 2-red 2-black
1 LED (red) with bezel
1 PCB, 60mm x 56mm code 79TT7
4 1N4148 diodes or similar
1 BC559 transistor or similar
1 BC549 transistor or similar
1 9V battery, 216 size

RESISTORS (½W)
2 39ohms
2 100ohms
1 390ohms
2 8.2k
2 12k

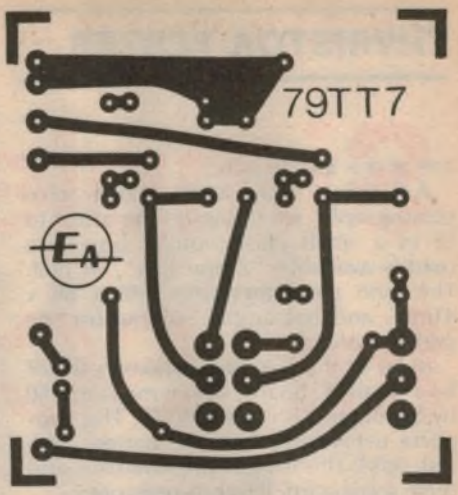
MISCELLANEOUS
Hookup wire, solder.



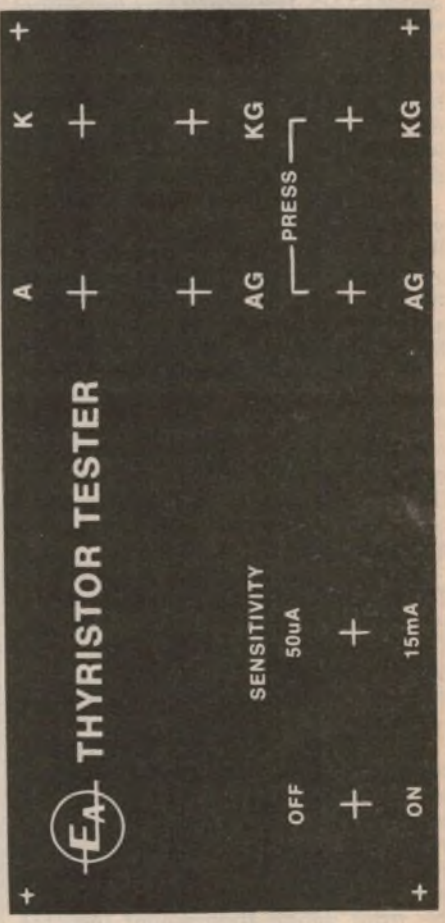
THYRISTOR TESTER

7/VT/-

Here is the finished tester, housed in a small plastic utility box. To keep cost down, a LED is used as the test indicator.



Above is the PCB pattern, while below is the artwork for the front panel of the tester. Both are actual size.



regulator circuit, using a transistor whose base voltage is stabilised by two forward-biased diodes.

Two values of emitter resistance are provided for both current regulators, so that two levels of trigger current may be selected: 50uA for sensitive low-power devices, and 15mA for higher-power devices. A two-pole switch is used for the emitter resistor selection, so that both trigger current sources are set by a single switch.

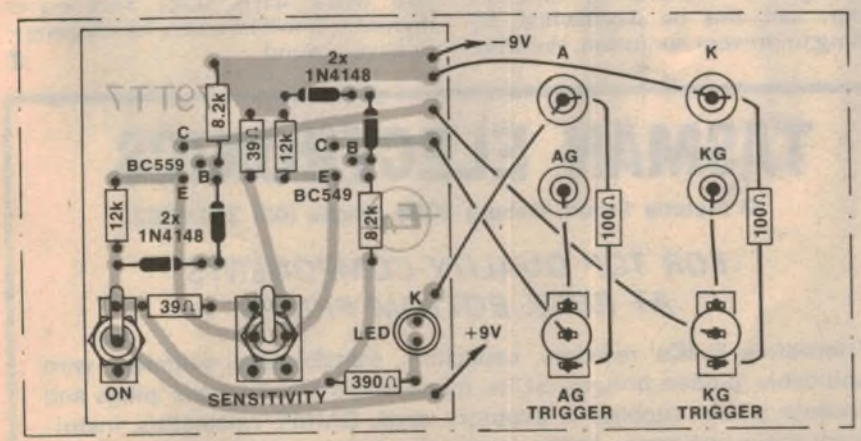
With a normal device, it should be possible to trigger it into conduction (lighting the LED) by pressing the appropriate trigger button after setting the gate current level. And the LED should remain illuminated when the trigger button is released, showing that the thyristor has indeed latched in the conductive state.

If the LED does not glow at all, and you are testing with the low level of gate current, try switching to the higher level and test again. If there is still no result, the thyristor is either entirely open circuited or (less likely) it has an open gate. If the LED glows only when the button is actually depressed, the thyristor is probably damaged and incapable of latching.

If you are testing a low-power device and it only triggers normally with the high value of gate current, it could be simply an insensitive device. Or it may be faulty, its sensitivity degraded by internal damage. The only way to tell will be to look up the manufacturer's data for the device, and see what sort of gate current it should require for reliable operation.

Needless to say, you have to press the appropriate trigger button for the type of thyristor you are testing. For an SCR, this will be the KG trigger button as this type of device has only the cathode gate connection brought out. Similarly for a PUT you would press the AG trigger button, as this type of device only has a connection to the anode gate region.

Since the SCS device is provided with both gate connections, you need to perform two separate tests — one with the KG trigger button, to test the cathode gate, and the other with the AG button to test the anode gate. Note that you cannot leave the power switch on between the tests, however, as the device will tend to latch on from the first test. So you must turn off, then back on again before trying the second test. You may also need to change the trigger current level from one test to the other, as most SCS devices are more sensitive at the cathode gate than they



The full circuit of the tester is shown at left on the facing page, with the wiring diagram above. Note that the wiring diagram is drawn from above, as if the front panel were transparent. The PC board is actually supported by the two toggle switches.

are at the anode gate.

As you can see from the photographs, we designed the tester to fit in a small plastic utility box — a readily-available "Zippy Box", in fact. The one used measures 130 x 68 x 41mm, and has ample volume for the parts involved.

Most of the circuitry is taken care of by a small PC board, which measures 60 by 56mm and is coded 79TT7. This supports everything but the battery, the test jacks, the trigger pressbuttons and their associated 100ohm resistors.

Actually the PCB does not support all of the remaining parts, but is itself supported by three of them: the power switch, the gate current selector switch and the LED. The switch lugs do most of the supporting, but this is quite adequate as the PCB is very small and the remaining parts on it have very low mass. The construction should be evident from the photographs and the wiring diagram — which is drawn as if the front panel were transparent.

To assemble the unit we suggest that you first fit all of the switches to the front panel, along with the test jacks and the LED in its bezel clip. Make sure that the power and sensitivity switches are orientated squarely, so that their lugs will mate with the holes in the PCB — but at this stage don't actually attach the PCB. Also make sure that the LED is correctly orientated with its cathode towards the centre of the panel. The cathode lead is usually the one nearest the "flat" on the LED body, if there is one, or the shorter lead if they are of different length.

At this stage you can wire the two 100ohm resistors between the A and K test jacks and their respective buttons. Then wire the rest of the minor components on the PCB, using the wiring diagram as a guide. Make sure that the transistors are correctly orientated.

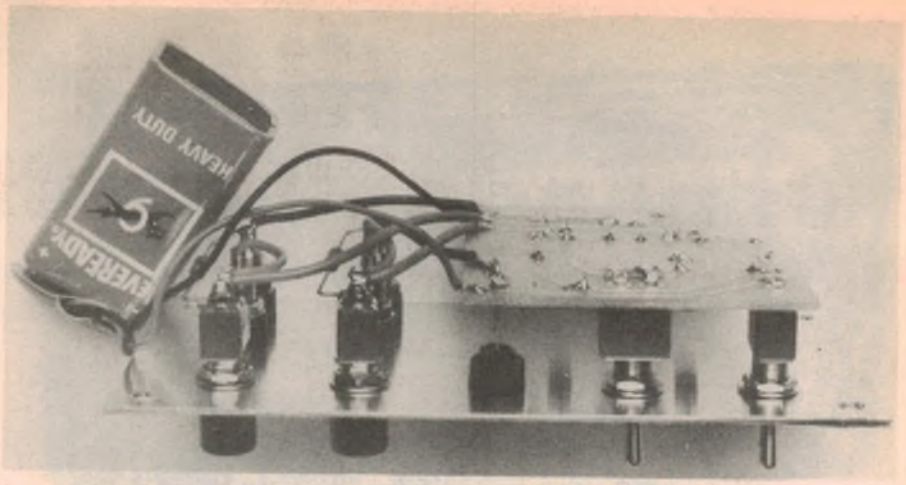
You can then offer the PCB up to the back of the switches, guiding the leads of the LED through their appropriate holes and the PCB onto the switch lugs. When it is in position, solder the switch lugs to secure the PCB in place, making sure that it is square and parallel with the front panel; then solder the LED leads and clip off any excess.

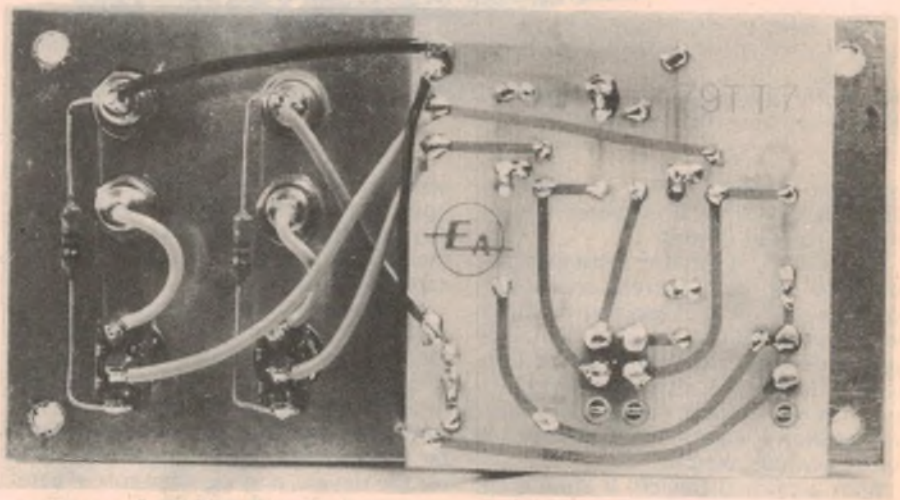
Finally you can add the wiring between the PCB and the test jacks and trigger buttons, and add the battery connector leads. You should then be ready to add the battery and try out the tester with a known good thyristor, before fitting it all into the case. Rather than make up a battery clamp, you can simply wrap the battery in a small piece of foam plastic sheet, so that it will be held gently in place under the PCB.

To make the tester easy to use, we suggest that you make up four short clipleads. These can be about 80mm long, with a banana plug at one end to mate with the test jacks and an insulated crocodile clip at the other. This will make it possible to connect rapidly to any thyristor device, whether it has leads or solder lugs.

Having the clipleads in different colours can also be worthwhile, by helping to prevent confusion. We were only able to get banana jacks, plugs and insulated clips in red and black, but even these two colours help. If you can get four different colours, so much the better.

Well, there it is. A simple little tester that will cost you very little, and can be assembled in a couple of hours. But if you work with SCRs and other thyristors, it will be a very handy gadget to have around.





Here are two views of the inside of the tester, to show how it is assembled. Note that the PCB is supported on the switch lugs, and the two 100-ohm resistors are not on the PCB.

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3106


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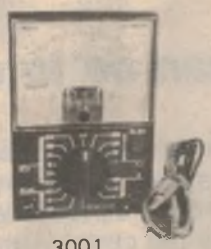
3003


3001


3011


3101

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0.5/10/250mA DC ±3%
10/50/250/1000V AC 2kΩ/V ±3%
3k/30k/300k ±3%F.S. R.C. 26Ω

3002 PRACTICAL COMPACT TESTER
0.5/2.5/10/50/250/1000V DC 20kΩ/V ±3%
50 A/25/250mA ±3%
10/50/250/500/1000V AC 9kΩ/V ±3%
10k/100k/1M ±3%F.S. R.C.100Ω
L.F. Output —20 to +36dB ±4%

3003 PRACTICAL MEDIUM CLASS TESTER
0.25/2.5/10/50/250/1000V DC 30kΩ/V ±3%
50μ A/2.5/25/250mA/10A DC ±3%
10/50/250/1000V AC 13.5kΩ/V ±3%
10A AC ±4%
5k/50k/500k/5M ±3%F.S. R.C.50Ω
L.F. Output —20 to +36dB ±4%

3005 HIGH CLASS TESTER WITH RELAY PROTECTION
0.25/1/2.5/10/50/250/1000V DC 50kΩ/V ±3%
50uA/2.5/5/50/500mA/10A DC ±3%
10/50/250/1000V AC 10kΩ/V ±3%
10A AC ±4%
2k/20k/200k/2M ±3%F.S. R.C.20Ω
L.F. Output —20 to +36dB

3010 HIGH SENSITIVITY (10μ A OPERATING CURRENT) TESTER WITH RELAY PROTECTION
0.1/1/2.5/10/50/250/500/1000V DC 1000kΩ/V ±3%
10 A/100μ A/1/10/100/500mA/10A ±3%
10/50/250/500/1000V AC 10kΩ/V ±3%
10A AC ±4%
2k/200k/2M/20M ±3%F.S. R.C.20Ω
L.F. Output —20 to +36dB

3011 HIGH CLASS WIDE RANGE TESTER FEATURING ELECTRONIC RELAY PROTECTION
2.5/5/10/25/50/100/250/500/1000V DC 40kΩ/V ±2%
25μ /50μ /100μ /250/2.5m/25m/250m/2.5A/10A DC ±2%
2.5/5/10/25/50/100/250/500/1000V AC 10kΩ/V ±3%
25μ /50μ /100μ /250μ /2.5m/25m/250mA/2.5A/10A AC ±3%
3k/30k/300k/3M ±2%F.S. R.C.20Ω
L.F. Output —20 to +36kB

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Ω 0-200/2000/20k/200k/2M/20M
DC A 0-200μ A/2000μ A/20mA/200mA
AC A 0-200μ A/2000μ A/20mA/200mA

3101 CLAMP TESTER WITH CONVENIENT METER LOCK
6/15/60/150/300A AC ±4%
150/300/600V AC 2kΩ/V ±3%
0-1kΩ (Centre 30Ω) ±3%F.S.

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Surge Current 0-1000A
AC V 0-199.9V/1000V (Auto)
Surge Voltage 0-1000V
0-199.9/1999Ω (Auto)

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The Serviceman

What an intermittent can do to a guarantee

The story I am about to relate is as much one of public relations as it is of technical problems and the resultant hide-and-seek. At the same time the technical problems and the diplomatic ones were inextricably interwoven — as is usually the case — inasmuch as the one created the other.

It is not my own story, but one from a colleague who operates in the channel 4/channel 5A area south of Sydney, and whom I have quoted in these notes before. This fact allows me to tell it in what I believe to be an unbiased manner; something which might have been difficult had it been my own. I will tell it more or less in his own words, as he told it to me:

The set involved was a monochrome, hybrid, HMV TV set originally sold by our organisation some five years earlier. It had given very little trouble during that time and such service as it required, mainly valve replacements, I had done myself.

On the last occasion it was much the same story; a couple of valves and the usual once-over for height, width, linearity etc. That done, the set was working virtually as when first installed. Nevertheless, I took the opportunity to suggest to the owner that it was perhaps time he considered a colour set, pointing out that we could give him a reasonable trade-in on the old set since it still had some resale value.

It was a low key approach and, when he indicated that he was quite happy with the monochrome set, I didn't press the point. But apparently I had given him food for thought because, a couple of weeks later, when we were able to offer a batch of colour sets at a special price, he was suddenly quite keen to know what kind of deal we could offer.

So a bargain was struck, he took delivery of a new colour set, and the old monochrome model went into the store room. It stayed there for two or three months until a man and his wife came into the shop looking for a 23in monochrome set which wouldn't put too big a dent in their bank account.

This set seemed to be just the answer. We could confidently recommend it and were happy to get it off our books for a nominal profit of $20. When we demonstrated it, the couple were obviously impressed, the wife particularly so. Also the price seemed to suit them, and the husband forestalled any problem of installation costs, by saying that he was an electrician and could handle this himself.

That left only one point, did the set carry any kind of guarantee? We offer a standard guarantee with a deal of this kind; 90 days full cover, labour and materials, no hassles, no arguments. That clinched it; the deal was made, and the couple went happily on their way.

And that was the end of the matter for a couple of months. Then the lady was on the phone complaining that it was not going at all well and, rather tersely I thought, reminded me that the set was still under guarantee and indicated that she wanted things put right before this period expired. Reasoning that I couldn't really blame her for being cautious, I simply reassured her that the guarantee would be honoured.

I was at the house bright and early next morning and a quick look at the set confirmed that it was delivering a very poor picture. More particularly it showed all the signs of having insufficient signal, and a check with the signal strength meter confirmed this. This was rather surprising as the location was a good one and I had noticed what appeared to be a moderately elaborate aerial as I stepped from the van.

But a closer inspection revealed a different story. The system consisted of two small 4/5A aerials, one above the other, connected together with a random length of 300 ohm ribbon, then connected to the house with more of the same ribbon. The random length of ribbon was bad enough, but I suddenly realised that one aerial was pointing north, towards the stations, while the other was pointing in exactly the opposite direction!

At this stage I still wasn't sure whether this was the extent of the trouble, or whether there was also a fault in the set. I questioned the lady as diplomatically as I could and her version of the problem was that the picture was broken up by flashes and streaks. Considering the state of the aerial system, this didn't surprise me, but I refrained from comment other than to point out that this could do with a general tidy-up.

The husband arrived home at this stage and frankly admitted that he wasn't sure whether he had done everything correctly. He quite readily agreed to give me a hand to "tidy it up".

We pulled the two aerials down intending, among other things, to turn one of them around the right way. This revealed another anomaly — one of the aerials had been incorrectly assembled at the factory, with some of the element positions transposed. As an aerial for 4 and 5A, it was worse than useless!

So we scrubbed that one, settled for a single aerial, and put everything back together in an approved fashion. The result was a solid 1mV signal into the set, which turned on a first class picture; better I suspected, that it ever had at that location.

So that seemed to be that. I waited a reasonable time to see if any other symptoms showed up and, when they didn't, I took my leave. I felt sure that would be the last I would hear of the set.

Not so, alas. A couple of days later the lady was on the phone again, even more irate than before, and complaining that the set was worse than ever. What was more, she reminded me that there was now only about 10 days remaining of the guarantee period, and she wanted the fault fixed before then. I did my best to reassure her, but without much success.

Nor did the visit to the house help much. As usual, the set was disinclined to misbehave while a serviceman was on the job, but it did condescend to turn on a brief flash and some horizontal tearing. It was hard to make much of it, but it did remind me of a similar case where the 6CM5 line output valve had

developed an intermittent fault.

I pulled the back off and checked which valves I had last replaced. It turned out that 6CM5 was not one of them, so I replaced it as a matter of course. After that the symptoms vanished, at least for as long as I could afford to stay and check it. But I emphasised to the owners that, from the brief display I had observed, it was impossible to be sure, and to call me if it occurred again.

That "cure" lasted about a week, then the lady was on the phone again, saying that the trouble was back as before. This visit was largely a repeat of the previous one; some evidence of flashing and tearing (but not enough to work on), a valve replacement (the 6JW8 line oscillator and reactance valve) and, once again, an apparent cure.

But it wasn't, and they were one the phone again a few days later. By now I realised that the problem needed a more drastic approach. I grabbed loan set and drove straight to the house. The atmosphere was pretty tense when I arrived, the lady in particular being obviously very annoyed.

I did my best to defuse the situation. I pointed out that the set had developed a very difficult fault; one which, it was now obvious called for more than in-the-home attention. We would have to take it back to the workshop, run it for long periods, and tackle it as and when the fault appeared. In the meantime, we would loan them a set at no charge for as long as was necessary.

I could sense that I had made some impression, so I played my trump card. if they were not completely happy with this arrangement, or the deal in general, they had only to say so and we would refund the purchase price in full.

That really calmed things down. Apparently convinced that I was genuine, they readily agreed to accept the loan set and let me take the faulty one back to the shop. I may not have come much closer to solving the problem, but at least I had bought some time.

I installed the set in a corner of the work bench and let it run all day and every day, in the hope that it might provide enough symptoms to enable me to come to grips with it. In fact, the fault was very little in evidence but, when spare time allowed, I went over the horizontal section in a search for dry joints or suspicious looking components.

One thing I did find was slight evidence of charring of the width control, a pre-set pot which, when prodded, produced flashing and streaking. With the pot replaced, the incidence of the trouble was quite definitely reduced — but not eliminated. There was no doubt that it had been part of the problem, but equally no doubt that another fault, giving similar symptoms, still existed.

Unfortunately, the job was now a good deal harder. The set would run for days with no sign of the trouble; long enough to convince you that the last thing you changed had fixed it. Then — bingo — it would be up to its tricks again.

I was know suspecting the line output transformer, partly on the basis of previous experience, and partly on the basis that everything else I could think of had been tried or ruled out. Unfortunately, to even prove the point I would have to fit a new transformer and, to make matters worse, I didn't even have one in stock.

Enquiries revealed that delivery of a new transformer might be delayed, but I ordered one anyway. Then I had to decide whether to return the set to the owners while I waited, with several factors encouraging me to do this. For one thing, I doubted whether I could make much progress until I had ruled out the transformer, having reached the stage where I seemed to be going round in circles.

Another point was the lady's attitude. In spite of its faults, she was very keen about the set. She liked the size of the picture, the style of the cabinet, and the general impression it made in the lounge room. By comparison, the 12in portable loan set was a poor substitute.

For these reasons I decided to return the set. I was careful to explain that I did not regard it as fixed, but that the component I needed might take some weeks to obtain. If they preferred to have their own set back during this period, they were welcome, but they should contact me if the fault became intolerable.

Eventually the new transformer arrived, but I heard nothing from the owners for about four weeks; long enough to make me hope that was the end of it. It wasn't, of course, and the lady was on the phone again and quite emphatic that the fault was still there. So I packed the loan set in the van again, and set off.

I was hardly inside the house before she raised the matter of the guarantee again. It was now several weeks outside the guarantee period and she was obviously worried we were going to wriggle out of our obligations on this technicality. For what seemed the umteenth time I explained that this would make no difference; the fault had been reported within the guarantee period and that we would therefore honour our obligation.

At the same time, I could not help mentally speculating on what this warranty was costing us. The grand sum of $20 profit had long since been burnt up, with a lot more besides, but that is the kind of risk we have to take.

Back at the workshop I removed the old line transformer and fitted the new one; no small effort in terms of time. It was about the last straw, therefore, when I switched the set on and quickly realised that it was worse than it had ever been. What was going on? Was the

new transformer faulty, or had I disturbed something in making the change?

More importantly, where did the whole situation now stand? Could I justify persisting with the search, or should I recommend that we cut our losses, refund the owners their purchase price and scrap the set? Cold logic suggested the latter course, but having put so much into the problem I was loath to let it beat me now. Even if we made a refund I had a feeling that, sooner or later, I would want to tackle it again, just to find the answer.

So why not one more try? I went over the set and circuit again in an effort to confirm the source of the disturbances as in the line stage or, if not, establish where it was. As far as I could tell the line stage was still the prime suspect.

So I went over this stage and mentally checked off each minor component. Was it a likely suspect, either because of its position in the circuit, or because it was of a type known to be unreliable? Nothing seemed to qualify until I came across an 820pF polystyrene capacitor in the line oscillator circuit.

Suddenly I recalled another set from several years back which had exhibited similar symptoms. The fault was ultimately traced to the IF stages, and therefore seemed to have little in common with this fault, but the point was that the culprit was one of several low value polystyrene capacitors in that section, which had developed an intermittent fault.

Like a drowning man I clutched at the straw. There were two other polystyrene capacitors in this section, an 82pF and a .0047uF and I promptly reefed all three out and fitted new ones. Then I switched the set on and waited, with more hope than confidence.

It showed no sign of trouble when first switched on, or for the rest of the day but, on past performances, that didn't mean a thing. And any satisfaction I felt was quickly squashed by another complication — the new line transformer was overheating badly. It would obviously have wrecked itself eventually, so I had no option to pull it out and put the old one back in; more time and money down the drain.

(I subsequently returned the transformer and received a credit for it — which was some consolation — but with the credit note came a circuit modification which, apparently, should have come with the transformer. Fairly obviously, the transformer was not a direct replacement, even though it looked the same.)

Then it was back to watching and waiting. After several days it had not missed a beat, and I felt cautiously optimistic, but not convinced. Only after three weeks — yes three weeks — with absolutely no sign of trouble was I prepared to believe that I had found it at long last.

So now it was back to the owners, with the confident prediction that they would have no more trouble — a prediction which time has since confirmed. But the real punch line was still to come. I hadn't realised it, but the lady still had her doubts that we would go to all this trouble and still not present a bill.

It wasn't until I had put the set back in the lounge room, connected the aerial, and checked everything out to my complete satisfaction that I sensed that she anticipated a confrontation. Looking back, I am convinced that, had I presented even a nominal account, she was all set to threaten us with legal action, the Consumer Affairs Bureau, Syd Einfeld, Bob Hawke, and even the Prime Minister!

As it was, it was a complete anticlimax. I gathered up my tools, took a last look at the set, and said, "Well, good afternoon Mrs So-and-so, I hope you enjoy the set from now on; I don't think you'll have any more trouble from that fault."

The look on her face was a picture. "Is that all?" she queried.

"Yes that's all." I replied. Then I added. "If you mean is there any charge, the answer is no. We gave you a guarantee when we sold the set, and we always intended to stick by it."

I have never seen such a dramatic change of attitude. Suddenly she was highly delighted with the whole deal and couldn't praise our organisation enough. She was most emphatic that she would tell all her friends that our firm was the one to deal with when they wanted a new set.

And she has been as good as her word. Several new customers have come to us on her recommendation, and she has told them that she will be coming to us when she wants a colour set "— even if she can buy the same set cheaper at a discount house."

So where did we finally stand on the deal? In terms of cold hard cash we lost substantially. But in terms of goodwill we made up for that several times over. Maybe we could have found an excuse to wriggle out of the guarantee, and perhaps succeeded, but it would have cost us dearly in reputation.

And that is something no business can afford.

So that's my colleague's story. I think it makes the point well enough without any comment from me. Suffice it to say that it demonstrates that real life situations present a great many more problems than the purely technical problems which are seldom mentioned in the text books or the tech college classes, but which are every bit as important out in the cold hard world.

I think it is a story worth remembering.

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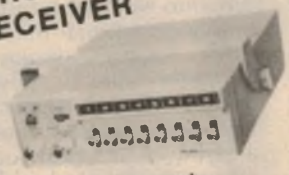

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Ultrasonic ear finds power line faults

A recent article by The Serviceman (April 1979) dealt with the problem of power line interference to radio and TV reception and discussed, among other things, various approaches to tracking down faults responsible for such interference. Since then, we have had the opportunity to investigate one of the latest techniques, which makes a very interesting story.

by PHILIP WATSON

The Serviceman's story was, in fact, a resume of a more detailed discussion published in the Institution of Radio and Electronics Engineers journal "Monitor" for December 1978, written by Mr R. G. Aujard of the Victorian State Electricity Commission. As well as discussing the mechanics of interference generation, Mr Aujard went on to describe a locating device which he had developed and which, hopefully, would be more effective than devices used to date.

The theory behind the new system assumes that, regardless of the hardware involved, the interference source is usually a spark. Find the spark, and you have found the hardware which needs to be attended to.

But finding the spark, using RF detecting devices, has never been spectacularly successful beyond nominating the general area in which it was occurring. The new approach exploits the fact that sparks also create acoustic noise, and that this noise extends well into the ultrasonic region. What is more, at these frequencies it can be detected over quite useful distances.

Mr Aujard started out using a commercial ultrasonic detector but this lacked sufficient sensitivity and directivity for the new role. So he developed a completely new device especially for this application.

It is designed around a simple 40kHz transducer readily available on the local market and, in fact, it was this availability which dictated the frequency. As far as is known there is nothing magical about the figure.

However, it is suitable in that the sparking emits useful energy at 40kHz. Also because the wavelength (0.34in or 8.9mm) is small enough to allow a practical size reflector to be used in conjunction with the transducer, to make a highly directional microphone.

Mr Aujard's design used a 30cm diameter reflector, having an elliptical (rather than a parabolic) curvature. The transducer was so located as to produce a point of sharpest focus at about 10 metres — the kind of distance likely to be involved when checking pole-mounted hardware from the ground.

To make the signal audible, it was hetrodyned with a locally generated 43kHz signal, amplified to provide sensitivity, then fed to a speaker. The end result was a device which could detect an individual faulty insulator from the ground even when, in some cases, the insulator opening was facing away from the microphone.

And that was more or less the end of the story as far as the "Monitor" article was concerned. The sequel occurred when we learned that a Sydney firm, Kiel Electronics, was planning full-scale production of these detectors and that the director of the firm was Mr Eddie Roberts, formerly an engineer with the (then) PMG's Department specialising in interference problems.

A phone call served to renew an old acquaintance, and Eddie Roberts was only too happy to give us the full story on the new device and offer us a sample to play with. He also invited us along to a field demonstration for the Lower Blue Mountains County Council, at Springwood, NSW.

The commercial version of the detector is virtually identical, acoustically and electrically, with Mr Aujard's design, Mr Aujard having made all the information freely available.

The heart of the unit is the reflector, of spun aluminium and 30cm in diameter. It supports a small tripod, at the apex of which is the transducer, facing the reflector. The distance from the transducer to the centre of the reflector

This posed picture illustrates how the ultrasonic detector might be used to check a typical sub-station installation. Note that the operator can work from outside the boundary fence, which may often be quicker and more convenient than having to obtain permission to enter the area.

Part of the Springwood engineers' test set-up — a faulty insulator on top of, and connected to, an 11kV transformer. Mr Eddie Roberts checks for acoustic noise but, for the purpose of the photograph, is much closer than necessary.

is about 32cm and, as in the original, this sets the sharpest focus at between nine and 10m. At this distance the beam width is quoted as "2⁰ or better".

The reflector is mounted in a shallow "pie dish" type housing about 6.5cm deep and the same diameter as the reflector. This houses the electronic circuitry, battery, loudspeaker, etc. With battery, it weighs less than 2kg.

Also on the underside of the dish is an on-off switch (spring loaded to conserve battery power), a gain control knob, a battery monitoring meter, and an opening for the loudspeaker.

In use the operator aims for the greatest noise, then identifies the faulty component through a pair of sighting holes provided.

One other feature is a headphone jack on the side of the case, which automatically disconnects the speaker when in use. Originally, the headphones performed two functions; limiting ambient noise for the operator, and permitting more effective sensitivity from the unit.

In the early models sensitivity was limited when using the speaker, due to acoustic feedback caused by vibration of the reflector assembly by the speaker. This problem has now been solved, but the headphones are still useful in noisy locations.

The field trip to Springwood had been organised partly at the request of the Lower Blue Mountains County Council, and partly as an exercise to test the detector under field conditions. To date, there had been little opportunity to test it outside the laboratory.

Accompanying Mr Roberts were Mr Ted Whitworth and Mr Brian Hill, both of the P&T Department's Radio Branch, and the author. We were met at Springwood by Council engineers, including Mr Brian Cartwright, Chief Electrical Engineer, and Mr John Piper, and escorted to the Council's substation and workshop.

In one respect conditions were disappointing. It had rained the day before and overnight, and we were unable to find a source of RF interference anywhere, even in locations which the radio inspectors knew were notoriously bad!

Fortunately, the Council engineers were equal to the occasion. They had provided a 240V to 11kV transformer and Variac and, with this, they were able to provide a varying voltage up to 11kV to energise a number of noise-producing devices. These included a spark gap, a cracked insulator, and a faulty surge arrestor.

Radio receivers left no doubt that quite violent RF interference could be generated, and also that it could be controlled by varying the voltage. This provided a very interesting demonstration in the case of the surge arrestor, where it was discovered that the voltage could be reduced to the point where there was little interference in the radios, yet the fault was still evident as ultrasonic noise.

But one of the most impressive aspects of the demonstration was the narrow beam width of the detector. Having seen it in operation, it is easy to believe that it is " . . . 2⁰ or better"; probably "better". When sighting onto a faulty insulator, even at 10m, the insulator occupied a substantial area of the sighting hole; yet moving the detector far enough to lose sight of the insulator was sufficient either to lose the sound completely, or to reduce it very substantially.

Nearly as impressive is the nature of the sound which is characteristic and easily recognised. Since there is very little other noise at 40kHz, it stands out from a quiet background.

Altogether it was a most interesting exercise, and one which gave some insight into the thinking of the Council engineers. They are as concerned as anyone about this problem, but are faced with very real economic constraints. Unless they have some means of narrowing the search area to within a few poles, the time — and cost — of tracking down even one fault can be quite prohibitive.

Thus, they are interested in any device which will allow rapid and positive location of interference producing faults.

Later we had a chance to play with one of the devices in our own laboratory, and everyone who tried it was most impressed with both the sensitivity and directivity. One source of signal we tried was to jiggle a bunch of keys; a trick which produces a surprising amount of output at 40kHz. Even at 14m, the sound in a pair of headphones was uncomfortably loud.

Next, we tried a loudspeaker fed directly from an audio generator set to 40kHz. Not only would the efficiency of the loudspeaker have been way down at that frequency but the power fed to it, thanks to a large mismatch, would have been only a milliwatt or so. In spite of this, it produced a healthy signal at useful distances.

Subsequently, Mr Roberts arranged two more field tests at the request of

Eddie Roberts (left) discusses the operation of the ultra-sonic detector with electrical engineer John Piper of the Lower Blue Mts County Council. The Council has since purchased a unit.

Ultrasonic ear

power supply authorities and, although the author was not able to be present, reports on both exercises were made available.

The first test was arranged by the NSW State Electricity Commission, who were keen to evaluate it as a means of checking 330kV lines in the Dural area, north-west of Sydney.

Quite apart from RFI problems, faults on 330kV lines can have serious consequences and anything which might give advance warning of a developing fault could be very valuable. The Commission is also very sensitive to accusations of RFI, even though it has been shown that the very high voltage lines are far less likely to cause such problems. Medium voltage lines, around 11kV, are much more likely to be the culprits.

In fact, the exercise served to substantiate this fact. Although interference to TV reception had been reported from this area, and tentatively blamed on the 330kV line, no reason for this could be found. However, the device did detect a possible fault on a nearby county council line, and this was subsequently reported to the council engineer.

The second test was at the request of the St George County Council, which serves a large area south of the city. This Council is also very much aware of RFI problems and have appointed an Interference Officer, from among their engineers, to investigate such complaints and liaise with the P&T Department when necessary. Significantly, the Officer has a radio amateur licence in addition to his engineering qualifications.

The council's report on the tests is a very interesting and detailed document, the highlights of which can be summarised as follows:

The test was in two sections: simulated faults in a high voltage bay, and field tests involving genuine TVI complaints. For the simulated faults four defective disc strain insulators were strung together and connected across voltages varying from 3kV to 15kV. In addition to the ultrasonic detector, a sensitive Eddystone receiver (Noise Measuring Set No. 31A) was used as a reference. The ultrasonic detector was set up about 10 metres from the insulators.

With 3kV applied both the Eddystone set and the ultrasonic detector indicated a faint response, but not sufficient for the ultrasonic detector to pick which of the four insulators was responsible. At 6kV however, even though the Eddystone set showed only a slight increase in level, the ultrasonic detector correctly nominated the faulty insulator. This was in spite of the fact that the insulator fault — a crack — was on the far side from the detector.

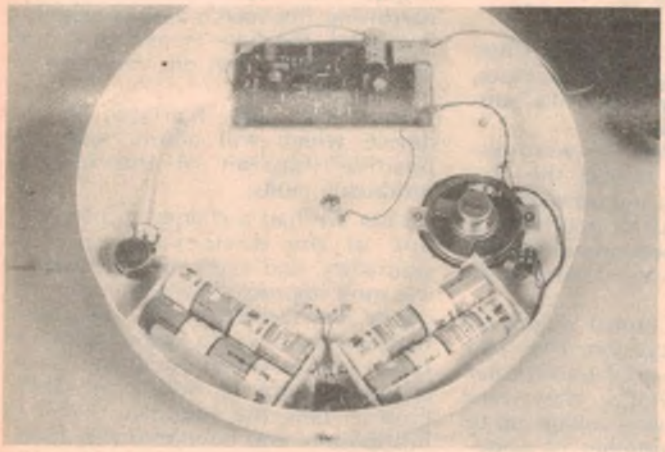
With 7.5kV applied the ultrasonic detector correctly nominated a second insulator as emitting noise and, at 15kV, indicated that all four insulators were faulty.

The field test involved three locations, but two were unproductive. At one address there was no one at home, and so the TV set could not be checked, but no interference could be heard with either the Eddystone or ultrasonic detector. In the second case faint TVI was visible, but nothing could be heard with either detector.

At the remaining location TVI was clearly apparent. The Eddystone detector confirmed that there was interference at about 60MHz beneath the 11kV lines, but was unable to pinpoint the source. At this point the ultrasonic detector proved most effective, eventually pinpointing two disc strain insulators as the source of interference.

These tests so impressed the Council engineers that they recommended the purchase of an ultrasonic detector.

And that about sums up the status of the ultrasonic detector to the time of writing. While no one would claim that it is the complete answer to the RFI location problem, there seems little doubt that it is better than most devices to date and represents a significant advance in the fight against electromagnetic pollution. (The address of Kiel Electronics is 26 Gammell St, Rydalmere, NSW 2116.)



The interior of the ultrasonic detector showing the speaker, batteries, circuit board, etc. Note the transducer lead running to one of the tripod legs on the reflector, in the top right hand corn

The ideal companion for your Micro 2 receiver:

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Here's a little amplifier that's ideal for the experimenter. It uses only a handful of parts, and works from a battery for maximum safety. It's just the thing for driving a loudspeaker from small earphone-type radio receivers, like the Micro 2 described last month.

by GERALD COHN

The little amplifier design presented in this article is mainly intended for use with small radio receivers, such as the Micro 2 receiver which we described last month. However it can also be used for lots of other purposes, and would make a good utility amplifier for the experimenter.

As it runs from a 6 volt battery, it is also completely safe as a project for the younger reader. Being battery operated also makes it ideal for portable use, on a bike for example.

As you can see, the circuit is a simple one employing only two low-cost NPN transistors. The second transistor (Q2) is connected as a common-emitter class A amplifier, meaning that it conducts current at all times. It drives the loudspeaker via an impedance matching transformer (T1), in order to provide the speaker with a moderate amount of power while keeping battery drain to a minimum.

The transformer is a miniature audio output type, as used in personal portable receivers, and is readily available at low cost.

The input transistor (Q1) of the amplifier is also connected as a common-emitter amplifier, in this case with a resistor as the collector load. The collector is also connected directly to the base of the output transistor Q2.

Base bias for transistor Q1 is provided by the 22k resistor connecting back to the bypassed emitter resistor of Q2. This arrangement provides DC negative feedback which, together with the direct coupling between the stages, stabilises the operating currents of both transistors. The amplifier is thus protected against damage due to "thermal runaway".

The 100-ohm resistor in the emitter circuit of Q1 is unbypassed, and so introduces degeneration or AC negative feedback. This stabilises the AC gain of the amplifier. Decreasing the resistor value will increase the amplifier gain, but will also make the gain less stable and hence increase distortion.

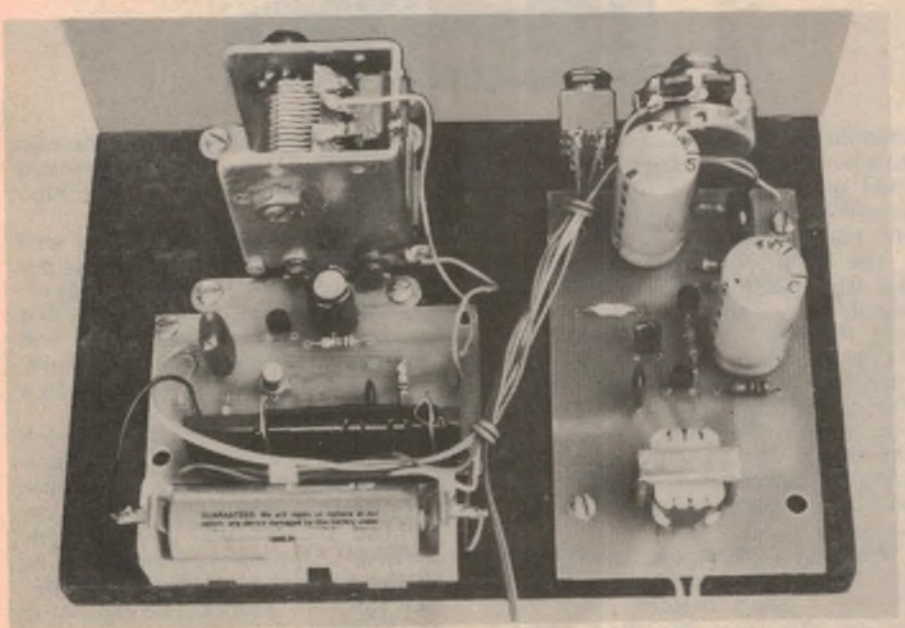
The 100-ohm resistor in the emitter of Q2 limits the collector current of Q2, and also sets up a voltage drop to provide the bias for Q1. As the resistor is bypassed by a 1000uF capacitor, it does not affect the amplifier's AC gain.

The .01uF capacitor across the output transformer primary winding is to reduce the amplifier's gain at frequencies above the audible range. This is to ensure that the amplifier does not "take off" or oscillate, due to stray coupling between input and output.

The 470-ohm resistor in series with the base of Q1 is also there to ensure AC stability. Together with the input capacitance of Q1, it forms a simple filter which reduces the gain of Q1 at high frequencies. This also helps protect the amplifier from being disturbed by any RF signals which may be picked up by the input wiring.

The 0.1uF capacitor which is also in series with the input of Q1 is to couple in the input signals, without disturbing the DC bias on Q1.

The purpose of the 22-ohm resistor shunted across the input of the

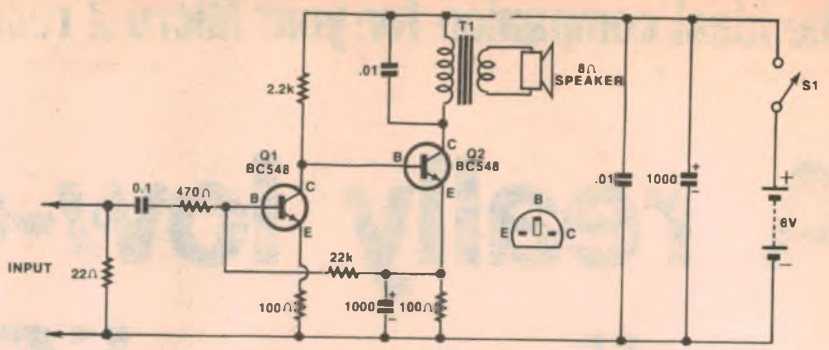


This view shows how the amplifier module (right) has been connected to the Micro 2 radio receiver. External leads go to the battery and the speaker.

We estimate that the current cost of parts for this project is approximately

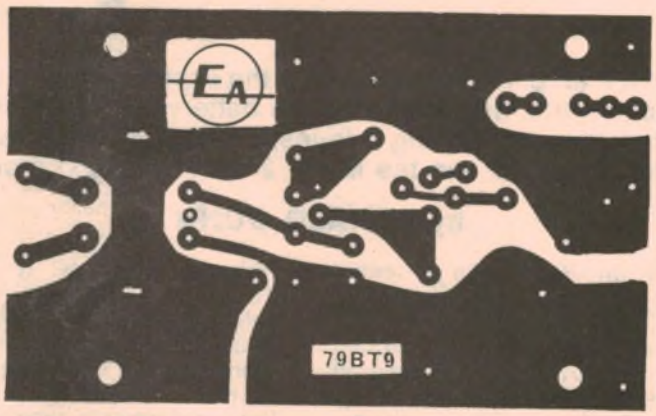
$8.00

This includes sales tax.

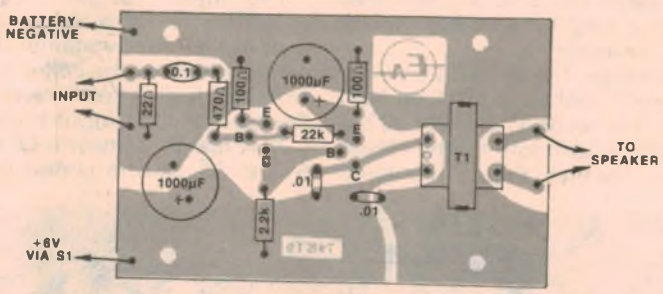


SIMPLE AUDIO AMPLIFIER 1/MA/-

The circuit employs two NPN transistors operating as common emitter amplifiers.



Above is the PC pattern, reproduced actual size. The component overlay diagram (below) shows the PC board as viewed from the component side.



amplifier is to act as a substitute for the earphone normally connected as the load of the Micro 2 receiver. If the amplifier is used with other receivers, this resistor may not be needed.

The 1000uF electrolytic capacitor and the .01uF plastic capacitor between the supply rails of the amplifier are to ensure that the rails remain at the same AC potential, even when the internal resistance of the battery rises with age. This is necessary because the performance of an amplifier can drop considerably if the two rails are not at the same AC potential. The gain may fall, and/or the amplifier may become unstable.

Why put a .01uF capacitor as well as the 1000uF? This may seem silly, but there's a good reason. Large electrolytic capacitors are good when it comes to low frequencies, but they tend to be less effective at high frequencies due to internal inductance and losses. So the .01uF across the rails as well is to make sure that they remain at the same AC potential even at high frequencies.

In fact the supply rails are so well bypassed that the reader could use the amplifier with a mains power supply instead of a battery, if desired. All that would be required to operate the unit from the mains would be a transformer with a 3-4 volt secondary, followed by a full wave bridge rectifier.

The complete amplifier is assembled on a printed circuit board (PCB) which measures only 50 x 85mm. A copy of the PCB pattern is given here actual size, for those who may wish to make their own board. However ready-made PCBs will no doubt be available from the usual suppliers shortly. The pattern is coded 79BT9.

As mentioned earlier, the output coupling transformer is a miniature type as used in portable transistor

radios. The transformer in the prototype came from Dick Smith Electronics, and is listed in their catalog as part M-0216. The cost of this transformer is only $1. It has an input impedance of 100 ohms and an output impedance of 8 ohms.

Before you rush into the assembly of the board, carefully look at the component overlay diagram and check the positions of the various components. Also make sure of the polarity of the capacitors.

Following the component overlay, mount all the passive components first, that is the resistors and capacitors. After the resistors and capacitors have been mounted, place the transistors onto the board, checking the lead orientation, and using a heat clip or a pair of long nose pliers, solder them to the board. Now we can proceed to mount the transformer.

You should note that the transformer has three leads on one side, and only two on the other. The side with the three leads is the input, and this side should face the transistor when mounted. The centre tap of the transformer is not used here, so there will be no connection to the centre copper pad.

When mounting the transformer check the lead orientation and carefully place it onto the board, making sure that the small lugs pass through the board. Bend the lugs over so that they are flat against the copper, then solder them to the board. Finally solder the leads themselves, making sure not to strain them.

Once the assembly of the printed circuit board is complete check the soldering for dry joints, solder bridges etc., and then turn the board over and do a final check on the capacitor polarities, and transistor lead orientation. Once you have satisfied yourself that all is in order you can proceed to connect the input, output and power leads. The positive of the battery is wired via a switch, and in the case of our prototype we replaced the switch on the front panel of the Micro 2 with a double-pole double-throw miniature toggle type. One pole is used to switch the 1.5V supply to the tuner, while the other is used to switch the 6V supply to the amplifier.

What sort of loudspeaker should you use with the amplifier? Just about any permanent-magnet speaker with a voice-coil impedance of between 8 and 16 ohms will do, and strange though it may seem, the bigger the speaker you use the better will tend to be the results. This is because big speakers tend to be rather more efficient than small ones: with a bigger cone and a bigger magnet, they generally produce more sound from a given amount of electrical input.

So use as big a speaker as you can, to make the most out of the modest power available from the amplifier. A 25cm or 30cm unit from an old radio or 'gram would be ideal, particularly if you can mount it in a wooden baffle or box.

The prototype amplifier was mounted on the same block of wood as the tuner, as can be seen in the photographs. The input to the amplifier was taken directly from the tuner output.

Once the unit has been mounted, switch on the power and tune in a station. If the received signal sounds distorted, rotate the receiver to find a null and the distortion should now disappear. If distortion is still evident, rotate the AGC pot on the front panel of the tuner anticlockwise and find the point at which the station can be heard clearly. Rotation of the pot increases the amount of AGC action that is applied to the gain stages of the ZN414, and decreases the gain in the case of a very strong signal being received.

The sound quality should be of a quite reasonable standard, providing more than adequate output power for enjoyable personal listening.

We mentioned at the beginning of the article that the amplifier need not be restricted to use with the Micro 2, but that it could also be used with other receivers. To use it with other sets, you may have to increase the input resistance of the amplifier. This is quite easily done by removing the 22-ohm resistor at the input stage of the amplifier, which changes the input resistance to around 22k.

Well, there it is. A simple little amplifier, but one which can be used to turn an "earphone only" receiver into a handy loudspeaker set for personal use. Or you can use it for experimenting with oscillators and other test circuits. Either way, you'll have the satisfaction of knowing that "you built it".

Parts List

Printed circuit board 50 x 85mm, code 79BT9
2 100 ohm ¼W resistors
1 22 ohm ¼W resistor
1 470 ohm ¼W resistor
1 2.2k ohm ¼W resistor
1 22k ohm ¼W resistor
2 .01uF polyester LV capacitor
1 .1uF polyester LV capacitor
2 1000uF 10V electrolytic capacitor
1 miniature output transformer
Switch (DPDT if used with Micro 2), hookup wire, solder, battery, etc.

PRACTICAL ELECTRONICS

Mains wiring: what you need to know

While you're likely to start off in electronics by building up some simple battery projects, sooner or later you're going to want to build a project that's powered from the mains. So let's find out how to wire mains plugs and sockets, and how to install mains wiring into a metal chassis.

by GREG SWAIN

When dealing with mains wiring, it's very important to know exactly what you are doing. Let's get one thing straight right now. Mains voltages are extremely dangerous and if you receive a shock, it could be fatal!

The above warning is not intended to discourage you from building or using mains operated equipment. Far from it. Rather, it is intended to make you safety conscious. In this chapter, you will learn how to use the mains safely, so that when you do come to wire up a mains project you can tackle the job with confidence.

The power point

The familiar power point (or general purpose outlet — GPO) in our homes delivers a nominal 240V AC — that is 240 volts of alternating current. This is the theoretical supply voltage to which household appliances and light machinery are connected. In fact, the actual voltage can vary, depending on the load placed on the supply network, although most supply authorities try to keep it within plus or minus 5% of the nominal voltage.

The maximum current that can be drawn from any one power point is usually 10 amps (10A). If more than this is drawn, the outlet may overheat and be damaged. In practice, the wiring is arranged so that several power points are connected in parallel and protected by a common 15A fuse at the fusebox.

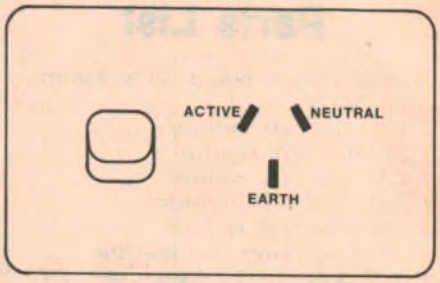


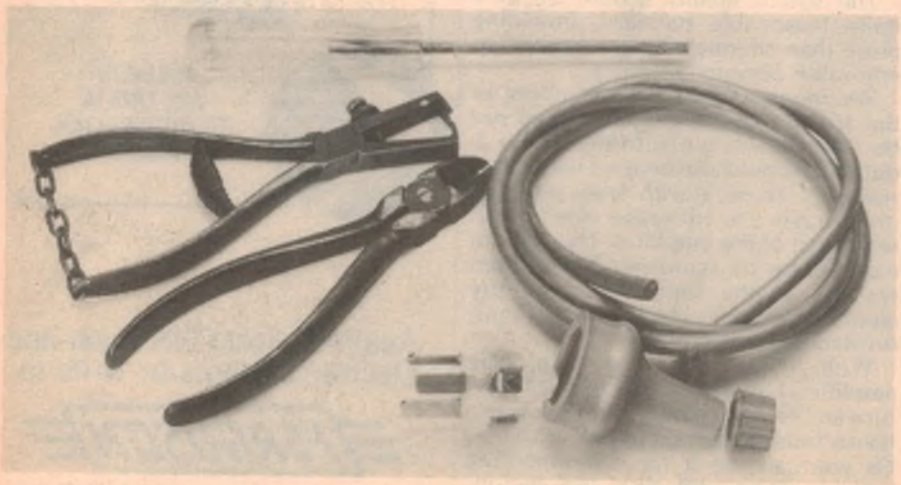
Fig. 1: the recommended wiring connections for a general purpose outlet.

What this means is that you can blow a fuse simply by drawing heavy currents from two power points connected to the same circuit — this in spite of the fact that less than 10A is being drawn from each outlet!

If you ever get the chance to examine the back of a power point, you will probably notice the letters A, N and E. These stand for the words "active", "neutral" and "earth", and are the names given to the three wires which connect to the power point.

Two of the wires, the active and the neutral, connect to wires coming into the house from the street. Both wires go back to the substation, where the neutral is earthed. The neutral is also earthed at various distribution points, and to the main earth system at the customer's fusebox.

The third wire in the system, the earth wire, is connected to a good earth connection — typically a water pipe —



The items needed to wire a mains plug — screwdriver, wire strippers, side cutters, length of 3-core mains flex, and the mains plug itself.

within the boundaries of the property.

In terms of safety, it is the active wire that is the most dangerous. This is because it is at 240V with respect to the neutral and, because the neutral is earthed, with respect to any earthed object. If a person completes a circuit between the active wire and the neutral or an earthed object, he will receive a shock. Just how severe the shock will depend on how good a connection is made to earth. The victim may receive a nasty "bite" — or he may be killed!

Wiring standards

Fig. 1 shows the recommended wiring connections for a general purpose outlet, as laid down by the Standards Association of Australia. The recommendation is that the left hand contact, when looking at the front of the outlet, should be the active. The remaining contacts are then neutral and earth in a clockwise direction.

The switch for the outlet must, by regulations, be in the active line.

Most modern installations conform to these recommendations. However, there are some installations which do not, particularly older ones and those installed by amateur electricians. The most common fault is for the active and neutral wires to be transposed, and the switch installed in the neutral line.

A correctly wired appliance will still work from an outlet wired in this fashion. The problem is that it can lead to dangerous situations when used with incorrectly wired appliances or extension plugs.

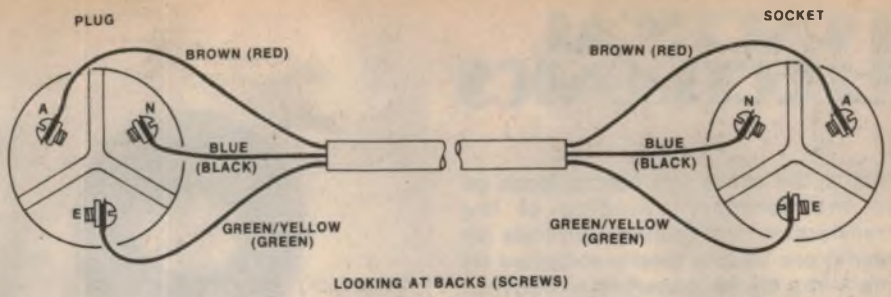


Fig. 2: how to wire an extension cable. Check it by pushing the plug into the socket — the three lead colours should correspond.

Another problem arises because the active line is no longer switched. This means that the active wire coming into the appliance will still be "live" (ie at 240V with respect to earth), even though the switch at the outlet is in the off position. For this reason, you should never assume that mains wiring is safe just because the switch is off. It's only safe to touch when the plug has been pulled out!

Wiring a mains plug

Inside a mains cord are three separately insulated colour coded wires. These must be connected to the plug terminals in the right order so that, when it is plugged into the socket, the active, neutral and earth wires all go to their correct socket contacts.

The three colours used in Australia in the past have been red, black and green. Other countries have used other combinations. However, a new international colour code has now been adopted by most countries, including Australia. The new colours are brown, blue and a green/yellow stripe pattern.

For the time being though, you will probably come across a brown, blue and plain green colour code, at least in Australia.

The brown wire (red) should be used for the active lead, the blue wire (black) for the neutral, and the green/yellow wire (green) for the earth. Fig. 2 shows how the various colours should be connected to the mains plug.

The same figure also shows how an extension cable is wired.

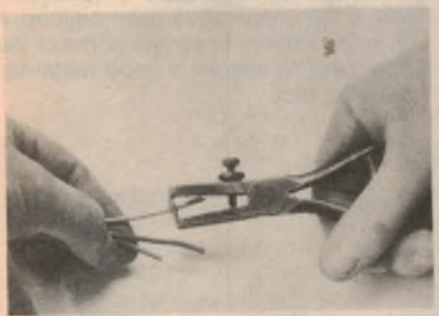
It's quite easy to recognise the earth pin on a mains plug, by the way. It's slightly longer than the other two pins, and is set at a different angle.

Mains-powered projects

In an electronic project, the active and neutral wires are almost always connected to the appropriate leads or terminals of a mains transformer —

How to wire a mains plug

REMEMBER: brown = active; blue = neutral; green/yellow = earth.

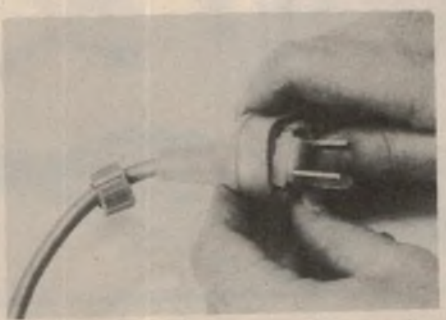


1. Remove outer sheath and bare wires.

2. Attach wires to screw terminals.

3. Tighten terminal screws firmly.

4. Loop each lead under the spigot adjacent to its terminal.



5. Push plug body into its mating plastic cover and do up cord clamp.

6. Check carefully — each wire colour should be adjacent its correct pin.

that is, the active and neutral leads go to the "primary" winding of the transformer. The primary terminals (or leads) are usually clearly indicated by markings on the transformer body, or the leads are colour coded red or red and black.

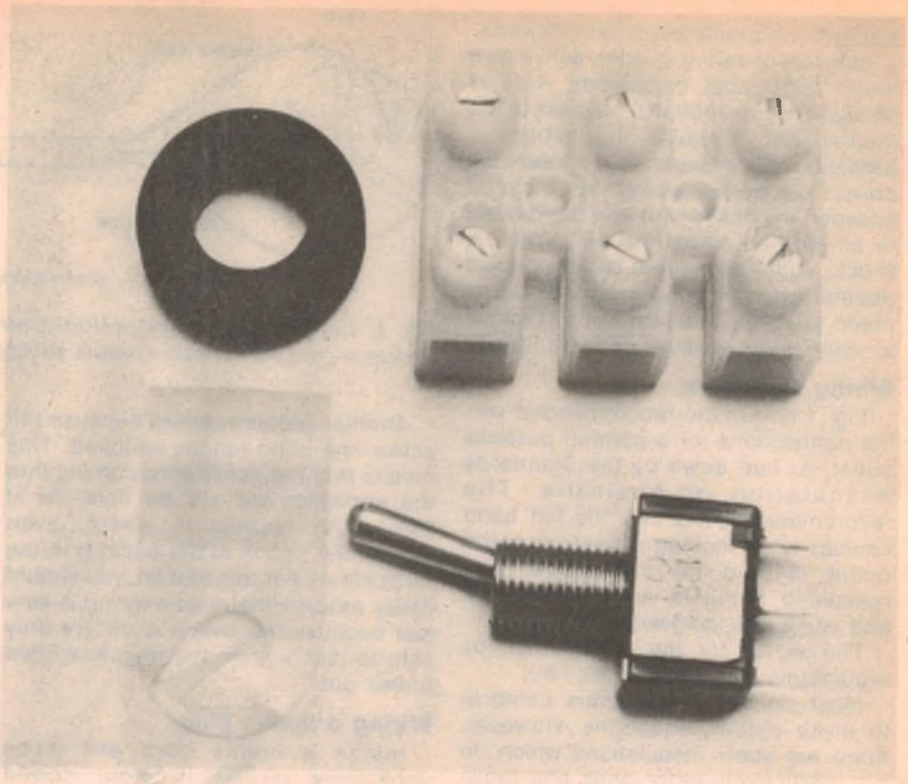
In general, it does not matter which way round the active and neutral leads are connected to the transformer (or to other mains devices such as heating elements and motors). However, if there is a mains on/off switch on the appliance, it should be in the active line.

The earth wire, green or green/yellow, connects to the metal chassis or frame of the appliance. It is vitally important that this lead is not confused with either of the other two leads. Transposed active and earth leads will result in the active lead being connected to the appliance frame, a very dangerous situation to say the least.

A transposed earth and neutral can be just as dangerous, but is more subtle. The appliance will work in a correctly wired power point, and is not particularly dangerous. But in a power point with transposed active and neutral contacts it will not work and again the active will be connected to the appliance frame.

Correctly connected. the earth wire provides a very high order of protection. An insulation breakdown between the active lead and the metal chassis will result in a short circuit across the supply, causing a blown fuse or a tripped circuit breaker at the fusebox.

This not only disconnects the supply voltage, but also draws attention to the fact that there is a fault.



Clockwise from top left: rubber grommet, 3-way mains terminal block, 240V AC on/off switch, and plastic cord clamp.

Wiring a project

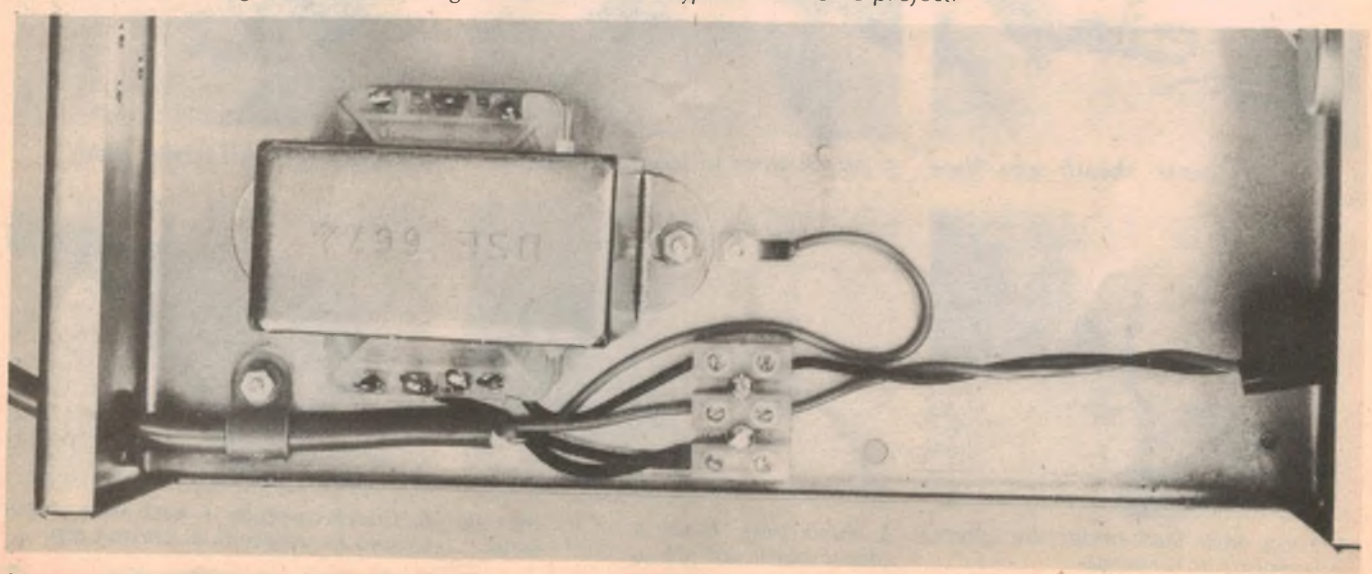
Fig. 3 shows how mains wiring is typically installed into the chassis of a project. This could for example, be an amplifier, a radio tuner, a piece of test equipment, or even a variable DC (direct current) power supply.

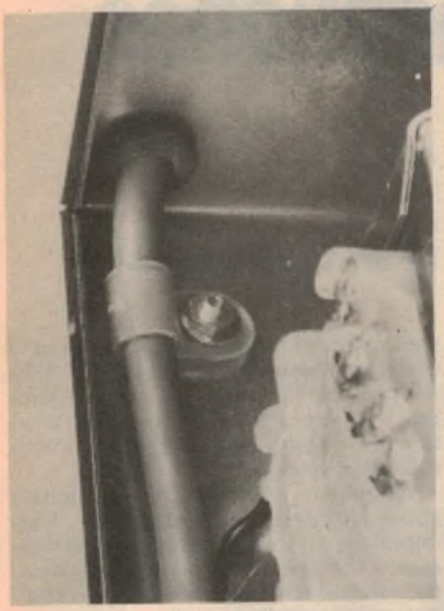
You will need the following items:

- 1 mains plug and length of 3-core mains cord;
- 1 rubber grommet;
- 1 cord clamp;
- 1 3-way mains terminal block; and
- 1 240V AC rated on/off switch

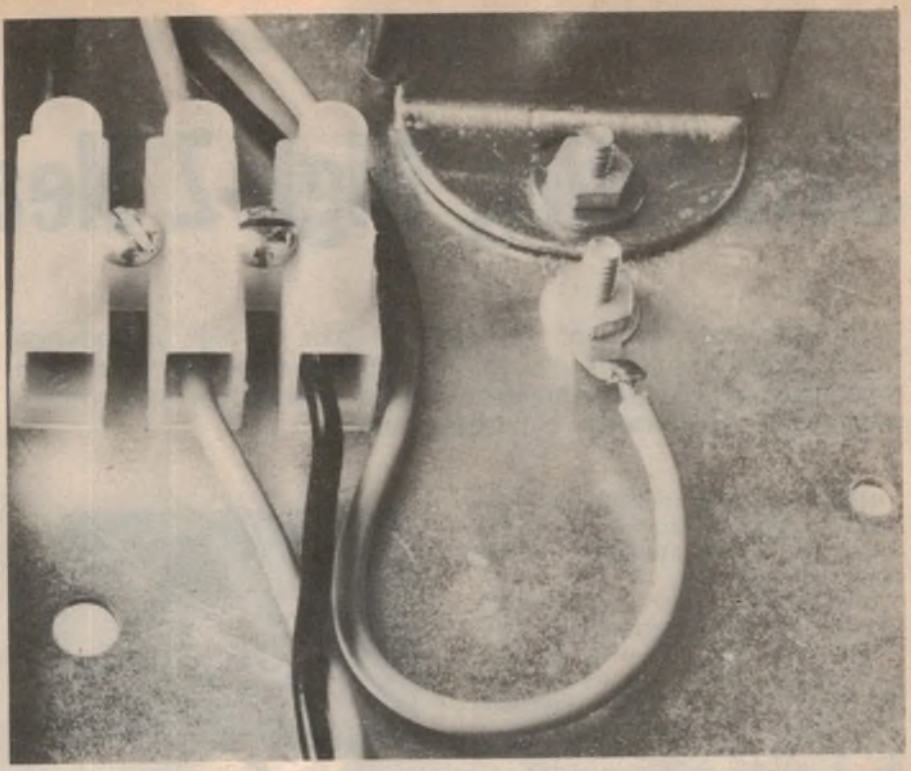
The first step is to mount all the chassis hardware such as the on/off switch, the power transformer, the mains terminal block, and the earthing solder lug. You should make sure that both the power transformer frame and the solder lug make good chassis contacts. If the chassis has been painted, it will be necessary to scrape some of the paint away to ensure a good metal-to-metal contact.

Below: view showing how mains wiring is installed into a typical electronic project.





The mains cord should enter through a rubber grommet and be securely clamped.



All wiring to the terminal block should be kept neat and tidy. Note how the earth wire is looped so that it will be the last to break in a situation of stress.

You can use a multimeter switched to the low-ohms range to ensure that a good contact has been made.

The rubber grommet is installed in the cord entry hole in the rear of the chassis. The mains cord passes through this grommeted hole, and is then securely anchored to the bottom of the chassis with the cord clamp. The earth lead is soldered to the solder lug near the transformer, while the active and neutral wires connect to the terminal block.

The terminal block is also used to terminate the two wires from the mains switch and the transformer primary leads. Before soldering the wires to the mains switch, it's a good idea to push a length of suitable plastic sleeving over the wires. After soldering, the sleeves can be pushed over the terminals of the switch to make it as shock proof as possible.

Alternatively, the switch terminals can be wrapped in insulation tape.

Things to watch

Before plugging in and applying power, you should check the following:

- Make sure that there are no connections between either the active or neutral lines and earth. You can easily check this with a multimeter switched to the ohms range. If the needle swings across the meter face, you've got a problem which must be traced and fixed before power is applied.
- Is the mains cord securely clamped? If not, any strain on the cord could pull the active and neutral wires out of the terminal block, and they could short to chassis. It's best to make the earth wire longer than the active and neutral wires, so that it will be the last to break in this situation. While it remains connected, it will continue to provide protection, even if the other wires are pulled from the terminal block.
- Examine the terminal block carefully. All wires should be tightly connected, and there should be no bared wire protruding beyond the edge of the terminal block insulation.
- Finally, go over your wiring carefully, to make sure that you haven't made any mistakes.

Note that the wiring for some projects may differ slightly from that shown in Fig. 3. Some projects do not require an on/off switch, for example. However, the basic principles still apply — just follow the wiring diagram for the project that you're working on.

That's it! As you can see, it's not a particularly difficult job, but one that should be done neatly and carefully to ensure personal safety.

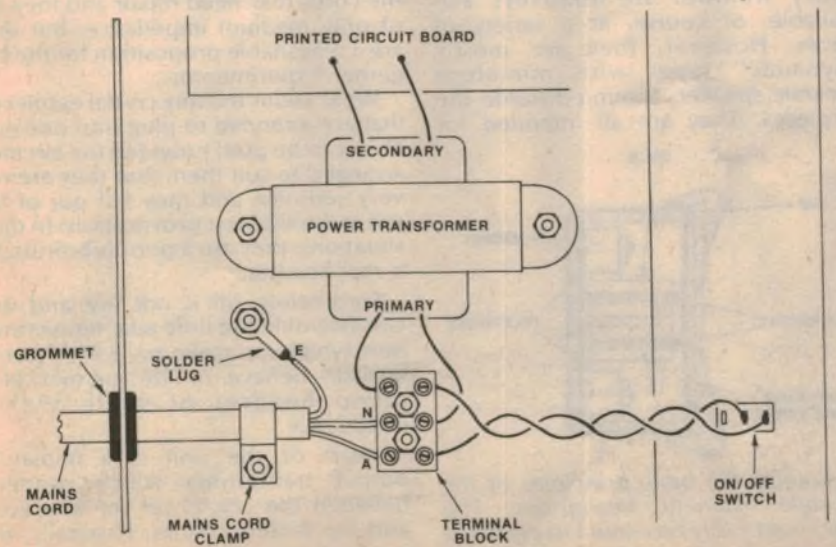


Fig. 3: typical mains wiring diagram.

An old way around a new dilemma —

Simulating High-Z Headphones

From the early days of "wireless" a pair of high impedance headphones has been vital for the would-be experimenter with crystal sets and other elementary circuits. There's just one problem these days: you virtually can't buy them!

by WALTER NEVILLE

High impedance headphones have varied a good deal in appearance but they have almost invariably used the same basic principle.

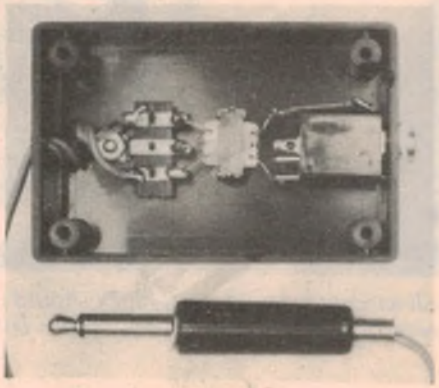
Each phone involves a cup (usually moulded) in which is mounted a small permanent magnet, with an iron polepiece at each end. Across the open face of the cup is clamped a thin steel diaphragm, all dimensions being arranged so that the inner surface of the diaphragm is just clear of the polepieces. Because the polepieces are attached to a permanent magnet, they attract the diaphragm and hold it under slight inward tension.

Around each pole piece is wound a coil of wire, through which the audio signal current is passed. Passage of an audio current modifies the magnetic attraction of the polepieces for the diaphragm, so that it tends to vibrate. In so doing it disturbs the adjacent air, producing sound waves in sympathy with the signal current through the coils.

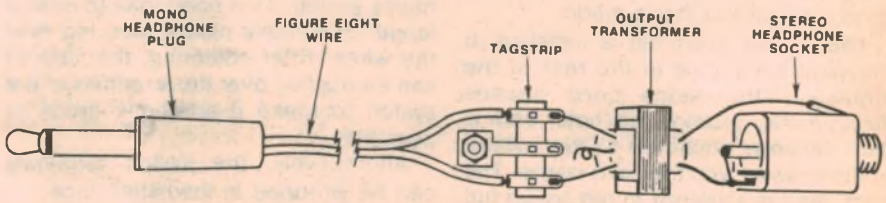
Because the coils are stationary, they can be wound with a large number of turns of fine wire, and can present a quite high impedance, nominally of a thousand ohms or more. When the coils in the respective earpieces are interconnected to one pair of flexible output leads, they commonly present a nett nominal impedance of around 2000 ohms. In practice, any headset with an overall impedance of anywhere from 1000 to 4000 ohms would qualify for description as a"high impedance" type.

Impedance is important in a headset to be used with a crystal receiver or with elementary 1 to 2-valve or 1 to 2-transistor receivers. The reason is simply that the audio signal currents produced by these receivers are very small and only by passing them through a fairly high impedance transducer can they produce enough acoustic energy to be heard.

In terms of fidelity and distortion, these traditional "magnetic" headphones have never been very marvellous but they are sensitive to small signal currents, they are traditional, and their use is assumed in a lot of older and ex-disposal type receivers and transceivers.



There is plenty of room to spare, even inside the smallest Jiffy box!



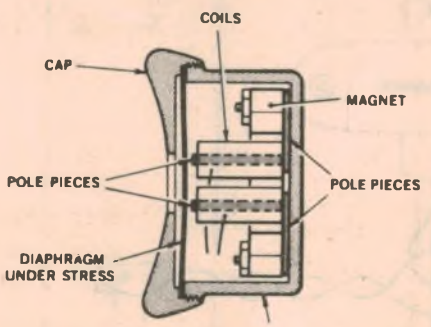
The wiring is simple but check the connections to the stereo socket, in case they differ from the one we used. See text re. wiring the phones in series or parallel.

The only trouble is that they seem to have disappeared off stockist's shelves!

Any number of headsets are available, of course, at a variety of prices. However, they are mostly "dynamic" types with miniature dynamic speakers mounted inside the earpieces. They are all intended for stereo listening and are all rated at 8 ohms or thereabouts. They work fine with stereo signals from a hifi system, but they are a poor proposition, as is, for the would-be experimenter with elementary receivers.

When we queried a few suppliers about importing conventional high impedance phones they suggested that, even if they did manage to locate some, they would have become a "specialist" line at a specialist price!

The best we could turn up was a limited supply of ex-military headsets from disposals sources. A.C.E. Radio in Marrickville, NSW have some at $3 per headset, plus $1 P&P in NSW and $1.75 P&P interstate. They are second-hand, the cords may need repair and they are of only medium impedance, but they are a reasonable proposition for the beginner/experimenter.



Illustrating the basic principles of the old-style magnetic headphone. The coils could easily be wound to present a high impedance — typically about 2000 ohms.

What about the tiny crystal earpieces, that are intended to plug into one ear? They can be used provided the circuit is arranged to suit them, but they are not very sensitive and they fall out of the ear at the slightest provocation! In most situations, they are a poor substitute for a real headset.

Fortunately, all is not lost and one can assemble the little adapter pictured here which can make any 8-ohm stereo headset behave in the manner of a mono headset of much higher impedance.

Heart of the unit is a miniature output transformer which connects between the crystal set (or whatever) and the 8-ohm phones. Physically, the primary winding connects to the receiver, via a short piece of twin lead,

normally by way of a conventional 6mm mono jack plug or one of the modern miniature equivalents.

The secondary (or 8-ohm) winding connects to the stereo phones, normally with both channels wired in parallel — achieved by bridging the two active lugs on the stereo headphone socket. (See diagram).

The transformer which we used came from Dick Smith Electronics and is shown as "1-k ohm CT to 8 ohm", catalog number M-0216, $1.00. Tandy list a transformer with the same ratio (catalog 273-1380) while similar products would almost certainly be available from other suppliers. Again, a suitable transformer could possibly be rescued from a discarded transistor portable of the older type; it doesn't even have to be a miniature component, provided it has a step-down ratio of the same general order.

Taking the figures "1k ohms to 8 ohms", the impedance ratio is 125:1. If the two tip segments of the stereo jack are bridged to put the phones in parallel, and if the phones are really 8 ohms each, their parallel impedance will be 4 ohms. Multiplying this by 125 gives an apparent impedance across the primary winding of 500 ohms, which should be adequate for most circuits requiring "high impedance" phones.

If you want to achieve a still higher impedance, it can be done very simply by ignoring the barrel of the stereo jack and connecting the transformer secondary to the two end segments. This puts the phones in series, produces a combined impedance of 16 ohms and a nominal impedance across the transformer primary of 2000 ohms. Acoustically, it means that the phones will be out of phase but, if it makes the signal louder with a crystal set, you'll probably prefer it that way!

CONSTRUCTION SIMPLE

There is not much to building up the adapter. We used a Jiffy box from Dick Smith Electronics measuring 80mm x 50mm x 28mm, but the shape and size is quite unimportant. The components including the tagstrip were arranged to support the transformer but, to make sure, it was spotted in place with a blob of Araldite.

The distribution of the lugs on the stereo socket may very with the brand supplied but it should be easy enough to identify them by inspection or by checking with a multimeter. For the normal parallel connection, connect one side of the transformer secondary (8 ohms) to the barrel of the plug, and the other side to the two end segments bridged together. The alternative series arrangement has already been mentioned.

As far as the primary winding is concerned, use the two ends and ignore the centre-tap. The polarity of the windings — which ends goes to what — is of no consequence.

Versatile moisture & light detector

Build this multi-purpose alarm unit

You can use this easy-to-build little gadget as either a moisture alarm or a light level sensor. Completely self-contained and battery powered, it provides an easily heard 1kHz warning tone.

by GERALD COHN

The fact that this alarm system is designed to operate from two quite different types of sensing devices may appear a little strange at first, but it is a very interesting concept which has a lot to offer. In particular, it offers the opportunity to experiment with other types of sensors, or variations on the sensor circuits described.

But even as it stands, it can be a very versatile device, with applications ranging from simply amusing, or instructive, to some of real practical value. For example, as a moisture sensor it can serve a real purpose as a rain alarm; something which any housewife will consider is worth its weight in gold when she has a load of washing on the line.

Another application is as a water level detector. If it is necessary to monitor the level of water in an inaccessible tank, or remote dam, this simple device may well be all that is needed, and could save a lot of unnecessary walking or climbing.

In the light sensing mode it can be equally useful. An obvious application is monitoring shop doorways, particularly where a lone staff member has to divide his time between the shop and a workroom or store at the rear. Used with a suitable light beam across the doorway, it can eliminate the strain of listening for a customer — or shoplifter!

Another application, which we suggested in a previous article, (Low Cost Alarm, February 1976, File No. 3/MS/62) also provides a form of property protection. In this case the light sensor (but not the alarm) is placed in a cupboard or drawer which may contain anything valuable. When opened, the admitted light will activate the alarm, making a very simple but very effective protection system. (This application calls for a circuit change, discussed later.)

A third application involves the physically handicapped. Any person confined to bed needs a means to summon assistance, and a simple pressbutton and buzzer is customarily used. However, some patients may be so handicapped that the normally simple action of pressing a button may be beyond them.

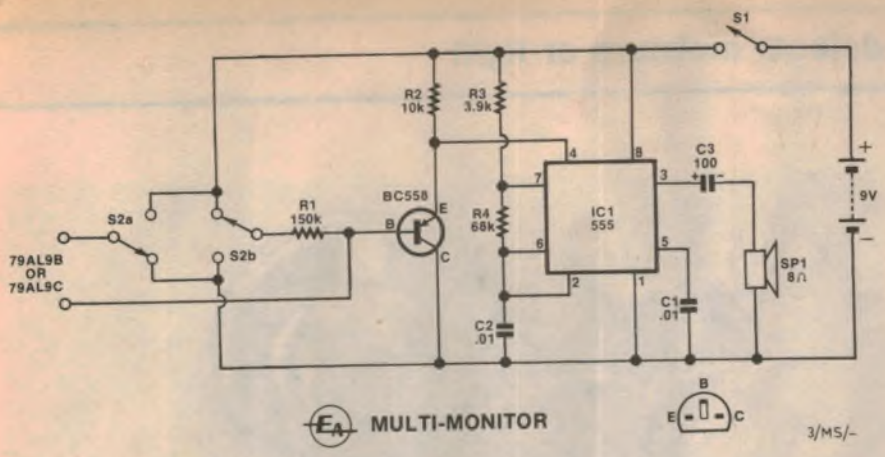
In this case the light sensor can do the same job, if the patient simply places his hand over it, at least while the room is illuminated. For use in darkness a small torch globe could be mounted about 15cm above the sensor, suitably shaded, but still providing a pool of light which would pinpoint the sensor in the dark.

The circuit is built around what I consider to be one of the most versatile devices ever manufactured, the 555 (timer) IC. The IC is used as an astable free running 1kHz oscillator, held in the normally reset (off) state until the unit is triggered by one of two sensors that form part of this project. The "front end" consists of a PNP transistor wired as an emitter follower; a configuration which gives it a very high input impedance and, therefore, a high sensitivity.

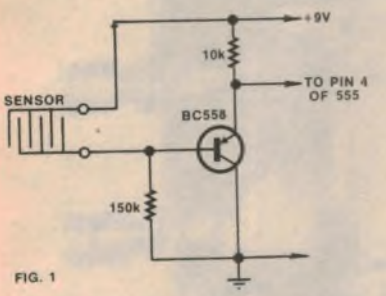
To understand "how it works" take a close look at the switching arrangement at the input to the circuit, and how this provides the two modes. Consider first the moisture sensing mode. To make this easier to follow, we have provided the equivalent circuit for the "front end" when switched into the moisture sensing mode (Fig. 1). The text that follows should be read together with this circuit diagram.

The transistor, Q1, is biased on by the 150k resistor, allowing collector current to flow, and thereby holding the voltage at pin 4 at ground potential. This switches the 555 to its reset, or

This photograph shows the complete unit with the two sensor boards.



Above is the circuit diagram of the unit. Take particular note of the switching arrangement at the input.



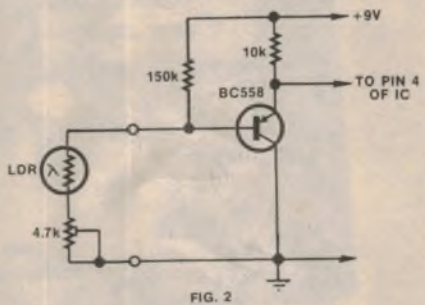


Fig. 1 shows the equivalent circuit of the input stage when switched into the moisture sensing mode, while Fig. 2 shows it in the light sensing mode.

PARTS LIST

Printed circuit boards; 79AL9A, 79AL9B, and 79AL9C.
Plastic case, 130mm x 68mm x 41mm, UB-3 or similar
1 BC558 PNP transistor
1 NE555 timer IC
1 ORP-12 (or similar) light dependent resistor
1 3.9k ¼W resistor
2 68k ¼W resistors
1 150k ¼W resistor
1 4.7k horizontal mount miniature trimpot
2 .01uF capacitors LV polyester types
1 100uF electrolytic capacitor
1 single pole miniature toggle switch
1 double pole double throw miniature toggle switch
No. 216 battery and clip to suit
Spring loaded terminals (1 red and 1 black)

Miscellaneous:
Solder, screws, nuts, hookup wire, etc.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may be generally used provided they are physically compatible.

"off", state. The sensor board, 79AL9B, attached to the input is an open circuit, and therefore has an infinite resistance.

If a drop of water falls on this board its resistance falls, the bias on the transistor base is reduced, and the collector current is reduced. When this happens the voltage at the emitter (which is applied to pin 4 of the 555) rises towards the 9V supply. This takes the 555 out of the reset state (or into an "on" state), and allows the oscillator to start, giving a 1kHz tone at the output.

If we assume that the switch is changed to the light sensing mode, Fig. 2 shows the basic circuit. Here, the sensing device is a light dependent resistor (LDR), the resistance of which will vary from about 300 ohms under bright light conditions, to several hundred thousand ohms in darkness.

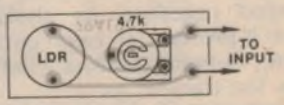
Note that there is a basic difference between this circuit and that of Fig. 1. In Fig. 1 the sensor starts out with a high (infinite) resistance and the alarm is sounded when the resistance falls. In Fig. 2 the sensor starts out with a low resistance and the alarm sounds when the resistance increases.

Compare the two circuits and you will see why. The sensor and the 150k resistor have changed places in Fig. 2, relative to Fig. 1. In Fig. 1 lowering the sensor resistance reduces the bias on the transistor base, whereas in Fig. 2 increasing the sensor resistance reduces the bias.

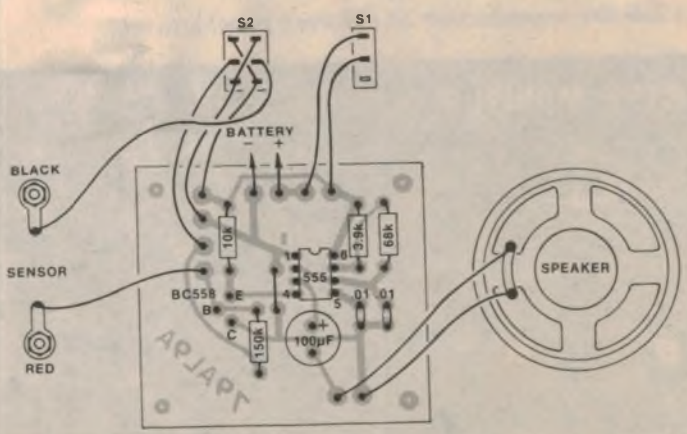
Thus, when the light on the LDR is high, and its resistance is low, the transistor is biased on and, as previously explained, this switches the 555 to its reset, or "off" state. When the light is removed from the LDR its resistance increases, the bias on the transistor is reduced, the 555 is switched out of its reset state, and the alarm sounds.

Instead of this arrangement, it is sometimes desirable to have the alarm sound when the light on the sensor increases, as for the cupboard application which we mentioned earlier. This can be done, and we will have more to say about it later.

The light sensor is in its most sensitive condition when the 4.7k pot is at its minimum setting. In these circumstances a minimum of light is need-



There are only two components on the light sensor board, the LDR and the pot.



Use the above diagram as a guide to the placement of the components. Check that the transistor, IC and electrolytic capacitor have been inserted with correct polarity.

ed to hold the alarm off, typical examples being a LED (light emitting diode) at a distance of about 2.5cm, or a 6V, 50mA torch globe at about 15cm.

If you find the ambient light level to be a bit too high, then it may be necessary to increase the resistance of the pot. This is done by trial and error, until you have the right setting to trigger the unit.

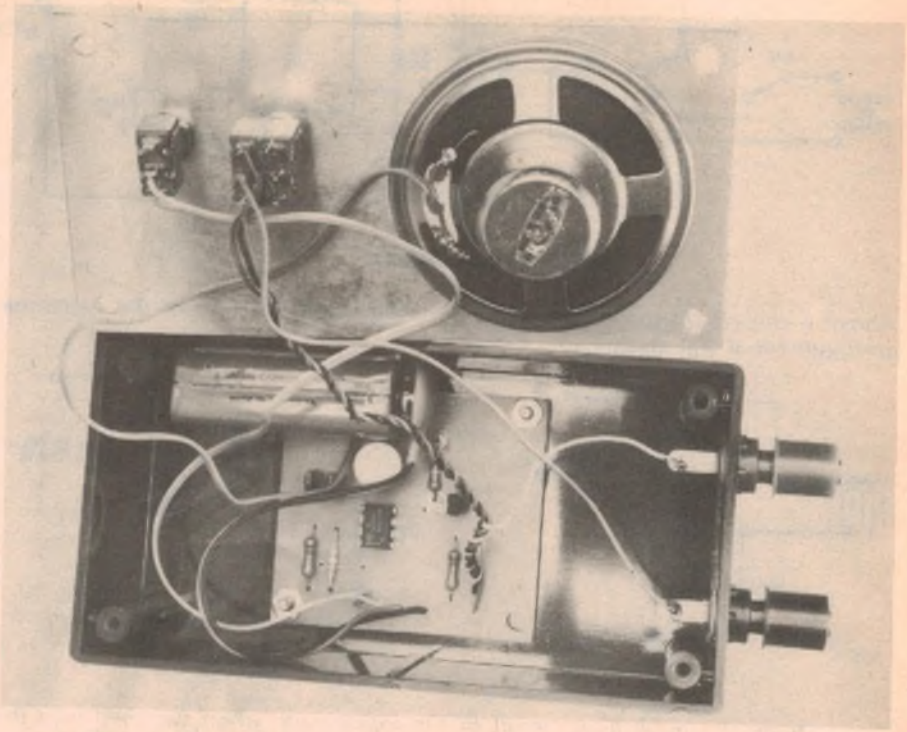
Construction of the unit is simple and should take only a couple of hours. All the components are accommodated on printed boards, which makes assembly simple and reduces the risk of errors. The unit, complete with the sensing devices, consists of three printed boards. The main board is housed in a plastic "Zippy box" together with the battery and the loudspeaker.

Either sensor board is connected to the master unit via a pair of spring terminals and any convenient length of cable. This makes the system quite flexible, allowing the sensor and the alarm to be well separated, if necessary.

We estimate that the current cost of parts for this project is approximately

$18

This includes sales tax.



Here is a view of the works. The speaker is attached with contact adhesive.

The moisture sensing board (79AL9B) has no components on it. It is simply two copper tracks, interwoven, but not connected together. As already explained, it presents an open circuit in a dry state, but will conduct when water bridges the tracks.

The light sensing board (79AL9C) has two components on it; the LDR and the 4.7k trimpot in series with it. This is used to set the minimum light level at which the system will trigger.

When assembling the main board mount the passive components first, checking that they are placed in their correct positions, and also the polarity of the 100uF electrolytic capacitor. Then fit the transistor and integrated circuit, being particularly careful regarding the lead identification and the orientation of these devices. (Mistakes of this kind are by far the most common among home constructors — even experienced ones.) Then add the battery clip, speaker, power switch, and changeover switch.

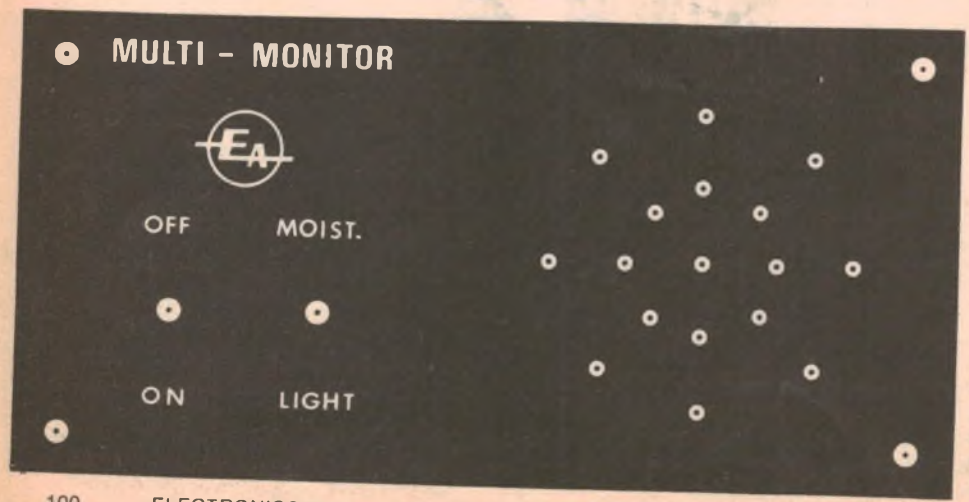
We used a plastic box for the prototype, one of the range of "Zippy Boxes". The one we used was type UB-3, and was purchased from Radio Despatch Service, in Sydney, but this type is also available from Dick Smith Electronics, as well as other component suppliers. The overall dimensions are 130mm x 68mm x 41mm.

We made a front panel for the unit using artwork and aluminium "Scotchcal" material. Copies of this artwork will be distributed to those firms which have requested them, or readers may purchase a dyeline copy for $2.00. We have also reproduced the artwork full size and readers may use this as a template for the panel, or as a temporary label, protected by a piece of transparent plastic.

If a "Scotchcal" panel is used it should be stuck to the front panel of the box, then drilled. The holes in front of the speaker may be about 4mm and the switch holes are 6.35mm. The terminals for the sensor cable mount on one end of the case, as shown in the photograph. The speaker is attached to the front panel by contact adhesive.

The printed board has been provided with four mounting holes so that it can be screwed to the base of the box, but this is not the only method that can be used to mount it. Another mounting

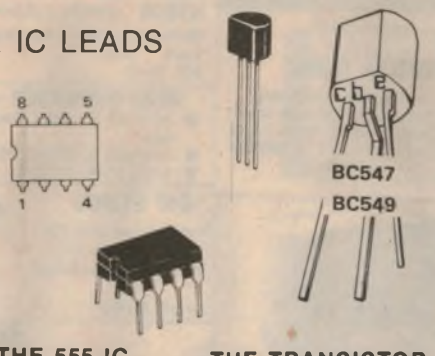
Here is a full size reproduction of the front panel artwork.



IDENTIFYING TRANSISTOR & IC LEADS

THE TRANSISTOR is a polarity sensitive device and must be connected the right way round. The collector, base and emitter leads are arranged according to the diagram at far right.

Pin 1 of the 555 timer IC is located adjacent to the notch (or dimple) at one end of the plastic package, as shown in the diagram at right. Note that the diagram shows the device as viewed from the top of the package.



suggestion is to use double sided foam tape, available from most hardware stores off the "Selleys" product racks. This same method can be used to provide a fixed mounting for the battery.

Once the unit has been fully assembled, place the mode switch in the light sense position and switch on the power. A high pitched sound should be heard from the speaker. Switch off, and connect the LDR module. Turn the trimpot on the LDR board fully anticlockwise, and place the board under a table lamp or other source of bright light. Turn on the unit and no sound should be heard from the speaker. Turn off the light and there should be a tone from the speaker. If there is no tone the light level is not low enough. Place your hand over the LDR and this should start the oscillator. If necessary, adjust the 4.7k trimpot to suit the light levels.

Connect the moisture sensor to the unit and place the mode switch in the moisture sensing position. Turn on the power and no sound should be heard at the speaker. Now place a drop or two of water onto the board and the 1kHz tone should be heard.

Earlier, we suggested that the light sensing function might be inverted, so that the alarm sounds when the light increases. To do this we use an arrangement similar to Fig. 1. The LDR connects in place of the moisture sensor and, because the LDR never becomes an open circuit, we must reduce the bias resistor from 150k to about 18k.

We also hinted that the system is not necessarily confined to sensing light or moisture. The basic unit can be used with any sensor which exhibits variable resistance over a sufficient range. For example, temperature dependent resistors may be tried, and could result in a simple temperature sensitive alarm.

But we leave these ideas to the reader to investigate for himself. Now that you have built the unit you will no doubt find dozens of applications for it. Apart from being an enjoyable and satisfying project, it should also help you understand more about circuit theory and practical construction. And, on top of that, it may well find a useful application around the home.

A full size reproduction of the three artworks for the PCBs.

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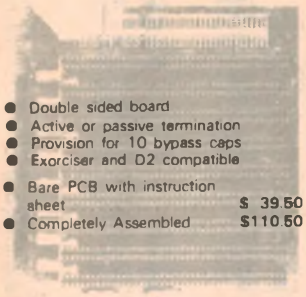

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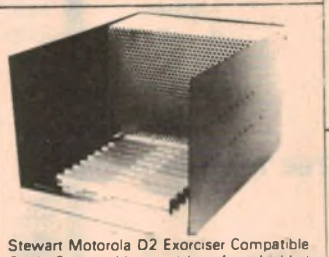
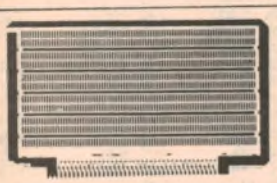


Stewart Motorola D2 Exorciser Compatible Card Cage with provision for shielded power supply. See E.A. Feb 1979 for full details shown with our 9 slot mother board fitted. Cage complete with 18 card guides $39.50



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16 PIN	37	74
18 PIN	32	90
20 PIN	37	1·20
22 PIN	43	1·20
24 PIN	48	1·30
28 PIN	56	1·82
40 PIN	63	1·96
60 PIN	1·35	

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8228	9.10	6820	5.50
9238	9.10	6821	6.50
8251	10.75	6828	9.60
8253	26.40	6840	15.00
8253-5	27.70	6850	7.50
8255A	8.60		
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New 80-column line printer is bi-directional

A new 80-column line printer is now available from Southwest Technical Products. The printer offers bidirectional printing, sprocket feed, a printing speed of 125 characters per second and the ability to use fan-fold paper of any width between 4 and 9 inches. These features should make it ideal for use with microcomputer systems.

by JAMIESON ROWE

The new printer is actually made in Japan by C. Itoh and Company, a well-known and respected firm who make a wide range of printers and similar equipment. The model PR-80 is a microprocessor-controlled dot matrix printer, which uses modern solid state technology to simplify the printer mechanics and provide greater reliability.

Housed in an attractive case of impact-resistant plastic, it measures 449 x 375 x 185mm and has a mass of 10kg. It has a maximum power consumption of 80W and draws only 7W when idling. The top half of the case hinges upward for paper threading and maintenance.

Inside the case the mechanism is sturdy and remarkably simple. Paper feed is via a solenoid and ratchet, while a single motor drives the 7-needle printing head back and forth across the paper via a toothed belt and precision spiral cam. Head position sensing is performed by opto-electronic sensors, for maximum reliability.

The operation is fully controlled by a microprocessor and associated electronics, for bidirectional printing at a maximum speed of 125 characters per second. The rated throughput speed is 60 lines per minute, while linefeed speed is 10 lines per second. Two character widths are provided: 10 per inch and 5 per inch, with only 40 characters per line at the larger width.

The electronics provides an 80-character line buffer, and responds to a number of function codes. These include codes for programmable vertical tabulation, form feed, normal/wide characters and vice-versa, select and deselect. Also provided is a manual self-test facility, whereby the printer electronics generates a continuously-cycling stream of alpha-numeric characters.

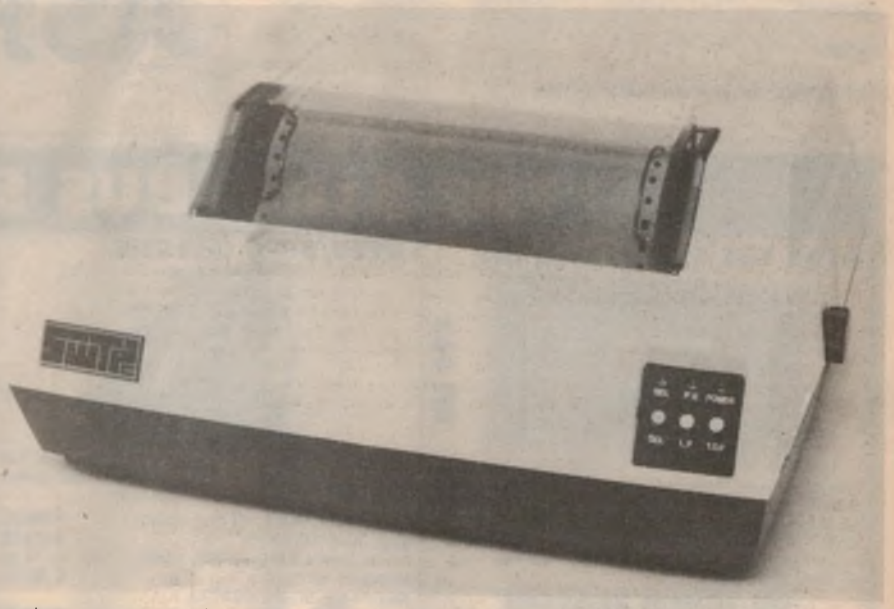
The printer is available fitted with either a parallel Centronics-type data input interface or a serial RS232C/TTY interface. It accepts normal ASCII code, and prints both upper and lower-case alphabetic characters (96 characters in all). The lower-case characters fit within the same 5 x 7 matrix as the upper-case characters — i.e., they are translated so that the risers and descenders fall within the upper-case matrix.

A control panel on the front of the printer provides an indication of its status and also allows some manual control. The panel has LED indicators showing power on, printer selected status and paper supply status, along with a manual select button, a line feed button and a "TOF" button which causes the paper to be fed up to the top of the next programmed form field. The LF button is also used to generate the self-test function, when used in conjunction with the power switch.

Actually the printer may be operated in either bidirectional or unidirectional modes, the mode being set by an internal switch which is easily accessible when the case lid is hinged up. Another internal DIP switch allows control over CR, LF, VT and SO functions if desired. A power interlock switch is fitted, so power is removed from the printer when the case is open; this is a worthwhile safety feature.

The printer uses fan-fold perforated paper in any width from 4in to 9in (102mm to 229mm) between perforations. The paper thickness may be from 0.05 to 0.28mm, allowing up to three carbon copies to be made along with the original. Paper may be fed in from either the rear or the bottom of the case.

The printer pictured was provided by Paris Radio Electronics, the Australian representatives for Southwest Technical Products, for our evaluation. We found it to be a well-made and nicely finished product, and one which should work well with a variety of microcomputer systems. It produces clear printout, and does not make excessive noise — although like most line printers it isn't exactly quiet.



Moderate in cost, the PR-80 offers printing at 125 characters per second.

In short, the SWTP model PR-80 line printer seems good value at the quoted price of $950 plus tax where applicable. If you're looking for a reasonably-priced printer, it's well worth considering.

Further information is available from Paris Radio Electronics, PO Box 380, Darlinghurst NSW 2010, or telephone (02) 31-3273.

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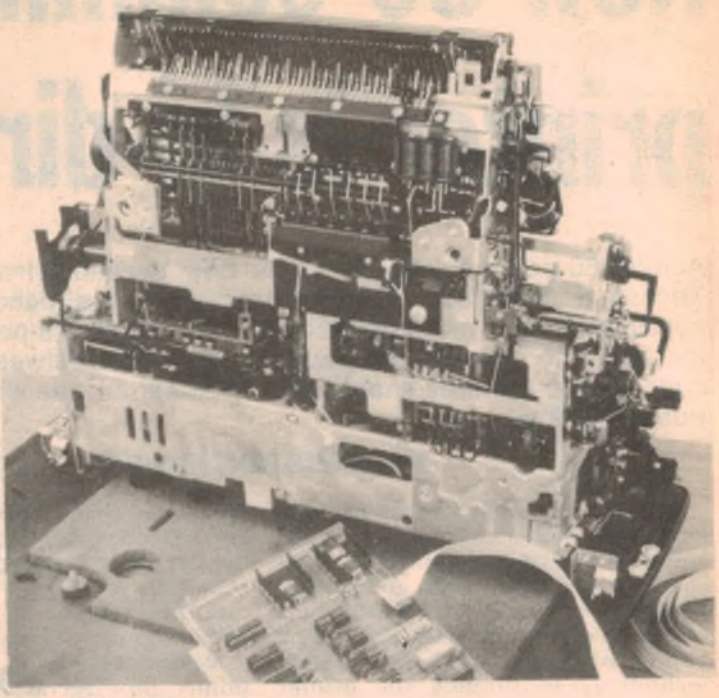

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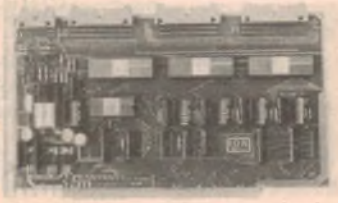

9 Parallel Ports (programable). 1 Serial Port-TTY RS232 or TTL. Baud rate generator 9600 to 75. fully address decoded. low power buffers. plated thru holes solder mask.
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Microcomputer News & Products

TI finally unveils its personal computer

After months of rumour and anticipation, Texas Instruments finally unveiled its home/personal computer at the Chicago Consumer Electronics Show, in June. Called the TI-99/4, the machine consists of a keyboard console mating with a 33cm colour video monitor. The CPU uses TI's powerful 16-bit 9900 microprocessor.

Inside the machine is 16K of RAM and 26K of ROM. Built-in firmware includes a 14K byte extended BASIC interpreter, graphics language interpreter and monitor.

Built-in hardware features include a five octave music generator capable of generating three tones and a noise signal simultaneously; interfacing for up to two audio cassettes; graphics in up to 16 different colours; and an optional voice synthesiser peripheral based on TI's "Speak-N-Spell" technology. Joystick-type remote controls are also available, as is an RS-232C interface.

The keyboard console is provided with a slot, into which may be plugged ROM modules containing applications firmware. TI has announced a big range of these modules, and is apparently committed to continuing development in this area. Current modules include home finance management, household budget, maths and grammar tuition, and games like football, video chess and video graphs.

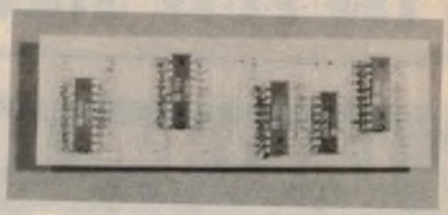
Retail price in the USA is around $1150, with the plug-in ROM modules from $20 to $70 each. The speech synthesiser peripheral sells for a further $150. Prices in Australia are expected to be higher, perhaps around $1650 for the basic machine. It is hoped that a sample will be on display at this month's Melbourne Computer Show.

Melbourne Show

This year's Melbourne Computer Show is being held at the Exhibition Buildings, on 27-30th of this month (September). It will be open from 10 am to 6 pm on the Thursday, 10-8 on the Friday, 10-10 on the Saturday and 10-8 on the Sunday. It is anticipated that it will be even bigger than the Sydney show in May, which had 38 booths and some 13,800 visitors.

Among the exhibitors will be Computerland, Futuretronics, Dick Smith Electronics, Tandy, Hanimex, TCG Systems, Abacus, Adaptive Electronics, ASP Microcomputers, Philips, Anderson Digital Equipment and Warburton Franki. Futuretronics hopes to have the Voice Chess Challenger on display, while it is not certain who will have the new TI home computer. Computerland plans to have the 11-Megabyte hard disc for their Apple-II plus, and Dick Smith their new System-80.

Further information is available from show organisers Australian Seminar Services, 10/14 Queens Rd, Melbourne. Telephone (03) 267 4311.



D2 memory expander

A memory expansion module designed for the Motorola MEK6800D2 evaluation kit has been announced by Raydata. The 2KD2 module is designed to plug into the four existing RAM sockets on the D2 kit PCB, in place of the original ICs, and to expand the RAM from 512 to 2048 bytes. It uses 300ns static memory chips and has an on-board decoder so that the expanded memory occupies the address range 000-7FF.

The 2KD2 is based on a fibreglass PCB and comes fully assembled and tested

Microcomputer News & Products

with instructions for $39.95. This includes post and packing.

Further information from Raydata, Box 477, Gosford NSW 2250.

Fans from Japan

Paris Radio Electronics have available a range of "muffin"-type cooling fans, made by the Japan Servo Co Ltd under licence from Rotron Inc. The fans are available in either 115V or 240V types, and in either the 10W "Wafer" size or the 6W "Pixie" size. All models are very quiet and reliable in operation, and are ideal for cooling computer equipment.

Price of the fans is $25.80 for each size. Enquiries to Paris Radio Electronics, PO Box 380, Darlinghurst, NSW 2010. Telephone (02) 31 3273.

Chess Challenger wins battle of computers

One of the features of the recent Home Computer Show in Sydney was the "Australian Computer Chess Championships", which were conducted by the NSW Chess Association. There were four entrants, all eagerly goaded by their operators in an effort to win the coveted title of top chess-playing computer. Tandy Electronics had a TRS-80 (16K Level 2) running a Sargon program; Computerland an Apple II (24K), also running a Sargon program; Programmable Caculator Sales had a 16K Commodore PET, running a Microchess program; and Futuretronics had a model 7 Chess Challenger — the only dedicated chess-playing machine.

The games were played over a number of days, and were not without their problems. The TRS-80 had program loading problems, while the Apple persisted in making the odd illegal move! Once or twice havoc was also caused by a spectator pressing a machine's reset button.

Perhaps the results were predictable: Chess Challenger won, with a score of 3. The TRS-80 came next, with 2, and the PET third with 1. The Apple was (s)-coreless!

CLUBS UPDATE
(Continued from last month)

NEWCASTLE. Newcastle Microcomputer Club. Meetings are held at 7pm on the second and fourth Mondays of the month in room G03 of the Engineering building at the University of Newcastle, Shortland. Further information from Brian Hill, 5 Kalinda Street, Blacksmiths, NSW 2281.

NEW ENGLAND. The New England Computer Hobbyists Club. Membership is by no means limited to students, and enquiries are invited. Further information from Colin Kemp, secretary New England Computer Hobbyists Club, University of New England, Armidale, NSW 2351.

GEELONG. Geelong Computer Club. Meetings are held on the second Thursday of each month at Tybar Engineering, Hampton Street, Newtown, Geelong Victoria. Further details from Ian Stacey, PO Box 93, Geelong Vic. 3220.

TOOWOOMBA: Darling Downs Microprocessor Group. Meetings are held at 8pm on the first Tuesday of the month at the R.M.C. Theatre, Darling Downs Institute of Advanced Education. Further information from Ken Griffiths, School of Business studies, DDIAE c/-PO Darling Heights, Toowoomba 4350.

TOWNSVILLE. Microprocessor Special Interest Group, associated with the Townsville Chapter of the Australian Computer Society. Meetings are held monthly. Further information from the secretary, Peter Quodling, MICSIG, ACS, PO Box 82, Aitkenvale, Qld 4814.

2650 USERS' GROUP. Further information is available from Applied Technology Pty Ltd, 109-111 Hunter St, Hornsby, NSW 2077.

2650 ENTHUSIASTS' GROUP. Further information is available from Bruce Riley, 15 Salisbury Street, Wangaratta, Victoria 3677.

TRS-80 USERS' GROUP. Meetings at the Tandy store, Adelaide, on the first Thursday in the month. Details from R. G. Stevenson, 34-36 Sturt Street, Adelaide SA 5000.

TRS-80 USERS' CLUB. For further information contact Pitt St Microcomputer Shop, PO Box 105, Marrickville 2204.

APPLE-2 COMPUTER USERS CLUB. Further information is available from Computerland Pty Ltd, 55 Clarence St, Sydney 2000.

SORCERER USERS' CLUB. Details from Frank Schuffelen, 66 Porter Street, Templestowe, Victoria 3106.

NEW ZEALAND MICROCOMPUTER CLUB. Meets monthly at 7.30pm on Wednesday evenings in E block staff room, Auckland Technical Institute. Mail address Box 6210, PO Auckland.

WELLINGTON MICROCOMPUTER CLUB. Mail address Box 1581, PO Wellington, NZ.

CHRISTCHURCH. Contact Paul Campbell, 50 Francis Ave, Christchuurch, NZ.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

di & Telemann: a pleasure to hear

. Concerti in D minor .100) and C minor (F.I.No.12). Stern, violin and conductor; -Pierre Rampal, flute.
AANN: Suite in A minor. Jean-erre Rampal, flute and conductor. erusalem Music Centre Chamber Orchestra. CBS Stereo disc SBR 235958.

The two Vivaldi concerti on this record were originally scored for two violins, but the substitution of a flute for one of them is quite acceptable. It would have been accepted without a murmur in Vivaldi's day and tends to add interest to the music. I have yet to hear a Vivaldi concerto that is less than inventive and attractive and these two are no exception, following the usual fast-slow-fast pattern, with some brilliant work for the soloists. Hearing Stern again after a break of a few years proved to be a considerable pleasure.

I suspect that purists will not be entirely happy with these performances — if for no other reason than the brilliant modern sound of the strings. As far as I am concerned, both Stern and Rampal are splendid. They blend quite wonderfully well and the orchestra (as far as I know, an ad-hoc ensemble) are excellent. Of special interest are the acoustics of the venue used for this recording: the Jerusalem Music Centre, completed in 1975, provides superb facilities for recording and film making. Unlike most recent halls, it does not produce a clinically dry sound and its timber panelling seems ideal for baroque music.

Telemann does not come off quite as gloriously as did Vivaldi. Possibly Mr Rampal should have retained the assistance of a conductor; whatever the reason, the balance is less convincing on this side of the disc. There seems to be some bass bias, possibly caused by restraining the higher strings in order to boost the flute, possibly because the fiddlers were not quite up to the mark. Also, there are some problems with tempi; the lovely "Rejouissance" is so fast as to almost come unstuck and the "Passepieds", which starts out at quite a respectable speed, sutters considerable acceleration.

This Telemann Suite is extremely popular with good flautists and I find eight other versions currently listed. My own preference is for the late David Munrow's performance on recorder (the instrument the work was written for) with the Academy of St Martin-in-the-Fields under Neville Marriner. As far as Mr Rampal's playing is concerned, I can find not the least fault and loved every moment of it, but perhaps he should not have conducted? In any event, this is a wonderful disc in many ways, well engineered and a great pleasure to hear.

☆ ☆ ☆

SCHUBERT: Masses in G major (D.167) and C major (d.452). Erika Falter, soprano; Elisabeth Kinsky, contralto; Franz Donner and Adolf Tomaschek, tenors; Leopold Spitzer, bass; Chorus and Orchestra of the Church of St Augustin, Vienna; conductor Friedrich Wolf. Fontana stereo disc 6598 940.

That this record should appear here at all is rather curious; Schubert's liturgical work commands very little respect among critics. These two Masses were written when the composer was only about 18 years old and they are no more than "occasional" music, written to fill an immediate need and surely with no thought that they might still be sung 165 years later! In any event, the annotations (in German only) to this disc from the Netherlands are condescending, not to say derogatory.

From the foregoing it should be obvious that no-one ought to expect much; this impression would be strengthened by the fact that a small church orchestra has been used for the recording, together with little-known soloists and conductor. All of these things put together would indicate an almost unsaleable product. I do hope that sufficient listeners will hear the disc before deciding against it — because all these negative indicators are pretty unreliable!

It would be nonsense to claim that these Masses contain great music, even that they contain some of Schubert's best. This is good church-music of its period, tailored for performance by a congregation rather than by professionals; but it is good church music! Even more to the point: here is one of those rare occasions when we can really hear what a fine rococo church offers its worshippers acoustically.

The organ (and it is a very fine one), the solo voices and the choir sound quite exquisite and there is near-perfect balance between them and the small orchestra. If it is true that there is no great music on this disc; it is equally true that it contains some of the most beguiling sound I've heard for many a day, matched by flawless recording and quite excellent singing by all concerned.

Dvorak: Piano Quintet in A

DVORAK: Piano Quintet in A, op. 81. The Cleveland Quartet with Emanuel Ax, piano. RCA Red Seal stereo disc ARL 1-2240.

The first thing I feel constrained to say about this disc is that it fails to give value for money. There has been at least one other instance (in the early days of LP) when this quintet was made to occupy a whole disc, but there really is no excuse for this kind of thing now. On side two, there is a total of 12 minutes and 13 seconds of music. As against this, the older HMV recording

Reviews in this section are by Paul Frolich (P.F.), Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

by the Smetana Quartet occupies one side and the whole of the quartet op. 96 has been fitted on the reverse side.

In the case of a truly first-rate performance (such as that by the Smetanas), a little commercial buccaneering might even be forgiven. This performance, alas, leaves quite a lot to be desired.

The quality of recorded sound is wholly adequate and the balancing has been done with great skill — the technical people have clearly done their job efficiently and well. What trouble there is must be put at the doors of the various people involved in the musical side. Perhaps characteristically, an attitude of some disdain has carried over even into the sleeve notes which, other infelicities apart, patronisingly describe the composer as one who "suffered from middle-class ailments".

Unfortunately, the participants in the quintet seem to have avoided the middle-class traditions of adequate rehearsal and of respect for the composer's score. Throughout the work, there occur instances of coarse and undisciplined playing in the strings, percussiveness in the pianism, lack of ensemble bordering on utter disorder, and wild changes in tempi without any motivation.

Reading the notes, I learnt of Mr Ax' impressive list of competition wins — proof yet again that competitions disclose little about innate musicianship. In any event, there's more to playing with a string quartet than just playing the piano well.

As I had been overseas when The Cleveland Quartet toured Australia, I was determined to disregard the rather gloomy reports I'd had heard about them. On the strength of this record, the only one of theirs to have come my way, I certainly would not be tempted to engage them for Australia. They are far below the level of the young Sydney String Quartet, and Australian listeners may fairly judge highly publicised imported groups by the standards of the domestic product.

☆ ☆ ☆

MOZART: Complete Songs. Elly Ameling, soprano & Dalton Baldwin, piano. 2 Philips stereo discs in album 6747 483.

Although the above is what appears on this album, at first sight, the following must be added: in two of the songs, really church hymns, Mr Baldwin plays the organ instead of the piano. In a further two of them (K.349 & 351) Miss Ameling but, very properly, by Ludemann on the mandolin. Finally, K.539 and 552 are not sung by Miss Ameling but, very properly, by Meinard Kraak, a fine tenor — the words, in these instances, would have sounded odd coming from a soprano!

These additions to the cast were made necessary by the set purpose of having all of Mozart's songs for solo voice on one set of records; whether this was particularly wise or desirable is another question.

Miss Ameling is a very fine singer and Mozart was a very great composer, but neither of them is ideally served by this set of (admittedly well-made) records. Not surprisingly, some of Mozart's songs, particularly the early ones, are trifles in every sense of the word, so quite a few of them rarely get an airing nowadays, even as encores. Of the total of 39 tracks here recorded, one would probably not wish to listen to more than seven or eight repeatedly.

The singer, on the other hand, is one known more for artistry than for temperament or strong character. In her version, too many of the songs are made to sound alike in tempo and style; this impression is strengthened by Miss Ameling's diction which is rather blurry, except only in K.152 and 579 which are sung in Italian. Neither her German nor her French allow one to follow the texts with ease.

I hasten to say that Miss Ameling sings very beautifully indeed and is wholy admirable in some of the more romantic items, such as K.523 ("Abendempfindung") or the Arietta of K.579. On the whole, however, she apparently tries to simulate animation by speed and almost each one of the naturally slower songs is taken at far too great a tempo. She is well accompanied and abetted by Dalton Baldwin who, as is his wont, keeps very much to the background and fails, I think, to assert himself as a full partner except once or twice.

I suspect the truth is that, in recent decades, we have been so spoilt by superlative recitals (Schwarzkopf, de los Angeles, Ludwig, Baker to name some of the best) and assertive accompanists such as Moore and Parsons, that the very good is simply not quite good enough.

POPULAR & SPECIAL INTEREST

Audio Symphony: a disc to challenge hifi systems

AUDIO SYMPHONY No. 2. Check up on your sounds. Stereo, RCA RVL-2. (From M. R. Acoustics, PO Box 165, Annerley, Qld 4103).

This album is about as far removed as it could be from the present-day concept of a "purist" recording. The NHK Symphony Orchestra was arrayed in one studio, with intervening screens and the best part of 30 microphones. A modern rock style group were in another studio, with 10 microphones, one direct pickup and a TV monitor to allow them to watch the conductor.

All this was brought together through two separate mixing consoles to produce a 16-track 30ips master tape. Later, this was mixed down to a 2-track stereo master, with contributions from a time delay loop and two echo machines to add the "concert-hall" ambience that was lacking in the recording studios!

Despite the shattering of every purist rule in the book, the sound is full bodied and clean, as evidenced by the fact that RCA released it only last year as a disc intended to challenge and demonstrate hifi systems.

And the music? Well there are two "Audio Symphonies" by Japanese composers, intended simultaneously to entertain and to expose instrumental sounds, solo and en masse. To guide the listener, a booklet with the disc carries segments of the score and pointers as to what to listen for. I should warn that you'll need to work at it if your going to cope with the score and the mix of Japanese and English information.

You will undoubtedly listen to both sides but my guess is that the most played track will be the last one — an orchestral arrangement of "Bridge Over Troubled Water". You can demonstrate the sounds and the dynamic range to your friends without condemning them to lengthy explanations. (W.N.W.)

☆ ☆ ☆

ONE MORE DAY. Percy Grainger, recorded from Duo-Art piano rolls. Folk Music arrangements. Stereo, Larrikin Records LRF 034. (PO Box 162, Paddington, NSW 2021).

This has to be an interesting album in its own right. A booklet accompanying the album emphasises Percy Grainger's keen interest in folk music, and the degree to which he shared this interest with others, such as Evald Tang Kristensen and Edvard Greig. It explores his abilities as composer, arranger and performer, as well as his long association with the Duo-Art recording piano.

The Duo-Art technology retained a

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by BILL EDGE ELECTRONIC AGENCIES

These Economy Kits have everything electrically to build "EA" projects but do not contain miscellaneous items — in other words items which hobbyists have probably got lying around the workshop anyway — like wire, solder, nuts and bolts etc. In some cases no front panels are included as they can usually be made by using Scotchcal or Letraset with great savings. In this way projects have a bit of individuality, and we are able to stock a fairly large variety of kits. Full instructions provided with each kit.

115-117 PARRAMATTA ROAD, CONCORD 2137 PHONE 747 6472
Trading Hours: 9am — 5.30pm Mon-Fri/9am — Noon Sat/10am — 2pm SUNDAY

Fully protected dual power supply

This new dual power supply uses only a few ICs but provides accurately matched output voltages from ±5V to ±15V and currents up to 1.5A. The supply has excellent regulation characteristics and the outputs are protected against short circuits and thermal overloads.

E.A. JULY 79

$60.45

Here is what you get . . . everything on the parts list of page 44 E.A. July '79, with exception of nuts and bolts, front panel markings, grommet, cable clamp, termination block, solder lugs, hook up wire.

Masthead amplifier for TV and FM

E.A. August '79

While a very high proportion of Australians are said to be able to receive television broadcasts, many people do not enjoy the full benefits of our high quality PAL system because they are plagued with poor reception. If you are one of these people, then this handy masthead amplifier could be the solution. You can also use it for FM and UHF reception.

The amplifier is built in two parts. The diecast box is installed at the masthead, while the power supply box (right) can be attached to the back of the TV set.

ONLY **$26.47**

. . . and all you have to supply is your labour, a bit of solder and 75 Ω coax cable and a 300 Ω /75 Ω balun (if required) . . . excellent value as made up amps are around $40.

Based on the 555 timer IC.

Square wave oscillator

A simple circuit for checking audio gear & for IC experiments.

Only **$7.90**

(Page 76 E.A. Aug '79)

Here's an ideal project for beginners: a really simple and easy to build multi-frequency square wave oscillator. The parts will cost you less than $10 and you should be able to put it together in one evening. But you can use it for all sorts of things — from testing amplifiers and radios to experimenting with digital ICs.

If you can obtain a 9 volt battery, a couple of feet of hook up wire we'll supply the rest (lettering for front panel not included).

IMPEDANCE BRIDGE August E.A. '79

Complete set of parts as per parts list in E.A., with exception of label and batteries — miscellaneous items including cable, wire, solder lugs, nuts and bolts, brass for partition etc not supplied.

Bridge checks impedance, resonance, and SWR

Kit price only

$35.94

If you are involved in building and testing antennas, you are probably already aware that the simple tape measure and SWR approach leaves something to be desired. A useful addition to these basic tools is an impedance bridge — a device which can provide valuable data about an antenna, is simple to build, and which need not cost a fortune.

Fourth prizewinner of the EA-Parameters project competition

only **$28.95**

Excellent Value

Antenna tuning unit covers all HF bands

Everything on parts list (page 51, July '79 E.A.) supplied with the exception of the following: angle brackets, u-bolts, nuts and bolts, H.V. wire, coax cable, grommets, tape solder lugs.

Accurate frequencies from 4kHz to 2MHz!

Quartz multiple frequency reference

Kit price

$59.58

This relatively simple unit will give any of a series of accurately controlled reference frequencies, derived from a 2MHz crystal via a switched binary divider arrangement. A large number of frequencies is possible, ranging from 2MHz to just under 4kHz.

Absolutely everything supplied on parts list on Page 61 E.A. July '79, except miscellaneous lines — wire, solder, front panel markings, solder lug, screws, grommet etc.

High performance model train controller
by PETER STUART*
E.A. October 1978

Only **$45.35**

Utilising pulse width modulation techniques, this high performance train controller is designed to overcome the limitations of conventional controllers. Its main features include reliable starting and low speed running, a Westinghouse "air brake" (with optional air sounds), simulated inertia, and a speed indicating meter.

Everything supplied as per parts list Page 43, October '78 "Electronics Australia", except for 12 volt 60/45w auto globes, perspex sheet — miscellaneous items not supplied either as they are not essential to the electronics of the kit and most hobbyists have wire, solder, nuts and bolts etc. and hence save a little money.

Sound effects for model trains *March '79 E.A.* **"WHAT A GOOD IDEA"**

Designed to mate with the "High Performance Train Controller" featured in October 1978, this versatile sound effects unit should really gladden the hearts of model railroaders. It can realistically simulate the sound of both steam and diesel locomotives, the sound of air brakes being released, and even includes steam whistle and diesel air horn sounds!

SAVE MONEY

Kit price only **$35.73** including instructions

All parts fully guaranteed.

Everything supplied . . . case, printed circuit board, speaker, switches, plugs and sockets, semiconductors, resistors, pots, capacitors as per "Electronics Australia" parts list on Page 47, March issue . . . miscellaneous items not supplied; as they are not essential to the electronics of the kit and most hobbyists may have their own wire, solder, scrap metal, nuts and bolts.

10 Watt rms per channel . . . (less metalwork, knobs, power TRF) . . . a fantastic buy for only **$19.90**

— See E.A. August '79 for review. This amp is suitable for crystal/ceramic cartridge input. Can be run from magnetic cartridge with addition of preamp (preamp kit $8.50) . . . preamp can be powered direct from rail voltage of amp (diagram provided). Transformer (specially wound for this amp) only **$8.50**.

"THE MINICOLOR"
music to light converter kit

only

$49.90

FEATURES

- One control operation
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(Dimensions 160x100x125mm)

SPECIFICATIONS

Input sensitivity 500mV. Lamp load up to **1800 WATTS**. Preset frequency division: Bass 15 to 250Hz, middle 250 to 1200Hz, treble 1200 to 5000Hz.

It will suit almost any audio amplifier — you don't have to be technically inclined to get the machine working as all the hard part has been done for you and is completely guaranteed.

Coloured 100W spot floods B.C. — red, green, yellow, blue — only $5.99 ea. or $4.99 ea. for purchases over 5.

Standard base for lamps $1.10ea

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Heavy items sent freight on thru' carrier

substantial amount of the original expression so that the "performance" as recorded by the ABC in 1977, would not be too far removed from Grainger's original performance around 1918. The seven tracks include:

Jutish Medley (Danish, by Grainger) — Norwegian Folk Songs, Op.66 (Greig) — From "Cowboys" and "Old Fiddler's Breakdown" (Guion) — Irish Tune from County Derry (Grainger) — One More Day My John (Sea Shanty, Grainger) — Brigg Fair, An English Rhapsody (Delius, arr. Grainger) — Irish Dancers (Stanford, arr. Grainger).

According to the jacket notes, the ABC used a Steck Boudoir Grand to make the recording, and while the sound is clean, it does lack sparkle and ambience, particularly on side 1. Perhaps I listened to it too soon after Malcom Frager's performance on the Bosendorfer Grand Imperial (reviewed last month). But, even allowing that reservation, it is still an interesting album. (W.N.W.)

WALTZING MATILDA. Lionel Long, with the Noel Gilmour Sextet and The Delltones. Stereo, World Record Club W.R.C. — S/5467.

If you prefer folk ballads sung in the new accents of the Australian bush, you possibly won't like this performance by Lionel Long. As for this reviewer I'll take Lionel Long, any day, with his excellent diction, his smooth voice production and yet his ability to capture the basic mood of the song. I find it just so much more listenable. The twelve songs, all Australian compositions are:

Reedy Lagoon — The Old Bullock Dray — Moreton Bay — The Drover's Dream — Click Go The Shears — The Wild Rover — Botany Bay — Rush Away — Ring A-Ling — The Ballad Of Cobb And Co.

Full marks go to the backing groups for an accompaniment that is adequate without ever being intrusive. The quality, too, is fine. If you have a place in your collection for some polished Australiana, this is a good one. (W.N.W.)

☆ ☆ ☆

THE SKY IS BLUER IN SCOTLAND. Glen Daly. Astor PKL 5575.

An easy to listen to dozen familiar titles makes up the content of this record, originally from the Pye studios in London, with mostly a Scottish theme. The titles are: The Sky Is Bluer In Scotland — The Old Rugged Cross — What Do You Want To Make Those Eyes At Me For, Oh You Beautiful Doll — Eileen Oge, I Met Her In The Garden Where The Praties Grow — My Scottish Homeland — After The Ball Was Over, I'll Be Your Sweetheart, The Sidewalks Of New York — My Irish Jaunting Cart — Nellie Dean — The Heart Of Scotland, The Lang Road Back Hame — Down At The Corner — My Ain Folk — Blackboard Of My Heart.

The quality is good but I do wish sleeve note writers would take a vow of modesty before they sit down at the typewriter! (NJM)

MAX BYGRAVES, 20 All Time Favourites. Astor TVS 1010.

With the backing of Geoff Love's Orchestra on most of the tracks, Max Bygraves sings along in his usual effortless style 20 well known hits. Some of them are: Whispering Grass — Delilah — Walk Right Back — Memories Are Made Of This — Strolling — Fly Me To The Moon — Cruising Down The River — When I Lost You — Are You Lonesome Tonight — Consider Yourself. Although most of the songs go back a long way, the orchestral arrangements are up to date, giving the record a "now" flavour. (NJM)

☆ ☆ ☆

BING SINGS SONGS OF THE ISLANDS. MCA 8847. Astor release.

Although Bing Crosby was well known for his Hawaiian records as well as his usual ballads, a record with no less than 20 tracks in the same idiom is a little hard to take, unless you want a record to overcome insomnia.

However, considering the vintage of the original recordings, the overall quality is surprisingly good. Some of the titles are: Song Of The Islands — Beyond The Reef — South Sea Island Magic — The Moon Of Manacoora — Sweet Hawaiian Chimes — Moonlight And Shadows — Sing Me A Song Of The Islands. (NJM)

DIRECT-TO-DISC

SONG FOR SISYPHUS. The Phil Woods Quintet. Stereo, direct to disc recording. Century CRDD-1050. (From PC Stereo PO Box 272, Mt Gravatt, Qld 4122).

I may as well be frank and admit at the outset that, in terms of analytical appreciation, this album is well outside my spectrum. I am prepared to accept the verdict of those who know and understand the work of this "permanent" American jazz group: Phil Woods, saxophone; Mike Melillo, piano; Harry Leahey, guitar; Steve Gilmore, bass; Bill Goodwin, drums; Jill Goodwin, band manager.

Lengthy notes in the double-fold jacket were written by Don

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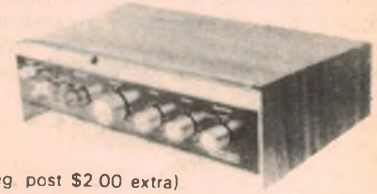

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Morgenstern, Director of Jazz Studies at the Rutgers University. He describes the players and the empathy that allows them to explore and invent, without "hyphens" and without concern for the mechanics of musical creation. He analyses their approach to the respective tracks and emphasises that this direct cut recording is a spontaneous performance, free from editing and patching.

The tracks: Song For Sisyphus — Last Night When We Were Young — Nuages — Change Partners — Monking Business — Summer Afternoon — When My Dreams Come True — Shaw Nuff.

Recorded in 1977, in the New York Studios of RCA, the actual pressing was done in West Germany for release in 1978. As you might imagine, the sound is very clean and you need have no worries on this score. But it is jazz for the student and the devotee, not the "commercial" type that is mass produced for the average audience — or average record buyer. (W.N.W.)

☆ ☆ ☆

THE SAGA OF "BATTLESTAR GALACTICA". MCA 3078 Astor release.

In contrast to the usual movie sound track record, where you need to see the film to appreciate the music, this release at least attempts to tell the story against the background of some of the sound effects that go to make a science fiction epic work. I sometimes think that the real stars of such movies are the special effects wizards, such as John Dykstra. Listening to this story, one gets the feeling that the author has had more than passing interest in Von Danekin's "Chariot Of The Gods". (NJM)

☆ ☆ ☆

ERICH KUNZ SINGS BEST LOVED GERMAN SONGS with the Vienna State Opera Orchestra conducted by Anton Paulik. Stereo, World Record Club S/5394.

A re-issue by WRC of one of the original Vanguard recordings made by world-famous German baritone Erich Kunz. If you've heard him before, you won't need to be told that it makes very pleasant listening. Kunz sings a selec-

Devotional Records

JOHN PAUL II. The People's Pope. Stereo, Image (Astor) ILP-803.

I didn't quite know what to expect of this album and, having listened to it, I am still not much wiser. It commences with a brief Papal blessing, spoken in English by the new Pope; side 2 carries another brief blessing in Polish, largely over-ridden by a perfunctory "translation" by an American commentator. Add a front cover portrait and a few newspaper pictures on the back and that is all there is about John Paul II.

The rest comprises two solos, "The Lord's Prayer" and "Ava Maria", and a group of inspirational pieces sung indifferently by a choir from a church in Wallington, N.J., USA: My Chcemy Boga (We Want God — Pod Twoja Obrone — Magnificat (Mozart) — Jezu Badz Zemna — Serdeczna Matko (Dearly Beloved Mother) — Veni Jesus Amor Mi — Maryja, Maryja — Pobiogosiaw Jesu Drogi.

Unless this has a special significance to you, pass it over. (W.N.W.)

☆ ☆ ☆

NEVER THE SAME. Evie. Stereo, Word WSB-8806. (From Sacred Productions Aust., 18-26 Canterbury Rd, Heathmont, Vic. 3135.)

Seen frequently on television, and as a soloist for the recent Billy Graham Crusade, blond charmer Evie is very well known in this country. You may be one of her fans — and she has many — or you may be happier with a more conservative style of Gospel song.

The program here is typical Evie material: modern, rhythmic, up-tempo, well arranged and well produced. The titles: Live For Jesus — Hold On — Special Delivery — Never The Same Again — This Life — Shine — At The River Of Jordan — Don't Run From Reality — Home — You Have Everything In Your Hands — Jesus I Love You.

The sound is clean, the lyrics are provided on a separate sheet and, if you like Evie's style, you'll like this one. (W.N.W.)

tion of traditional German songs, in his smooth and effortless style.

The recording is fine, so if missed out on the disc the first time round, here's your chance to try again. (J.R.)

☆ ☆ ☆

THE HISTORIC PAUL ROBESON. Three record set. Mono, Astor 959062.

This album will be a "must" for most of the many admirers of the late Paul Robeson, whether they want a record of his singing or simply a memento of a great artist and human being. It provides both, and does so very well except for one thing which I'll mention in a moment.

The records themselves trace Mr Robeson's singing career from the early days in musicals, through films and classical recitals, to spirituals and songs of the peace movement and the struggle for human rights. Just about all of his famous songs are there, including Lonesome Road, All Men Are Brothers, We Are Climbing Jacob's Ladder, Song Of Freedom, Going Home, Deep River, Sometimes I Feel Like A Motherless Child, Didn't My Lord Deliver Daniel?, and of course his most famous song of all, Ol' Man River.

Needless to say the recordings come from a number of eras in sound recording, and vary somewhat in quality. But generally speaking, those responsible for the new album have done a good job in transcribing them.

Now for the gripe. If you managed to see the excellent program on Paul Robeson's life shown recently on ABC-TV, you'll know just how much can be said about the energy, trials and achievements of this many-faceted man. You will therefore be disappointed, as I was, to find that the sleeves of this 3-record set carry only a meagre four-paragraph summary of his life, together with two pictures. Four of the six sleeve faces carry advertising for other albums!

What a missed opportunity. If only Astor had done a little more work, they could have produced a superb historical memorial to a great man — and one which I feel sure would have sold much better than will the present poorly documented effort (J.R.)

ROCK & ROLL . . .

NIGHT OWL. Gerry Rafferty. United Artists L 36799. Festival release.

"City To City", Gerry Rafferty's immaculate album of last year has, to date, sold over 4.5 million copies, undoubtedly due to the single "Baker Street". Raphael Ravenscroft, who played the haunting saxophone solo on "Baker Street" contributes to this latest album.

"Night Owl" contains many potential singles.

The 10 tracks on the album are: Night Owl — The Way That You Do It — Why Don't You Talk to Me — Get It Right Next Time — Take The Money And Run — Family Tree — Already Gone — The Tourist — It's Gonna Be A Long Night.

"Night Owl" picks up where "City To City" left off. (D.H.)

Gerry Rafferty

BREAKFAST IN AMERICA. Supertramp, A&M Records. L 36715. Festival release.

This sixth album release of Supertramp has already been one of the biggest selling albums of the year. It has been two years since Supertramp's last album release: "Even In The Quietest Moments". The ten tracks on "Breakfast In America" are: Gone Hollywood — The Logical Song — Goodbye Stranger — Breakfast In America — Oh Darling — Take The Long Way Home — Lord Is It Mine — Just Another Nervous Wreck — Casual Conversations — Child Of Vision.

Practically all of these tracks have received considerable air play on radio, so you've probably heard some of it in passing. (D.H.)

☆ ☆ ☆

CHANSON. Chanson. Ariola America Records SW 50039. RCA release.

This debut album is a combination of disco and rhythm-and-blues and featues the American disco hit "Don't Hold Back". The six tracks are: Don't Hold Back — I Can Tell — I Love You More — Why — Did You Ever — All The Time You Need.

Chanson are assisted by Boz Scaggs' rhythm section and Earth, Wind And Fire's Horns. Disco followers should have a listen to this one. (D.H.)

L. E. CHAPMAN

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1000 ohm. 5W. 20c
330 ohm. 10W. 25c
220 ohm. 5W. 20c
5 ohm. 5W. 20c
220 ohm. 10W. 25c
950 ohm. 3W. 20c
115 ohm. 5W. 20c
10 ohm. 5W. 20c
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6.8k ohm. 3W. 20c
330 ohm. 10W. 25c
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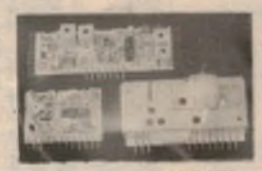

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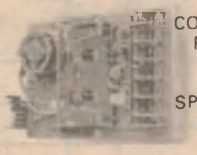

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Modifications for CMOS Die

The CMOS Die of April 1979 (File No 3/EG/11) contained two minor drawing errors, and a reader has also reported that it can develop a bias towards high numbers as the battery runs down. This note deals with both problems.

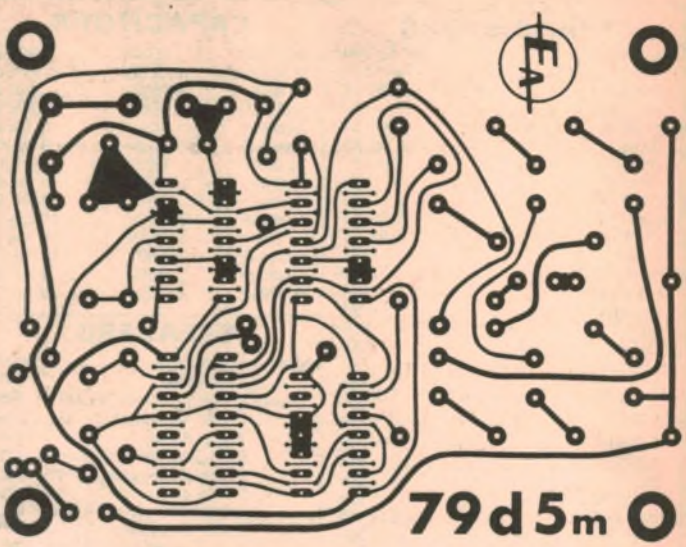
One error concerned the board pattern, whereby pin 2 of the 4017 was connected to pin 3 of 4001B/4, instead of pin 2. The other was a transposition of the pin numbers for 4017, on the overlay pattern. Both have been corrected on the accompanying drawings.

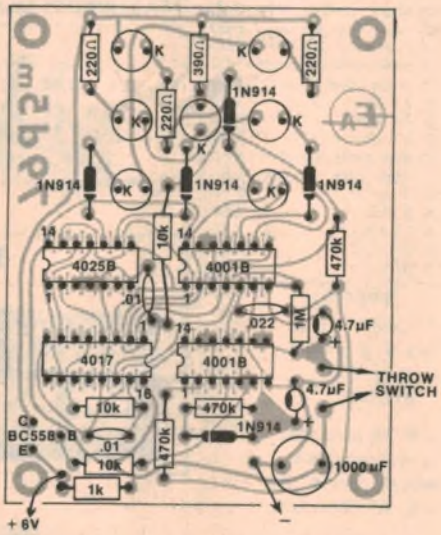
The high-number bias appears to be due to pulses from the display section coupling into the counting section, via the common battery impedance. The reader who reported this suggested sacrificing the "rolling dice" effect by removing the diode, 470k resistor, and C2 network. This approach is completely effective.

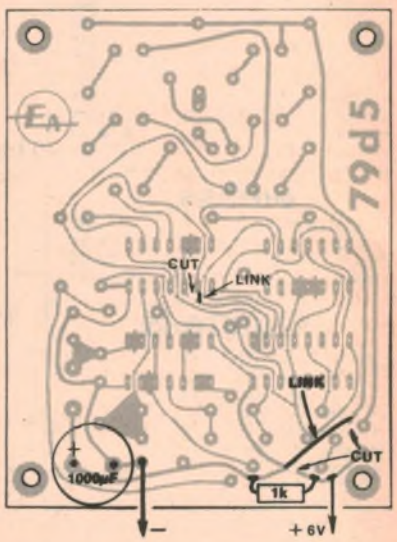
Alternatively, we can fit a decoupling network, consisting of a 1k resistor and a 1000uF capacitor. A modified board pattern (79d5m) with overlay is illustrated, and will take care of units yet to be built.

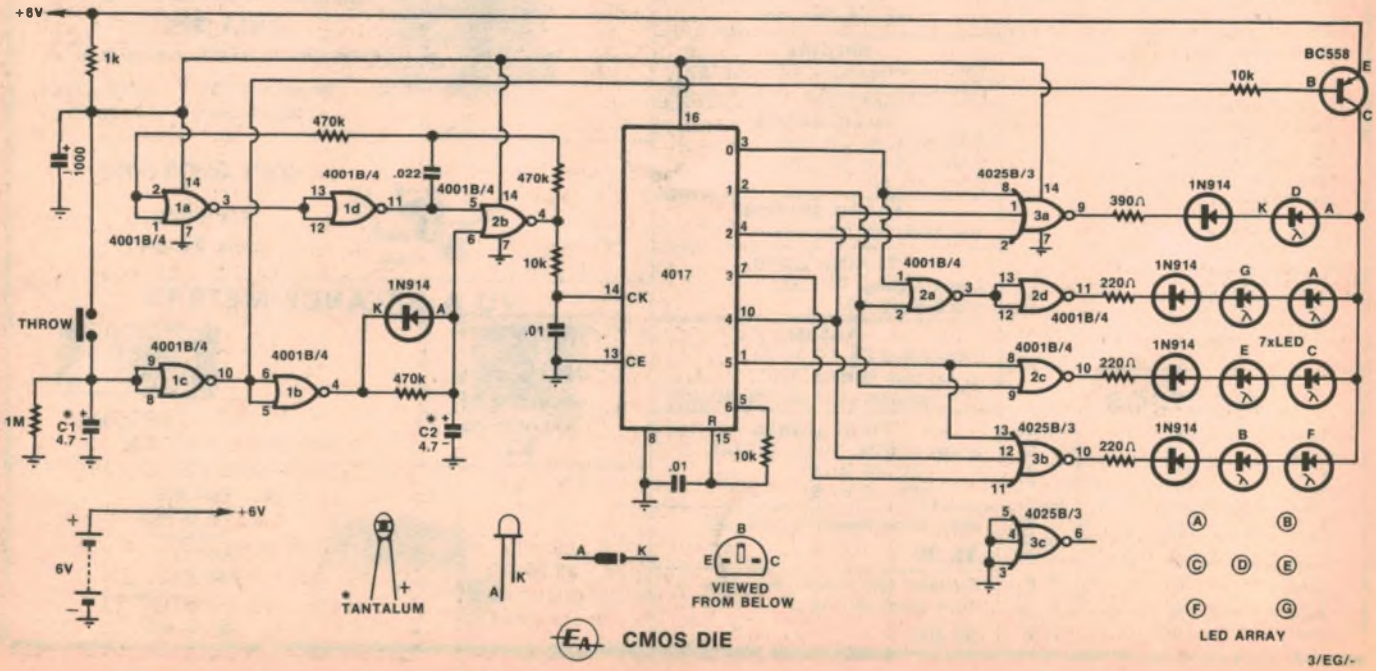
The drawing error in existing boards can be corrected by cutting the pattern and adding a link, and modified by making two more cuts and adding another link. The location of the cuts, links, and decoupling components are also illustrated.

Top right: the modified board pattern incorporating the corrections and modifications. Immediate right: The modified board with overlay pattern. Far right: How to modify an old board. Below: The circuit with the decoupling components added.









Letters to the editor

FM reception

In following the discussion on FM receivers installed in motor vehicles, I've been expecting someone else to mention a proven method of good reception of horizontally polarized transmissions. We have found that connecting the receiver to the car's roof rack is best. Additional noise on the AM band is received, but we found the improvement in FM worth it. The roof rack is electrically isolated from the car, and the tuning capacitors are realigned by trial and error for best reception.

Gregory See-Kee
Kensington, NSW

Circular polarisation

I would like to add my plea to those of the last few months for circular polarization of FM stereo transmissions. At present, mobile reception of FM in Melbourne is hopeless, the signal varying in the degree of distortion as well as fluttering with every movement of the vehicle. Let us hope we can follow the example of 2CBA-FM in Sydney.

I would also agree wholeheartedly with N.H. of North Carlton, Victoria (Forum, December 78 and May 79), that ignition noise on FM stereo is almost impossible to eradicate despite various capacitors, inductors and carbon resistance spark plug leads. Those so-called suppressors that are inserted in the signal path after the discriminator transformer are also next to useless. They decrease stereo separation and increase the distortion.

However, let us move one step at a time and keep plugging away at the authorities for circular polarisation.

Dr Peter Watson
North Balwyn, Victoria.

Beginner section

Congratulations on your editorial in the July issue, regarding material for the beginner. As one who has been buying your magazine for about 18 months now, and not being young, I have found it extremely difficult if not impossible to understand some of the articles. Nevertheless I have persevered, and the new articles by Mr Swain will be very helpful to me — and no doubt a large number of others.

Your correspondent's (anonymous) attitude is typical of so many in today's society: "Bother you Jack, I'm all right!"

Keep up the good work. We all have to start somewhere.

D. E. Jackson
Pakenham, Victoria.

COMMENT: Thanks for the encouraging response. As you can see, we're certainly trying to keep the beginner/newcomer articles coming.

Solar danger

It might not be out of place to warn readers of the possible danger associated with solar heaters. I don't recall it getting a mention before.

About 15 years ago we bought a disposals searchlight mirror. It's quite an interesting thing to have in a school physics laboratory. Once a year I'd fix it to a trolley, and wheel it out into the sun to show what concentrated sunlight could do. From memory, I'd say the mirror was about three feet diameter.

At a point about two feet in front of the mirror there would be a hot spot which was completely invisible. Anything held in this focal point would instantly burst into flames or melt. I estimated the temperature at 600 to 1000°F. (Haven't entirely gone metric yet), depending on time of day, atmospheric conditions, and the accuracy of aiming mirror at sun.

I always took the greatest care that children could not walk in front of the mirror, or worse still, look into it. This can safely be done indoors of course. The danger is simply that believe it or not, there is absolutely no sign of the existence of this hot spot. Until something moves into it.

People trying solar cookers should make sure children can't play with them.

Rev Bro D. Kinsella
Waverley College, Waverley, NSW.

AMATEUR RADIO

by Pierce Healy, VK2APQ

WARC 79 — Decisions which may vitally affect amateur radio

After years of discussion and preparatory work by amateur organisations world-wide, the World Administrative Radio Conference — WARC 79 — is about to commence. Just how well these amateur bodies have prepared their case will be reflected in the ultimate outcome of the WARC deliberations.

Geneva, Switzerland, is about to become the focal point for all those affected by international radio regulations; governmental, commercial, scientific, public service, commercial, entertainment or amateur service aspects. In fact regulations for the whole radio spectrum will be under review, whether they apply to fixed, mobile, or space services, for community, national or international purposes.

WARC 79 will commence on September 24, 1979, and will continue for 10 weeks. The effect of it will carry well into the 21st century.

During the past years much has been said and written about WARC 79. It has been my aim to report in these notes the work of the International Telecommunication Union and important events associated with that organisation which concern all amateurs. The need to support the national amateur radio society, the Wireless Institute of Australia, in its work on behalf of amateurs has also been continually stressed.

Well — the time has arrived for the conference to commence its deliberations. What progress has the Amateur Service achieved in making its views known?

In fact, the Amateur Service is probably better organised on an international scale than ever before, thanks to the work of the International Amateur Radio Union. This has allowed a more uniform front to be presented to national administrations.

Indications are that most of the developed nations readily appreciate the worth of a viable amateur service. However, some of the lesser or developing nations are inclined to disregard these benefits. It is, therefore, not possible to forecast the actual outcome in relation to amateur frequency allocations as they are today. The fact that each ITU member country has equal voting rights is a major factor affecting final decisions.

The ITU divides the world into three regions: Region I, Europe, Asia, Africa; Region II the Americas; Region III, Australia, Japan, SE Asia, India and Pacific area. The same regional areas apply to the IARU where the national amateur radio societies make up the membership of each region.

Locally, the rapport between the WIA and the Post and Telecommunication Dept is of a high order and the Australian delegation will include two WIA members as observers. No reductions to existing Australian amateur bands have been proposed and small additional segments in the HF spectrum have received some favourable consideration.

There have been reports however, that some countries in this region (Region III), are proposing changes in amateur VHF allocations. In Region II it has been reported that Canada is considering a reduction to the top end of the 3.5MHz band. In Region I the European countries appreciate the value of amateur radio and there are no details of any proposed changes.

However, the emerging African nations are exerting their requirements and the situation there seems to be that amateur radio may be of minor importance.

Unfortunately the mail dispute in Sydney has held up mail from Geneva and other overseas sources as well as local areas, from which additional information may have been available.

It is known that several other countries will have representatives of amateur radio societies as observer members of their delegations. Also, that within the ITU administrative structure the Amateur Service has influential friends.

The point being that, as a service, the amateur, although not having any voting rights, will be very well represented and may well influence decision making in respect to the amateur service.

27th South West Zone Convention

The 27th South West Amateur Radio Society Convention will be held at Young, NSW, over the weekend September 29-30, 1979.

The venue is the Young Showground and proceedings will commence with registrations and "talk-in" of mobile stations on Saturday morning from about 9.00am. However, similar talk-in facilities will be available for those arriving in Young on Friday afternoon and evening.

Frequencies will be — 3580kHz; 7090kHz; 28.55MHz, two-metre simple channels 40 and 50, and repeater channel 2 at Mount Canobolas, Orange, and channel 7 at Mount Ginini (Canberra), both being accessible from Young.

The program will include field contests as well as tests of skill and knowledge. There will be an RTTY display and a demonstration of radio controlled model aircraft. Events for ladies and children have been arranged, including bus tours to centres of interest in the area.

Ample area has been set aside for trade displays. There will also be a trading table for those wishing to sell or exchange equipment.

Light luncheon will be available at the showground from noon to 2pm on Saturday.

The convention dinner will be held in the Southern Cross Hall, Young, on Saturday evening at 7.30pm with pre-dinner drinks from 7pm.

Field events will continue on Sunday, coupled with a barbecue lunch, equipment auction, and presentation of prizes.

Registration fee is $5.00 which will also cover your family. The dinner will be $8.00 per person.

Accommodation: Motel or hotel rooms and caravan sites are available.

Bookings may be made through Peter Page, VK2APP, Stoneridge, Monteagle, NSW 2692. Telephone (063) 83 6206.

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AMATEUR RADIO

Despite this, some changes seem inevitable, due to ever-increasing demands on spectrum space and the need to plan for the future.

AMATEUR RADIO WEEKENDS

For those wishing to gain their novice, limited or full amateur licence, or just to improve their knowledge of radio and electronic theory, this is an excellent opportunity. Radio weekends have been arranged at the following locations by the YRS section of the NSW division WIA education service.

WAGGA: October 12-14, 1979. Location; the NSW Sport and Recreation Centre, Sturt Highway. Send bookings to the Education Officer, Wagga Amateur Radio Club, 110 Simkin Crescent, Wagga 2650, or telephone Bruce Grimmond on (069) 22 6746.

SPRINGWOOD: November 2-4, 1979. Location; the Blue Gum Lodge Youth Centre, Springwood. Send bookings to the WIA, NSW Division, PO Box 52, Asquith 2078, or telephone Sel Carlyle (02) 827 3589; Ken James (02) 638 1687; Les Dickenson (02) 477 3044.

OXLEY REGION: November 9-11, 1979. Location; the Wauchope Showground Hall, Wauchope NSW. Send bookings to Radio Weekend, Oxley Region Radio Club, PO Box 712, Port Macquarie 2444, or telephone Frank Gorton, on (065) 83 1256.

The cost for the weekend is — adults $22.00; wives not attending lectures $15.00; school students $15.00; children under the age of 10 years $8.00.

Activities start at 8pm Friday evening and finish 3pm Sunday afternoon. Meals and accommodation are provided.

All centres are handy to rail transport.

The organisers express their appreciation to Dick Smith Electronics for the generous donation of more than $60 worth of radio components as awards at a recent radio weekend. The introduction of a Dick Smith Electronics amateur radio incentive award is foreshadowed as being a feature of these weekends.

WEATHER SATELLITES

The April, 1979, issue of these notes featured details of the work of John St Clair, ZS2JR, in receiving pictures from geostationery and orbiting weather satellites.

In a letter from John, subsequent to the article appearing, he states that he has received letters from Western Australia, New Zealand and New South Wales seeking further information. He also included copies of some of his replies as a source of additional information on the subject.

John also mentioned that he has been improving his equipment. One simple addition, which has proved very worthwhile, was a trimming circuit in series with the local oscillator crystal for the 137MHz receiver. This permits compensation for temperature drift in the 1691MHz-137MHz down converter and allows the signal to be held in the centre of the passband.

Here is some information and suggestions John gave in his letters. For initial experiments use a high band commercial valve type receiver as used in taxi and similar services, available through disposal sources, converted to receive 137.62MHz (the American Tiros-N satellite frequency) and a six element home made hand held yagi antenna. Practice receiving and tracking the orbiting satellite, recording the signals received. When proficient at this, send a tape to John who will print it and provide further assistance with details of picture printing equipment.

This satellite is sun synchronous and will appear travelling south to north at around 3 pm each day. The orbital period is 102.0986 minutes.

Recommended reading: Articles by Paul H. Shuch in Ham Radio magazine — September 74; April, July, October, December 75; February, October 76; February, July, August, September 77; May, July, August 78.

RADIO CLUB DIRECTORY

Space, and advantage taken of this invitation, will determine the format of this year's radio club directory. Clubs wishing to be included must have details in by October 15, 1979.

Send details direct to address given elsewhere in these notes.

AMATEUR SATELLITES

The University of Surry's telecommunications research group has embarked upon a project to build Britain's first amateur spacecraft. It is working in conjunction with the international Radio Amateur Satellite Corporation (AMSAT), and with the active support of Britain's electronics, telecommunications, and aerospace industries.

The new satellite will be a departure from those of the OSCAR series. The details of the features and experiments that it could carry are still under discussion, but it is hoped to provide a facility to enable amateurs all over the world to study the ionosphere's effects on radio propagation. It may also include features enabling educational establishments to carry out practical experiments, thus stimulating a new practical interest in space sciences.

The construction and testing will take about two years. It is intended for a polar orbit at a height of 900km, and a possible launch opportunity exists early in 1981.

The cost is expected to be around $300,000 and support for the project in

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AMATEUR RADIO

cash and kind is being provided by the following organisations: — The Radio Amateur Satellite Corporation (AMSAT); Appleton Laboratories; British Aerospace; Ferranti; Marconi Space and Defence Systems; MEL; Philips Research Laboratories; The British Post Office; Racal; The Radio Society of Great Britain and The Royal Aircraft Establishment.

(Acknowledgement AMSAT Newsletter, March, 1979.)

IONOSPHERIC PREDICTIONS

Due to the recent industrial dispute at the Redfern (Sydney) mail exchange, material for the September prediction chart did not come to hand in time for these notes. We hope to resume this feature next month.

ANZA NET

There are many international nets on various amateur bands. These nets enable an orderly exchange of reports between stations in various areas, in particular between call areas where amateur activity is limited either because of the number of operators in the area is limited, time available for operation is curtailed for some reason, or the remoteness of the area.

One of these is the Australia-New Zealand-Africa (ANZA) net which has been in operation for about nine years. The net controller is Percy Anderson, VK3PA.

This net operates daily from 0500GMT on 21.202MHz short path to Africa across the Indian Ocean. The object is to arrange contacts with African stations for Australian and New Zealand stations and Pacific Islands stations for African stations.

The net is usually busy on Sundays, some of the regular African stations are ZS2OM (a blind operator who has been on the net since its inception), ZS2EM and 9J2GJ.

Percy, VK3PA is also senior net control Pacific DX net which operates on 14.265MHz on Tuesday and Friday at 0530GMT. First licensed in 1928, Percy has seen quite a lot of changes in equipment and also in operating habits which, in some cases, need improving, particularly by stations who cause deliberate interference.

CONFUSION CLARIFIED?

When two well known operators have the same name and similar call signs there can be some confusion in correctly identifying each. And when the name of each spouse is the same, it may lead to "utter confusion".

To clarify one such case and, hopefully, save further embarrassment and explanation to local and overseas operators, it is now possible to both prove there is such a situation, and to physically identify each.

The accompanying photo, taken at a Wagga Radio Club field day barbecue at Tumbarumba on May 27, 1979, shows Sid, VK2SG; Sid, VK2SW and their respective wives — both named Jean.

Twenty-five persons attended the picnic. Sid, VK2SG, and wife Jean, from Sydney, just happened to be motoring in the area and called in. Hence the opportunity for the rare photograph.

Who is who? Look at the photo and some time in the future try to recall which was VK2SG or VK2SW.

Still confused? — Sorry.

In case you didn't sort all that out, the names, left to right are: Sid Molen, VK2SG; Jean Molen; Jean Ward; Sid Ward, VK2SW. (Photo by John Tapper, VK2AQ.)

NEW SYDNEY REPEATER

A new two-metre FM repeater, VK2RMB, is operating at Beacon Hill, near Manly, NSW. The equipment was built and installed by members of the Manly and District Amateur Radio Club.

Input frequency is 146.275MHz and output 146.875MHz.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

The Australian CB SCENE

SOUTH AFRICA GETS 27MHz CB!

According to a recent report from South Africa, citizens of that country now have access to a CB service which, in terms of regulations and equipment, bears comparison with the Australian system. The channels specified correspond to US channels 19 to 27 inclusive: 27.185-27.275MHz, thereby overlapping Australian channels 15, 16, 17 and 18.

South Africa has had a low-power hand-held service for some considerable time, plus other official two-way radio facilities, but no CB service in the now accepted sense. However, according to the same correspondent, illegal operation has been rife, with an estimated 8000 to 10,000 de facto CBers active in the Johannesburg area alone. As in Australia, their very presence, as well as their lobbying power, has put tremendous pressure on the Government.

Some aspects of the South African regulations governing the new service will be of interest to Australian operators.

Basically, the technical specifications are very similar to our own, with a power output of 4W for AM and 10W for PEP sideband. Channels are spaced 10kHz apart, over the range already mentioned earlier. The antenna must be a unity gain type, but there are no restrictions in regard to its height.

The South African equivalent of our local RB14 sets out various other aspects:

DEFINITION: The CBRS is a private two-way, short distance communication service for personal and business use; it may also be used for voice paging.

EMERGENCY FREQUENCY: Channel 21FCC (27.215MHz) has been set aside solely for emergency communication and travellers assistance. However, priority must still be given to emergency traffic on any of the other channels.

BUSINESS USE: No licensee may accept payment for the transmission or reception of messages on the CBRS. The CBRS shall not be used to communicate for business purposes between two fixed points. Company employees may use the CBRS under the company license, provided the communication is for business purposes only.

ISM INTERFERENCE: The CBRS must accept interference from ISM equipment without ado, and no complaints about ISM interference will be investigated.

GENERAL CONDITIONS: License holders must be over the age of 18 years. All conversations must be limited to a duration of five minutes. No channels will be set aside for the exclusive use of any group or for an AM or SSB only operation.

Linear amplifiers are banned. They shall presume to have been used if they are in possession of the operator, and/or on his premises. The presumption is extended to include "tweaked" sets; that is a set that has been modified to increase the power.

The South African conditions do not state any ban on communications with overseas countries, although this may be covered by other acts of parliament.

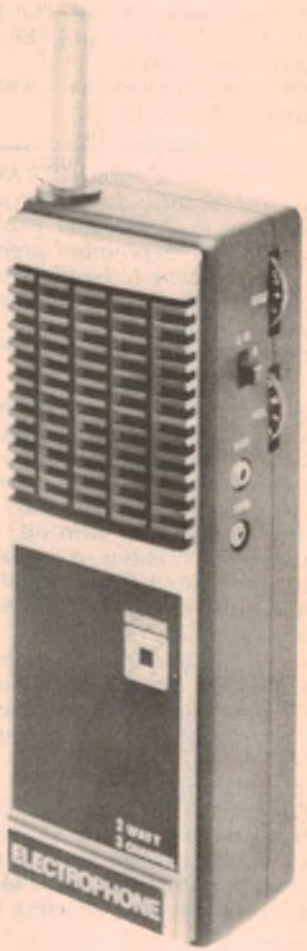
NCRA convention

Country and western singer Mr Nick Erby has been enlisted as master of ceremonies for the 1979 NCRA Festival, to be held in Canberra on September 8 and 9. The show promises to be a drawcard for all those associated with CB radio.

The electronics industry will be well represented at the festival, with displays by many of the major equipment manufacturers. And for those interested in commercial trucking, there will be a display of trucks and associated haulage equipment.

In addition, there will be a special seminar to discuss the future of the UHF part of the CB radio service.

All in all, it promises to be a great weekend, and we hope that you can be there to share the fun. See p125 of the August issue for further details.



HAND-HELD TRANSCEIVER — Called the Electrophone WT-273, this portable 27MHz transceiver features 3 channels and can operate either from internal batteries or from any vehicle 12V negative earth system. Transmitter output power is quoted as 0.7W. Further information from Radio Parts Pty Ltd, 562 Spencer St, West Melbourne, 3003.

CB merit award

Following a suggestion from individual member Mr David Flynn, the NCRA National Executive has decided to recognise the efforts of individuals who have promoted or improved CB radio operations in Australia by presenting annual CB merit awards.

Similar awards are made in the United States to individuals who have

used CB radio to assist authorities, or who have made an exceptional effort to improve conditions for CB operators.

The title of an Australian award is open to suggestions, but will definitely not follow the American practice of being known as "The CB Good Buddy Award"!

There are many people in Australia who rightly deserve recognition for the time, effort and money they have put into CB radio since legalisation, and even prior to legalisation. Suggestions for the most eligible candidates should be forwarded to the NCRA Secretary, PO Box 406, Fortitude Valley, Queensland 4006.

The presentation of this year's awards will take place during the Radio Festival to be held in Canberra on September 8th and 9th.

Technical Glossary

DETUNE: to "tune" a resonant circuit implies that it has been tuned to, or peaked on, a particular frequency. For example, a receiver might be accurately tuned to an incoming signal; again, an IF transformer might have been adjusted or tuned or peaked at 455kHz — or any other desired intermediate frequency. To "detune" a receiver or circuit implies that it has been set, deliberately or by accident, to a frequency to one side or the other of what might normally be expected.

DECIBEL: a term originally derived in the context of audio to express the ratio by which the power level of a signal must be changed for a keen human ear to notice any difference in subjective loudness under average conditions. Because it seemed to fit the behaviour of the ear, the practice which emerged was to express the particular power ratio as a logarithm, multiply it by 10 and call the result a "decibel". On this basis, a ratio of 1.25 (approx) or a power increase of 25% (approx) becomes a change of 1dB. If you increase any given power level three times in the ratio 1.25, you end up with twice the original power (2.0 approx) and a decibel figure of 3 (approx.). Although still most commonly used in the context of audio, the term decibel is also widely used in other contexts which might relate, in the ultimate, to an audio result. For example, if an antenna is devised which will double the effective power of a signal being radiated or intercepted, that antenna is said to have a gain of two-to-one, or 3dB. ●

New Products

Century 21 communications receiver

Relatively compact and easy to handle, the "Century 21" receiver is of potential interest to anyone who wants to explore the airwaves for interesting short-wave, amateur and CB stations, whether operating on AM or SSB. It covers the frequency range from 0.5 to 30MHz and can be operated either from the AC power mains or from an external 12V supply.

The Century 21 uses the now well known Wadley Loop principle, which exhibits a high degree of intrinsic frequency stability. Intermediate frequencies employed are of the order of 45MHz, 2.5MHz and 455kHz.

Selectivity, established mainly in the 455kHz channel, is quoted rather vaguely as 3kHz for -6dB in SSB mode and 5.5kHz for AM. In actual handling, selectivity appears to be fairly typical for a general purpose communications receiver — sharp enough to separate most stations, yet not so sharp as to present a problem for ordinary handling and listening.

The sensitivity, as quoted, is likewise typical for a modern receiver of this general class. Based on a 10dB signal/noise ratio, the figures are: 0.3uV for SSB and 1uV for AM, for frequencies in the range 2-30MHz; 1uV for SSB and 3uV for AM over the range 0.5 to 2MHz. Calibration accuracy is quoted as within 5kHz at all frequencies, with image rejection being typically better than 50dB.

General styling of the Century 21 falls somewhere between the somewhat spartan appearance of the well known Drake communications receiver and the more heavily styled Yaesu FRG-7, both of which use the same Wadley Loop system. The tuning method is the same in all three, allowing the operator to spot stations unerringly to an accuracy of a few kHz.

The operator first selects the particular megahertz band to which he/she wants to listen (e.g. 14MHz) by means of a band selector switch and a "MHz Tune" knob. The main tuning dial then selects any frequency in the selected 1MHz range, say 14.000 to 15.000 MHz, with calibration marks every 10kHz and scope for interpolation. A "Preselector" knob peak tunes the RF amplifier, while a "Clarifier" allows for fine tuning of SSB transmissions over a range of plus and minus 3kHz.

The receiver can be set for either upper or lower sideband and, of course, for AM. The one other control on the front panel is for RF Gain. This does not appear to have a very wide control range, but does allow control of large signals to prevent overload.

Normal listening is via a small panel-mounted loudspeaker, with a nominal drive power available of 2 watts. A jack on the front panel permits connection of an external 8-ohm loudspeaker or phones.

Items on the rear panel include a 12V DC input socket, audio connector for a tape recorder, external mute for use with a transmitter, mains fuse and power cord. A permanently connected telescopic antenna is provided, plus antenna and earth terminals which can be used either for 75-ohm unbalanced input or a normal open-wire antenna and earth system.

Perhaps because we were so accustomed to Wadley Loop receivers, operation of the Century 21 provided no hassles. On the telescopic antenna alone, an impressive array of international broadcast stations were received during various times of the day, most with very little background noise from the receiver. Amateur band SSB DX came through well with no obvious drift problems, while even a few CB DXers were logged for good measure.

The one disappointment was the behaviour of the receiver in the range 500-1000kHz — the low frequency end of the broadcast band. Perhaps because of their signal strength at the test location, stations from the 1000-1600kHz region broke through noticeably, if the Pre-select and even the MHz-Tune controls were not very carefully set. It's a pity that tuning over this one range tends to be so tricky, although all Wadley loop receivers tend to exhibit this problem to some extent.

Packaged with the receiver are a couple of items of hardware plus a booklet containing specifications and a block schematic, instructions on operating the receiver and a listing of the most used shortwave broadcast and amateur bands.

Summing up, the Century 21 is not a pretentious receiver but it is certainly a very practical and functional design with the inherent advantages of the Wadley Loop system. At the recommended price of $325 including sales tax it is certainly well worth consideration by anyone with an interest in all-round DX listening.

Further information on the Century 21 is available from the importers and distributors, Elmeasco Instruments Pty Ltd, of PO Box 30, Concord NSW 2137 or PO Box 107, Mount Waverley, Victoria 3149. The company also has offices in Adelaide, Perth and Brisbane. (W.N.W.)

New line of mains transformers

Designated as the "Force" series, an up-dated line of mains transformers is being offered by Automation Control Pty Ltd. The smaller units in the range are intended for direct mounting to a printed circuit board.

While the name may be new, the company involved has a long history in local component manufacture, being known formerly as Hallam Magnetics. There has been some change in company structure but the address and phone number remain the same: 2 The Crescent, Kingsgrove NSW 2208. Tel. (02) 50 0111.

The smallest transformer has a lamination measuring 25mm x 30mm, with a 12mm stack. The power rating is 1VA and five standard units are listed ranging from 6V at 170mA to 30V at 35mA. They are identified in the brochure as the "Force 001" series.

The next size in the new line is the "002" series which are rated at 2VA. On laminations measuring 32mm x 28mm, there are seven different types available, each with twin secondaries and therefore providing fourteen voltage/current options — from 3V at 840mA to 36V at 60mA.

The Force series includes 5VA and 10VA models, each in a range of voltages and currents. Included here is one of the 015 series, at 15VA. It, too, is available with a range of twin secondaries, which can be connected in series or parallel to give 14 voltage/current options.

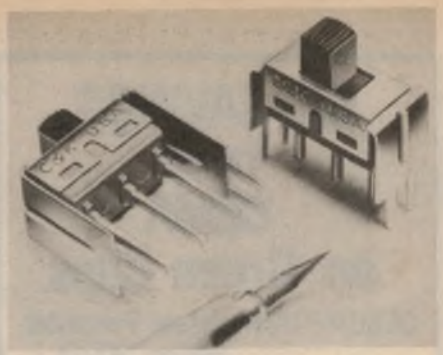
Automation Control say that they have tooling up to 60VA but, above 20W, they believe that the transformers should be chassis-mounted. All comply with the ASC-100 standard but they can be supplied to meet ASC-126 if necessary, with the exception of the 1VA type. Covers are also available for 2VA and upwards.

For further information, contact Sales Manager Ian J. Brown.

ICS expands product range

Instant Component Service (ICS) has taken over a range of products previously distributed by IRH Components (Division of Natronics). The following companies are now represented by ICS: Schadow, Shinko, Superior, Mulon, NKK, OMP, Siliconix, TRW Semiconductors, Hamlin, and T&H.

Further information on these, and other product ranges, is available from Instant Component Service, 248 Wickham Rd, Moorabbin, Victoria 3189.



PC mounting slide switch

C&K is now offering its subminiature slide switch with a "V3" or "V4" electro-tin plated vertical support bracket. This support bracket helps to absorb the shock of actuation, thereby relieving excessive terminal stress.

The "V" series "anti-stress" bracket also helps to maintain switch orientation to the PC board subassembly, thus giving a solid and secure base to the final configuration.

Switch specifications are as follows: slide handle, nylon — contact rating, 0.4VA max or 20V or 1A max — contact material, gold over brass — mechanical life, 250,000 actuations — actuator force, 150-350 grams initially.

For further information contact C&K Electronics (Aust) Pty Ltd, Office 2, 6 McFarlane St, Merrylands, NSW 2160.

New Products

100kHz-300MHz signal generator

The popular range of Leader test instruments is now being handled in Australia by Vicom Pty Ltd. Included in the range is the model LSG16 RF Generator which covers the RF spectrum from 100kHz to 300MHz in six ranges. A feature of the unit is the provision of a "D" type crystal socket for calibration frequencies between 1MHz and 15MHz.

Recommended retail price of the LSG16 is $118, including sales tax. It is available from the following stores: Radio Parts (Melbourne), Radio Despatch Service (Sydney), International Communication Systems (Adelaide), Atkins Carlyle (Perth) and Delsound (Brisbane).

Multi-Voltage Power Pack

A&R Electronics Pty Ltd have just released their Arlec PS405 Multi-Voltage Power Pack which has switch selection for 3, 6, 9 and 12 volts and a continuous output current rating of one amp. Main features include overload and short circuit protection, low output impedance and low output ripple, typically 200 millivolts RMS at 500 milliamps output. The PS405 is double-insulated and is fitted with a two-core flex and moulded two-pin mains plug.

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Books & Literature

Amateur radio

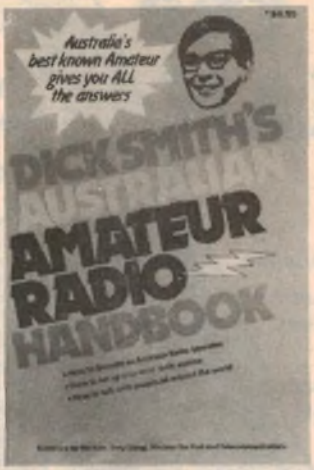
DICK SMITH'S AUSTRALIAN AMATEUR RADIO HANDBOOK. Edited by Sam Voron and Dorothy Deger. Horwitz Publications, 1979. Soft covers, 210 x 137mm, 192 pages, many illustrations. Price in Australia (SRP) $6.95.

The best way to describe this book is to describe its most likely reader: the person who asks, "What is amateur radio all about?" In fact it would be hard to think of a better way of answering this question.

It is not a handbook in the same sense as the "ARRL Handbook" or the "RSGB Handbook". It contains very little technical material, and then only at a rather superficial level.

What it does do is describe amateur radio — its place as a world recognised hobby, the kind of people who enjoy it, and how they use it. But more than that it endeavours to cover its many facets: the modes of transmission, the frequencies employed, the types of equipment, the rules and regulations, the exams, contests, clubs, etc.

It does all this particularly well; giving sufficient information to advance the reader's knowledge, yet not delving so deep as to lose his interest or make it sound too hard. And it is presented in a breezy, easy going style that makes it sound like a lot of fun.



Criticisms? Yes, a few minor ones. One which struck close to home was the incorrect spelling — twice — of our founding editor's name (John Moyles instead of John Moyle). There is also a reference (p17) to the original amateur allocation being less than 1.5MHz, when it was actually above 1.5MHz. There are a few others, too.

But these are minor points. Overall it is a book we would recommend to anyone wanting to get into amateur radio. It will put them on the right track and, we imagine, may make a significant contribution to swelling the amateur ranks. (P.G.W.)

Miller on physics

WHY IS IT SO By Professor Julius Sumner Miller. Published 1978 by the Australian Broadcasting Commission. Stiff paper covers, 296 pages 218mm x 134mm, freely illustrated. Price in Australia $5.95.

There would surely be few people in Australia, interested in matters scientific, who have not listened to, or watched, some of the author's presentations on radio and television. Sufficient to say that, having described or demonstrated some phenomenon, he characteristically asks "why is it so?". Sometimes he answers the question; at other times, he leaves it tantalisingly unresolved, for the audience to work out.

There's a lot of material in this book: 60 programs to do with mechanics, 30 on heat and temperature, 40 on sound, electricity and magnetism, and 21 on light and modern physics. The clipped and sometimes curious phraseology that is part of the Sumner Miller presentation is preserved in the text, along with his many historical references and asides.

For a teacher, a student or a reader with a technical turn of mind, the book will provide many hours of informative browsing. Our review copy came direct from the ABC at 145-153 Elizabeth St, Sydney 2000. Or through GPO Box 487 Sydney 2001. (W.N.W.)

Pocket reference

NEWNES RADIO AND ELECTRONICS ENGINEER'S POCKET BOOK, 15th Edition. Published 1978. Hard cover, 191 pages, 120mm x 75mm. Price in Australia $6.50.

First produced in 1940, the Newnes Pocket Book is now in its 15th edition, having been up-dated this time by the technical staff of ETI (England). In fact, its English origin shows clearly in a more tentative attitude to the SI units and in the space given at the back to British radio and television stations and standards.

However, it does contain a very large amount of reference data of the universal kind, ranging from units, formulas and tables to reference data on the most widely used transistors and ICs. As further evidence of its recent up-dating, a fair amount of attention is

given also to digital and logic information. It would be a handy book to have around.

Perhaps one should add the suggestion that edition number 16 be designed for a larger pocket. It would certainly allow some of the printing and diagrams to be somewhat more legible. (From Butterworths Pty Ltd, 586 Pacific Highway, Chatswood, 2067. (W.N.W.)

Hifi basics

HOW TO SELECT AND USE HIFI AND STEREO EQUIPMENT. By Murray P. Rosenthal. Stiff paper covers, 265 pages 226mm x 147mm, freely illustrated. Published 1979 by Hayden Book Co Inc New Jersey. Australian price $11.50.

A look at the introductory chapter gave the initial impression of a rather superficial approach to the subject, but this proved to be quite unjustified. The real treatment begins with chapter two and what follows is well planned and well expressed. It is also substantially up to date.

Chapter headings include: Acoustics — Loudspeakers and Enclosures — Amplifiers and Preamplifiers — Tuners and Receivers — Records and Record Players — Tape Recorders — Troubleshooting — Index.

The "How to Select" part of the title may be misleading because it could suggest overt guidance for the uninitiated. More precisely, it is textbook about the basics of hifi, appropriate to readers with some technical background, who can cope with illustrative graphs and circuits. For such people: positively readable.

Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. (W.N.W.)

HOW TO SELECT AND USE HIFI AND STEREO AMPLIFIERS. By Murray P. Rosenthal. Stiff paper covers, 122 pages 226mm x 147mm, freely illustrated, published 1979 by Hayden Book Co Australian price $7.50.

HOW TO SELECT AND USE LOUDSPEAKERS AND ENCLOSURES. By Murray P. Rosenthal. Stiff paper covers, 90 pages. Price in Australia $6.50. From Butterworths, 586 Pacific Highway, Chatswood 2067.

HOW TO SELECT AND USE RECORD PLAYERS. By Murray P. Rosenthal. Stiff paper covers, 122 pages. Price in Australia $7.50. From Butterworths, 586 Pacific Highway, Chatswood 2067.

An inspection of both the text and illustrations of these books indicates that each is basically a segment from the main work reviewed above. There is some additional information in each one, but in our opinion unless you are only interested in one of the specific areas covered, it would be better to buy the full version. (W.N.W.)

INFORMATION CENTRE

SUPPLY PROBLEMS: I am writing for several reasons; to ask for assistance, to make a suggestion, and to have a moan.

The moan first. Having taken your magazine regularly for 30 years I have watched it change from a reader orientated publication to one very much advertiser orientated. I can see the reason for this and appreciate your position but it makes me mad, particularly after the happening I am about to describe.

I was very interested in the impedance meter described in the December 1978 and January 1979 editions. As it had some items that appeared difficult to obtain in Tasmania, I chose two advertisers — one of whom stated, among other things, that they were "EA" kit specialists and the other who had advertised some of the close tolerance items — and wrote them polite letters asking for a quote for a complete kit or such of the harder-to-get components that they might be able to supply. I also asked for several other things and, to complete my subjugation, enclosed a stamped and addressed envelope.

The result (in the words of the emmortals): "Not a sausage". This was at least six weeks ago and even our post doesn't take that long to go from Hobart to Melbourne and return. As for labour costs, they could have got the office cleaner to scrawl "get -" on my letter and return it. I would have at least known where I stood. (The writer names both firms.)

Which brings me to my suggestion. Where a non-staff member describes a project like this, would it not be possible for him to list the firms from whom he obtained the more exotic components.

Being a pensioner (old age) I would like to complete this meter and use it while I still have my faculties. Could you please tell me where I can obtain a complete kit. If not that, the edge reading meter, transformer, germanium diodes and close tolerance capacitors. (W.K. Hobart, Tas.)

● While we can appreciate your feelings in regard to the individual firms, we are disturbed by your implication that we are, in some way, responsible for this by being "advertiser orientated".

While we are not exactly sure what you mean by this, we can state, quite emphatically, that we have no policy which we feel could be construed in this way. For example, the proportion of advertising space, relative to editorial space, is no greater now than it has ever been. In fact, it is, if anything, slightly less than at some times in the past.

On the other hand, neither we, nor our readers, can ignore our advertisers. Quite apart from the fact that they contribute a significant amount to the cost of running the magazine (no magazine of this kind could exist without advertising support) they are also the source of the raw materials on which we base our projects. Without such a source, none of our projects would be possible. And, to emphasise this point, we regard it as essential to ensure that any unusual parts for a project are in good supply before we describe it.

This is not a defence of the advertisers you name; it is simply a statement of fact in regard to advertising and advertisers as a whole. As we said before, we cannot see how we can be regarded as responsible for the actions of the two advertisers you name.

As for your suggestion; well we already do this, whether the project be our own, or contributed. We just did not feel that it was justified in this case. And, we have to be careful. Specifying one advertiser as the supplier of a component which is also available elsewhere, leaves us open to the accusation of favouritism — or even being "advertiser orientated".

We passed your letter over to a local advertiser, Radio Despatch Service, and they subsequently advised that they could supply all, but one, of the parts, including the close tolerance items. The one component is the Trimax TA2320 transformer, but they determined that this is listed in the catalogue of another advertiser, Radio Parts Group, and even supplied the catalogue number (4353-0785).

How's that for service!

So go to it W.K. Contact these firms and we are sure you will be well on your way to completing your project.

GRAPHIC EQUALISER: About 12 months ago, I constructed the 10-channel graphic equaliser published in the November 1976 issue of "Electronics Australia". While it did work, it does not appear to be as advanced as the May 1979 design. Consequently, I have a collection of 100k linear sliders. The new design calls for 50k linear controls. Is it possible to approximate these controls by paralleling 100k resistors with the 100k sliders, or would this complicate the RC networks unduly. Also, ignoring the differing pin connections, are the electrical characteristics of the LM349's used in the earlier design comparable to the characteristics of the uA4136's. (C.H., South Coogee, NSW.)

● The main area of superiority of the new design is the signal-to-noise ratio. The older design should be reasonably satisfactory provided it is used at a signal level of about 1 volt, ie, between preamplifier and main power amplifier.

It would be possible to use the 100k sliders as you suggest although it is likely that they would be less linear in their

control action than the 50k sliders specified. Note that you will probably find that your sliders are incompatible with the printed board we have designed.

The uA4136 op amps are similar in most respects to the LM349 except that have superior input noise characteristics.

● **RF OSCILLATOR, BATTERIES:** I hope to build your new RF generator, published recently. I would like to know if it can be modulated by a standard audio oscillator, say over the range 30Hz to 10kHz. This would make a much more versatile unit.

Also, can silver oxide batteries be recharged? Popular opinion around my school is that they can, but our science master is unsure, and we have no textbooks on silver oxide cells. (R.K., Riverside, Tasmania.)

● We assume that you are referring to the Modulated RF Oscillator of May 1979 (File No. 7/RO/59). This was a relatively simple design, and such a requirement was not envisaged. It is probable that it could be so modulated, but the modulation depth is likely to fall off significantly at the higher frequencies. Thus, as a means of checking wide band tuners, it would not be very satisfactory.

With regard to charging silver oxide cells, this is one of those "Yes but —" situations. The silver oxide cell is basically a primary cell, not designed to be charged. However, some users of these cells, typically Japanese watch manufacturers, have elected to try this, although the process might be more fairly described as "reactivation" rather than charging.

A typical example is a Japanese watch using a silver oxide cell and fitted with solar cells (on the watch face) which provide a regular daily boost. The watch makers claim that the battery life is likely to be extended from about two years to five years.

The secret of all such "reactivation" processes, whether used for Leclanche cells, selected alkaline cells, or silver oxide cells, appears to be based on a very shallow discharge/recharge cycle, ie, regular replacement of a small amount of energy taken out, without allowing the cell to be discharged significantly.

It is unlikely that the battery manufacturers would stand by any guarantee if these cells are treated in this way.

TOUCHFONE KEYBOARD: Are you aware of any criticism regarding Telecom's use of a non-standard keyboard for their Touchfone pressbutton 'phones? The electronic calculator has been with us for some considerable time, and its keyboard has become fairly well standardised. I was therefore surprised to see that the format used for the Touchfone keyboard is rather different, and have been waiting for some comment from the public. But none seems to have been forthcoming — unless I missed it. Why would Telecom adopt a keyboard layout which seems to be so different from that encountered in normal and familiar everyday equipment? (B.R.W., Port Lincoln, SA.)

● We're not too familiar with the keyboard on the Touchfone units, nor are we privy to the deliberations of Telecom's decision makers. However, we imagine that they may have been constrained by either the need to use keyboard assemblies or components from overseas manufacturers, or the desirability of maintaining compatibility with overseas telephones.

In any case, are calculator keyboards all that standardised anyway? We ourselves have come across quite a few with rather odd keyboard layouts.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

PROJECT QUERIES: Members of our technical staff are NOT available to discuss individual projects, either in person at our office or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

Notes & Errata

SOLID STATE RELAY (August 1979, File No. 2/PC/24): The active and neutral input to the circuit should be swapped, so that the Triac switches the active lead to the load socket.

DREAM 6800 (June 1979, 2/CC/39): The parts list has a number of errors. There should be 13 not 12 0.1uF capacitors; 6 not 5 x 2.2k resistors; 1 not 2 x 120 ohm resistors; 1 x 47 not 74 ohms, and 2 x 220 ohms should be added. There is also an error on the PCB diagram: The .01uF capacitor near pin 20 of the 6800 should be 0.1uF. On the PCBs currently being supplied, the 0.1uF capacitor nearest IC4 is shorted out. The pattern should be modified to agree with the PCB overlay. Finally in the 6875 substitute circuit published in August 1979, the pin numbering of the 74737 in incorrect; pins 4 and 6 should be swapped.

Marketplace

FOR SALE

RELAYS — Heavy duty. Contacts DPDT 30amp 28VDC/300VAC Coil 6VDC $10.00 each. Phone (03) 45 1779

EMM 3000, micro memory. 650NS 16K x 18 bit or 32K x 9 bit modes. $850. 13 Tivoli Road, South Yarra. Ph (03) 240 9788.

POLY 88 MICRO S-100 SYSTEM, with 16K, cassette, keyboard, VDU, BASIC, and Assembler. Cost $1600, offers around half price. P. Hooker, 5 Third Ave, Mt Lawley, WA 6050. (09) 271 9669.

ORGAN — HAMMOND BC — 2 Manuals each 61 keys, 25 pedals, 24 voices, 38 presets. Goes well at present but motorised tone generator and valve amplifiers not really reliable. Console, keys and controls would provide excellent basis for enthusiast to build modern electronics into. $400 ono. (02) 570 1333.

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ENGLISH SHORTWAVE STATIONS AUDIBLE IN AUSTRALIA lists over 40 countries to hear! This invaluable publication and our Monthly (except January) magazine DX POST, are available exclusively to financial members of Australia's national SOUTHERN CROSS DX CLUB inc. Annual subscription is still $5 (plus $1 joining fee); Students under 18, and pensioners pay $3.50. Further details for a 20c stamp to: Membership Sec, George Kuznecovs, 87 Cashel Street, Pasadena (Adelaide), SA 5042.

DISC MEMORY with power supply, data disc 7206, 6.4 million bit. Standard, simple TPL interface $850. 13 Tivoli Road, South Yarra. Ph (03) 240 9788.

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AUSTRALIAN RADIO DX CLUB — published over 360 pages of DX notes during 1978. The official news source for Radio Australia's DX program for over 14 years. 1979 is world DX youth year with special introductory membership fee for people under 18 years old. For full details write to PO Box 67 Highett Victoria 3190 or PO Box 79 Narrabeen NSW 2101 enclosing a 30c stamp and phone number.

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E-PROM 2708 and 5204 Programming Service. Your listing either typed or neat hand printed in Hex or Octal; your E-Prom $22 or plus E-Prom 450nS, $35 (2798 only). E-Proms modified to your requirements, send E-Prom to be modified plus. $6 up to 20 bytes, $10 up to 100 bytes, multiples also. MM5204 programmed only $20 or modifications as above. Enquiries welcome. Send to Micro-Assistance PO Box 49, Sandy Bay 7005, Tasmania.

FRONT PANELS, machine engraved to customer specifications. Singles or quantities, in aluminium, brass, acrylics, etc. Further information from: Commercial & Industrial Engraving, 9 Napier St, Westmead. Phone (02) 635 8537.

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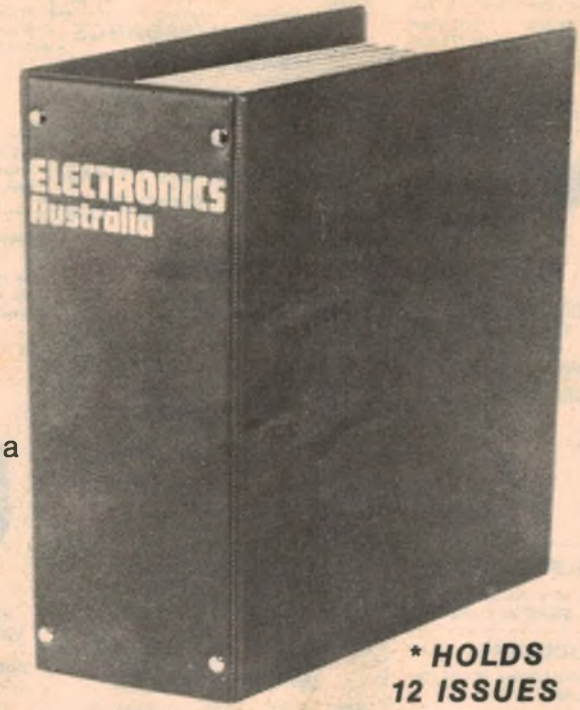

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