ELECTRONICS Australia

HiFi, Radio & Computers

DECEMBER 1979

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- New Compact Loudspeaker System To Build
- Fan Speed Control
- Electronic Bongos

UNIQUE.

Philips Motional Feedback Speakers.

Every now and then a technical breakthrough is achieved and a unique product emerges to set a new standard in its field.

Such is the case with Philips Motional Feedback Speakers.

These electronic masterpieces have been developed after years of exacting research in our European Laboratories and, as a result, we've created a speaker system that comes very close to the ultimate in Hi-Fi reproduction.

Technically speaking, the system incorporates a piezo-electric crystal built into the woofer cone that monitors and converts the acceleration of the cone into an electric signal. The acceleration of the cone is linearly translated back to the original signal driving the loud-speaker. This signal is fed back to a comparator circuit in the amplifier incorporated in the enclosure and compared with the original signal. This enables the loud-speaker to be immediately corrected at the slightest deviation. And, in this way, the acoustic behaviour of the woofer can be completely controlled.

Each speaker contains 3 integrated power amplifiers – a 50W amplifier for bass output, 20W amplifier for mid-range and a 5W amplifier for treble – providing a total power output of 75W. And low-note filters are incorporated in each speaker enclosure for matching the bass response to the location of the box near walls and floor.

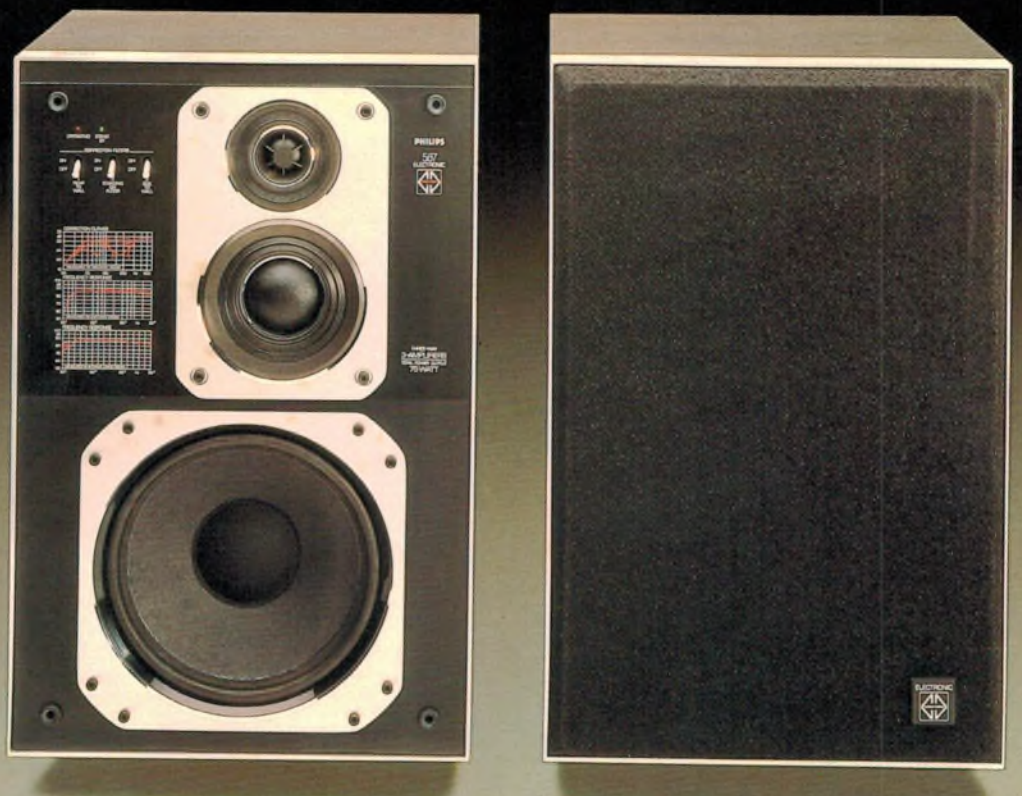
Listen to Philips Motional Feedback Speakers. They'll speak for themselves.

Technical specifications: Model AH 5875

Type of enclosure:	Motional Feed Back box with three amplifiers
Internal volume:	19 litres
Total power of amplifiers:	75W cont. sine wave power
Loudspeakers:	AD81671/MFB4, 8" woofer AD21160/ST 8.15 combi dome squawker/tweeter
Cross-over frequencies:	650 Hz and 3500 Hz
Frequency characteristic:	27-20,000 Hz
Input sensitivity:	variable; impedance up to 3V: 100 kohm above 3V: 1 kohm switchable
Low-note filters:	
Amplifier for woofer	
Output power:	50W cont. sine wave power
Amplifier for squawker	
Output power:	20W cont. sine wave power
Amplifier for tweeter	
Output power:	5W cont. sine wave power
Also available Model AH585	
Output power:	35W cont. sine wave power

Subject to modification without notice

Philips Motional Feedback Speakers.
A step closer to sound perfection.



PHILIPS

367 2219

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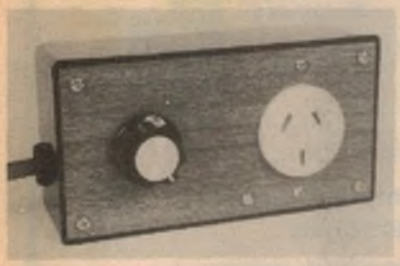
ELECTRONICS Australia

Volume 41 No. 9 December, 1979

Australia's largest selling electronics magazine



Summer is with us and the nights are hot and sticky. Our new fan speed control will help you sleep by slowing your fan to a whisper-quiet breeze. See p68.

Pushed for space but still want big sound? The new Playmaster 3-13L compact loudspeaker system should fill the bill. Find out more on p54.

COMING NEXT MONTH! — find out what's coming by turning to p44.

On the cover

NATIONAL'S "CinemaVision" TC-6200A video projection system gives a theatre size image in relation to your home living room. A report on the latest developments in giant screen colour television begins on p10. (Photo courtesy National Panasonic).

SIMULATED on-screen picture: you could save money and petrol by building our new electronic ignition system for your car. Details on p60. (Drawing by staff artist John Peterson).

FEATURES

HIFI TOPICS AND REVIEWS

PROJECTS AND CIRCUITS

SPECIALLY FOR THE NEWCOMER

MICROCOMPUTERS

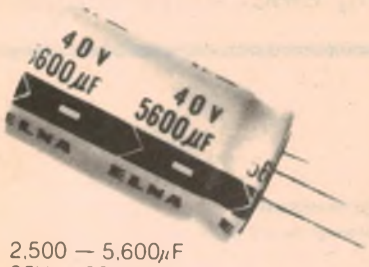
AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

SOANAR CAPACITORS

RP PCB Can Electrolytic

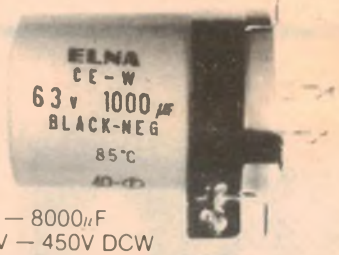


2,500 — 5,600µF
35V — 80V DCW

RB Radial Electrolytic

.47 — 2,500µF
6.3V — 450V DCW

RG/RD Lug Terminal

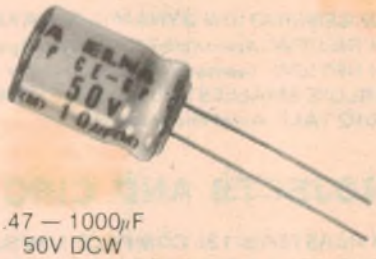


90 — 8000µF
15V — 450V DCW
SINGLE. DOUBLE. TRIPLE

DT Polypropylene Film

.01 — .47 µF
200V — 630V DCW

RBP Bi-Polar Electrolytic



.47 — 1000µF
50V DCW

Computer Grade Electrolytic

2900 — 68000µF
16V — 40V DCW

TL/TH Ceramic Disc.

1.0PF — .47µF
63V + 630V DCW

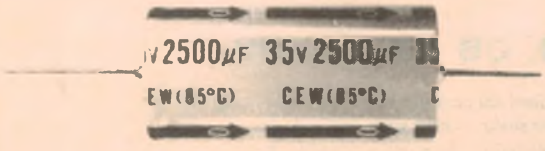
TAD Tantalum Electrolytic

.1 — 100µF
3.15V — 35V DCW

NL/NH Polyester Film

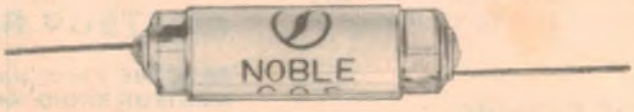
.001 — 10µF
100V — 630V DCW

RT Axial Electrolytic



.47 — 4,700 µF
6.3V — 500V DCW

PS Polystyrene Film



10PF — .01µF
125V DCW

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Editorial Viewpoint

How about being frank for a change . . .

Just before this issue went to press, it was revealed that the reactor at Lucas Heights near Sydney had been shut down for periodic major overhaul; that certain glands were to be replaced, which had begun to seep heavy water coolant — an innocuous occurrence that had been foreseen and provided for when the reactor was commissioned more than 20 years ago.

But it was too innocuous for some sections of the media, still mindful of the mileage they had got from the nuclear mishap at Harrisburg, USA. We had our very own nuclear "incident", "accident", "leak", "escape", right here on Sydney's doorstep. Our own Harrisburg, with posters and banner headlines to match!

In vain, scientists protested that there was nothing unsafe about the situation. They were challenged, rather, to give an unequivocal undertaking that there could never be an accident in the reactor. When they couldn't, it was interpreted as admission of a tangible risk. This was picked up by TV crews who toured the district and questioned residents about fears that had thus been heightened.

Positive feedback indeed!

I wonder whether the self-same news teams sought an unequivocal guarantee from their driver that they would not be involved in an accident on the way back to the studio? Of course not; they accepted the statistical likelihood that they would arrive safely at their destination. Literally, everything we do is based on that kind of judgement, so why the exception about a modest research reactor?

If some sections of the media stand condemned, what about the Premier of NSW? He made further headlines by allegedly rejecting an assurance from the Deputy Prime Minister, not on scientific grounds, but because it was qualified by "I am advised . . ."

I ask you: how else would the Deputy Prime Minister — a grazier/politician — have an opinion, unless it was based on advice from scientists who understand the workings of a nuclear reactor?

It is difficult to escape the conviction that, right across the political spectrum of Australia, frankness, commonsense and even truth itself is being sacrificed to personal and political point scoring. Blame the press, blame the politicians, blame who you like, but the spirit of honest inquiry, honest debate and honest consensus is a casualty of our present era.

I also happen to believe that the public is becoming heartily sick of the humbug. Maybe they — we — are ready to respond to leadership at all levels which lays a little more emphasis on frankness and truth.

Neville Williams

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*Recommended and maximum price only.

News Highlights

IBM to make video disc player!

The news that International Business Machines (IBM), the $21 billion US computer giant, is moving into consumer electronics will send a shiver down the spines of some competitors.

by Max Wilkinson
Financial Times

IBM has announced a joint venture with MCA of the US to make video disc players. These are expected to be compatible with units jointly developed by MCA and Magnavox, a subsidiary of Dutch Philips, and launched recently onto the US market in Atlanta, Georgia.

However, the race to perfect and market a viable video disc system is still at first base. Several other large corporations, including RCA of the US and JVC (a subsidiary of Matsushita), are at an advanced stage of development of their own product, using a completely different system of recording and playback from that of the Philips/MCA laser system.

The Philips/MCA laser system has many potential advantages over its rivals: the disc can be protected by a plastic coating and should last indefinitely; individual picture frames can be "frozen"; and, most important, it has very large capacity. The main drawback is that the disc is expensive to produce and there have been production problems with the cutting of the discs.

This is where IBM comes in: it has also been researching video disc technology for a completely different purpose. It would like to use discs for high density storage of computer data. Philips has also been interested in this possibility.

The reason that the computer industry and the home entertainment industry can make use of a basically similar machine is that video discs are recorded in the computer language of digital pulses. From the point of view of the machine, it makes very little difference whether the millions of digits on a video disc are encoding data or represent a moving picture.

The joint development with IBM has therefore a number of interesting implications for the future of both industries.

Firstly, it has been estimated that sales of video players to the computer industry could outnumber consumer sales by perhaps 10 to one. This means that high development costs could be more rapidly amortised, so that consumers could get a cheaper product more quickly — very important in the take-off phase of the market.

In the longer term, the advantages of digital techniques for sound only recordings are expected to be exploited by high fidelity manufactures. The largest size disc could hold more than 12 hours of continuous music, but more important, the sound quality would be better and less prone to deterioration than with conventional recordings.

British windmill is hurricane proof

A new generation of windmills developed in Britain are self-starting, unaffected by changes in wind direction — and will automatically adjust their aerofoil sails to withstand even hurricane winds. They can be used for electrical generation or for water pumping.

Most modern wind turbines revolve around a horizontal axis — as did their original and traditional counterparts — but the new British turbine rotates around a vertical axis. One major advantage of this design is that it does not matter from which direction the wind blows, the turbine will always rotate.

In high winds, conventional turbines must shut down to avoid destruction by the huge forces exerted on the structure. This new British turbine will shortly be used to power a lighthouse in the Leeward Isles and the manufacturers are confident that it will operate successfully even in hurricane conditions.

The turbine has straight aerofoil blades each of which is attached to its supporting crossarm by a hinge. In average wind speeds of 5-7 metres per second the blades are near the upright position, but as the wind increases the ends of the blades cone outwards — due to centrifugal force — preventing damage caused by bending.

A further advantage of the vertical windmill is that as the rotor gives direct dirve to the vertical shaft there is no need for complex, energy-absorbing gearing at the top of the turbine.

There are two versions avilable at present: a six metre version, seen here, producing 3200 watts shaft power in a 10m/s wind and a 500W 4.5 metre version specifically designed for generating electricity in remote areas.

Further information may be obtained from PI Specialist Engineers Ltd, The Dean, Alresford, Hampshire, England.

Speech aid for handicapped

At first sight "Splink" looks like one of the new electronic games played on a television set, but is in fact a new communication aid for the deaf and speech handicapped. Invented and developed in Britain, Splink is a microprocessor controlled device linked to an ordinary television set and has a keyboard on which there are 950 basic words and phrases.

The user presses the appropriate words on the keyboard and these appear as complete sentences on the screen. The keyboard includes some basic phrases such as "I want a . . ." and "What did you say?" Words that are not on the keyboard can be built up from the initial letters of some of the words that are available. Splink has a constantly available visual memory of about 110 words enabling the user to see on the screen not only what has been said, but how it was worded.

The keyboard can be used up to 6m from the TV set and has no trailing wires connecting the two. The secret is an infra-red datalink between the board and the microprocessor unit.

You can obtain further information on Splink from Medelec Ltd, Manor Way, Old Working, Surrey, GU22 9JU, England.

US award for Australian "talkies" pioneer

The man who put sound into the first Australian talking movies, Mr Arthur Smith, has been elected a fellow of the Society of Motion Picture and Television Engineers.

Mr Smith, who is 77, becomes only the third Australian to be accorded one of the greatest honours of his profession. He developed the sound recording equipment used by Cinesound in the thirties, and was the company's chief recording engineer from 1931 to 1958.

He first became interested in the recording of sound for films in 1929, and was involved with some of the earliest systems using tungston arc discharge tubes and, later, mercury vapour discharge tubes. The American-based society made its award to Mr Smith because of his outstanding career as an innovator.

Video recorders are lawful says US court

A US District Court judge has ruled that the non-commercial use of home video recorders to record television broadcasts is lawful, clearing the way for further expansion of a rapidly growing segment of America's consumer electronics industry.

The decision upheld the right of the Sony Corporation and, indirectly, other companies, including RCA Corporation, to market such recorders.

The suit, which has been widely followed in the electronics industry, was brought three years ago by Universal City Studio Inc and Walt Disney productions. They asserted that the sale of the recorders unlawfully facilitated the theft of copyrighted materials and would result in millions of dollars in lost sales.

Lawyers for Sony argued that use of the recorders was legal, and asserted that the major factor in Universal Studio's decision to bring the suit was the planned introduction of the videodisc playback system developed by MCA Corporation, Universal's parent company.

Spacecraft to probe Sun's polar regions

Man is expected to take his first look at the polar regions of the Sun as a result of a combined European-US space project planned for 1983.

These regions cannot be seen from Earth or from satellites in earth orbit. Now, under an agreement signed between the European Space Agency (ESA) and the US National Aeronautics and Space Administration (NASA), two spacecraft will travel in orbits passing directly over the Sun's poles.

NASA and the 11 country ESA will each provide a spacecraft and Britain, Germany, France and Switzerland will supply experiments for the craft.

The two spacecraft will be launched together, probably in February 1983 from the American space shuttle vehicle. They will be directed towards Jupiter along similar trajectories by booster rocket and then swing round the giant planet, using its gravity to redirect their paths into orbits passing directly over the Sun's north and south poles.

Scientists believe that by sending one craft over each pole simultaneously they can compare solar and interplanetary phenomena affected by the differences in activity between the northern and southern solar hemispheres.

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TRIONIC Dual Element	1/10-600	250 600	N.E.C. Holders	RK5	200,000	Motor starting and protection.
AMP-TRAP Form 101 Rectifier fuses	1-10,000 1-5000 1-2000 35-1600 20-1600 20-1600 20-800 20-800 20-600 20-600	130 250 600 500 700 1000 1200 1500 2000 2500	Clip or Bolt Mounting	*N.A.	200,000	Semi-conductor, rectifier, diode, SCR protection. D.C. power supplies Inverters U.P.S. systems Controls Variable speed drives Mine power supplies Special applications, A.C. or D.C.

*Not applicable

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NEWS HIGHLIGHTS

Meteor trail communications feasible

Menlo Park, CA — The hundreds of millions of meteors that enter the Earth's atmosphere every day leave in their wake a very inexpensive communications medium — the meteor trail. This naturally occurring band of ionized particles can be used instead of man-made satellites to relay brief radio messages up to 2000km.

Using these "natural satellites" could reduce the cost of communications systems for a wide range of applications according to Charles P. Mason, a senior consultant at SRI International. The meteor trails could be used as an effective alternative to satellites for ship-to-ship, ship-to-shore, and even air-to-ground communication systems. They could also be used to relay data on icebergs, pollution, earthquakes and weather.

Meteor burst transmission systems work in several stages. Sensors at remote sites gather and store data, such as temperature or precipitation measurements. Meanwhile, a microprocessor-controlled central station emits a continuous radio signal, which bounces off a meteor trail whenever one occurs within range. When this signal reaches a transceiver at the remote site, it triggers the transmission of the stored data, via the meteor trail, to the central station.

The meteor trails last up to a few seconds — ample time to transmit the message. And the frequency of meteor showers allows for up to 100 message exchanges an hour!

Meteor burst transmission technology has enjoyed limited use since SRI pioneered its development in the 1950s. Now, says SRI, microprocessors have reduced hardware costs and improved reliability to the point where far greater exploitation of the medium is possible.

Electronics courses at Newcastle Tech.

Newcastle Technical College wishes to advise readers that it provides a wide range of electronics courses for residents of Newcastle, the Hunter Valley, and northern NSW.

These courses include the Electronics Trade Course, which replaces the older Radio Trades Course. The course has recently been broadened to include both analog and digital techniques, and offers a range of optional subjects in stage 3 in specialised areas of industry. It can be taken either as a full-time pre-apprenticeship course, or in block release pattern.

Others courses offered include Post Trades Television, Radio Transmission, Industrial Electronics, Basic Electronics, Two Way Radio Users Course, Technical Principles of Two Way Radio, and Television Studio Techniques.

Further information is available from The Senior Head Teacher, School of Applied Electricity — Electronics Division, Newcastle Technical College, Maitland Rd, Tighes Hill, NSW 2297.

Business Briefs:

D. D. Webster Electronics Pty Ltd has appointed Anderson Digital Equipment Pty Ltd (ADE) as its sole sales representative for Australia, New Zealand, and Papua-New Guinea. Under the agreement, ADE will be responsible for sales and service of Webster's Computex Spectrum-11 range of small business computers. This includes Spectrum models A, B, C, D, E, F and Z with disc capacities ranging up to 2.52 megabytes. Further information on the Spectrum-11 range from Anderson Digital Equipment Pty Ltd, 1 Expo Court, Mt Waverley, Vic 3149.

Mr B. R. Goddard, Regional Managing Director of the **Plessey** group, has announced the resignation of Mr David Towey from the position of General Manager of Plessey Data Systems. Mr Malcolm Humphreys has been appointed acting General Manager of the division.

Fairchild Australia Pty Ltd has moved to new premises at Suite 1, First Floor, 366 Whitehorse Rd, Nunawading, Victoria 3131 (telephone 877 5444). The company's NSW branch office is at Third Floor, FAI Insurance Building, 619 Pacific Highway, St Leonards 2065 (telephone 439 5911).

Sanyo Australia Pty Ltd has moved to new national headquarters at 225 Miller St, North Sydney 2060 (telephone 02 436 1122). The move completes the transfer of Sanyo's corporate headquarters from Melbourne and marketing head office from Lane Cove.

National Semiconductor Corporation, California, has reported first quarter fiscal 1980 sales of $US242, up 31% over 1979. Earnings were put at $12.5 million, or 93c per share, up from 65c a year ago, a 43% increase.

Pollution-free thermal power plant

Menlo Park, Calif. — Led by scientists at SRI International, formerly Stanford Research Institute, an industrial team has designed a solar power plant which could produce electricity more cheaply than coal.

The SRI scheme envisages 440 small, clean 100MW solar thermal power plants serving the southwestern US states within 30 years. The design concept is said to represent a major advance in the generation of cheap electricity from solar energy.

SRI calls its design a "line-focus" system because its sun reflectors (heliostats) are arranged in rows. Each heliostat, a long mirrored panel backed by fibreglass-reinforced cement, tilts upward to reflect sunlight toward a long receiver raised on steel towers. Sunlight concentrated in the receiver cavity heats salt, which is used to generate steam for a conventional turbine generator. The plant can store extra heat to generate electricity through the night.

Several features beside possible cost savings make the plant attractive. Additional groups of heliostats can easily be attached to the existing system to increase its capacity. And, as soon as the storage system and generator are in place, the first group of heliostats can start reflecting sunlight to generate electricity. Thus, unlike other solar plant designs that cannot operate until fully built, the line-focus system can produce solar energy while it is still being built.

In addition, solar power plants pose no pollution threat and could be placed close to communities, thus keeping transmission costs down. Traditional fossil fuel stations would provide back-up for the solar stations during extended periods of cloud cover.

EEEMC'79 a success

Equipment from more than 130 companies went on display at the 5th Electrical Electronic Engineering Measurement and Control (EEEMC) Exhibition and Convention held in Sydney last October. On show were items ranging from electronic components through small business computer systems to heavy industrial equipment.

A number of seminars were held in conjunction with the exhibition, and dealt mainly with the use of microprocessors and computers in industrial plant. Energy needs and conservation measures were also considered.

Contributing sponsors included the Institute of Instrumentation and Control Australia (NSW Branch); the Microprocessor Group of the Institute of Radio and Electronics Engineers; the Institute of Engineers, Australia; the Australian Electrical and Electronic Manufacturers' Association; and the Micro-Computer Enthusiasts' Group.

Vicom International showed Leader test instruments and a range of professional communications equipment.

Roger Ellis (right) and Nick Fondas (centre) were on hand to demonstrate TI's 5TI Programmable Control System.

The latest test equipment from Hioki Electric Works was displayed by H. Rowe & Co. Pty Ltd.

John F. Rose showed a range of business computer systems.

Computerland displayed the 16K Apple II Plus computer.

Three new ways to low-cost, super-bright

Giant screen colour television

Things are really looking good when it comes to projection-type big screen colour TV sets. The latest generation of sets provides brighter, crisper pictures than ever before, and the systems currently being developed look like producing even better results again — at lower cost.

by C. P. GILMORE

I have just returned from a trip to a small laboratory/factory in the shadow of MIT in Cambridge, Massachusetts, to a plant just outside Cape Kennedy, Florida, to a plastic-lens factory in the rolling hills east of Cincinnati. In these diverse facilities, a new generation of projection television is being readied for production. Some of these units will be on the market before the end of this year. I am convinced that they will launch a new age of giant-screen projection TV for the home.

Of course, projection TV has been around for some time. Advent put a high-quality set on the market back in 1972. Other three-tube sets using both Schmidt and refractive optics (see diagrams) have come on the market since then, and are now available in the $3000-$5000 range. Also available are a number of "one-eyed monsters" — small television sets in a box with a projection lens in front of the screen. They project a considerably dimmer image (though some are okay in subdued light), and most fall in the $1000-$2000 range.

Two of the three new approaches I've just seen are similar to current three-tube sets: One is a Schmidt; the other, refractive. But they feature advances that make them dramatically cheaper and at the same time brighter and sharper. The third is totally new. All three produce high-quality, super-bright projection TV at a price substantially below anything remotely comparable in quality today.

ROGER HOWE of US Precision Lens holds revolutionary f/1.0 plastic lens that makes possible a refractive system rivalling the Schmidt system in brightness.

The Novatron

Henry Kloss started Advent Corporation 12 years ago to make a projection-television set with a mirror inside the tube — a Schmidt projection system. "It was quite an effort to get this system, with parts that had to be kept to tolerances of within a couple of thousandths of an inch, in the tube and stabilised," he told me recently. "So I chose a heavy-handed way that I knew would work." The inner structure was composed of more than 20 steel parts, which had to be carefully assembled and aligned before being sealed in the glass envelope.

Two years ago, Kloss left Advent and retired to his basement for a year. "I had the luxury of having the time to see if I could find a more elegant way to make the tube," he continued. "If you want to reduce things to a minimum, you've got to have a mirror. You need a vacuum enclosure. You need a window for the light to get out, and a place to put the phosphor.

"Now suppose you make the mirror as part of the tube (which had been suggested, but I don't think ever done

commercially before), and let the faceplate carry the phosphor. The mirror and phosphor for optical reasons must have the same centre of curvature. If you separate these two spherical surfaces by an accurately ground cylinder — the barrel — it's got to come out right. The accuracy of the position of the barrel isn't important. If it has spherical curves ground into its end, then the two end pieces will automatically be held in perfect alignment."

Kloss showed me what he meant. He set up a tube neck with a mirror, a cylinder, and an end plate containing phosphor. Then on an optical bench he shot a beam of laser light through the axis of the system. As he moved the barrel around, the laser beam showed that the two optical elements remained in perfect registration.

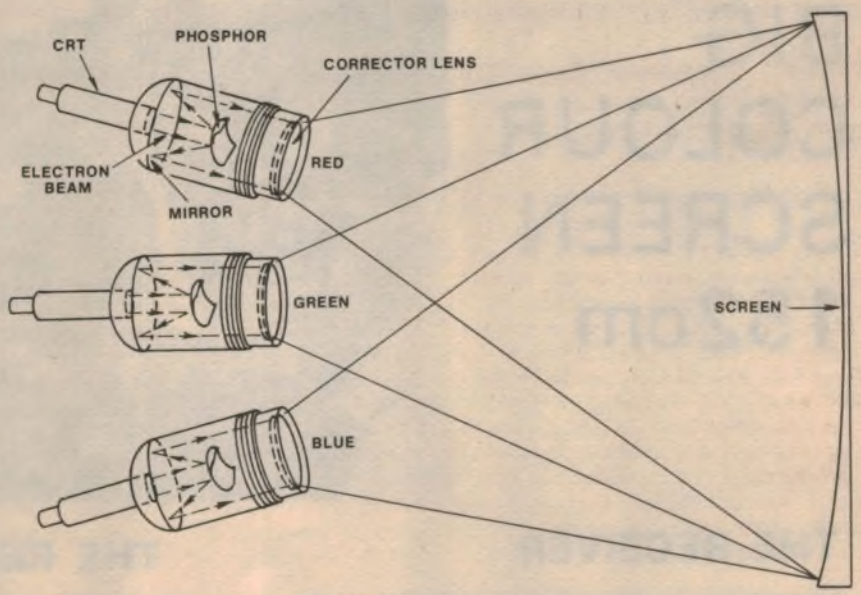
Once the basic concept was hatched, there remained the problem of seeing if it could be built. "Here is a little research furnace that came from my basement," he said, walking through a laboratory at his new Cambridge firm, Kloss Video. It was a 90-litre stainless-steel lobster pot enclosing a smaller pot and fitted with an elaborate array of Calrod electric heating elements. "The key was to be able to differentially heat the mirror, different parts of the cylinder, and the face-plate to appropriate temperatures. I had four Variacs for controlling heater temperatures, and night after night I sat down there trying different temperature schedules so that when the glass came out it was free of strain."

The new Novatron tube has many advantages. Because of its simplicity and ease of manufacture, it's cheaper than other Schmidt-type tubes. It's also brighter. "The electron beam has a better focusing system on it, so you can put higher beam current in," says Kloss. "And the phosphor can be kept cooler because we can get to the back of that glass and put a heat sink on it."

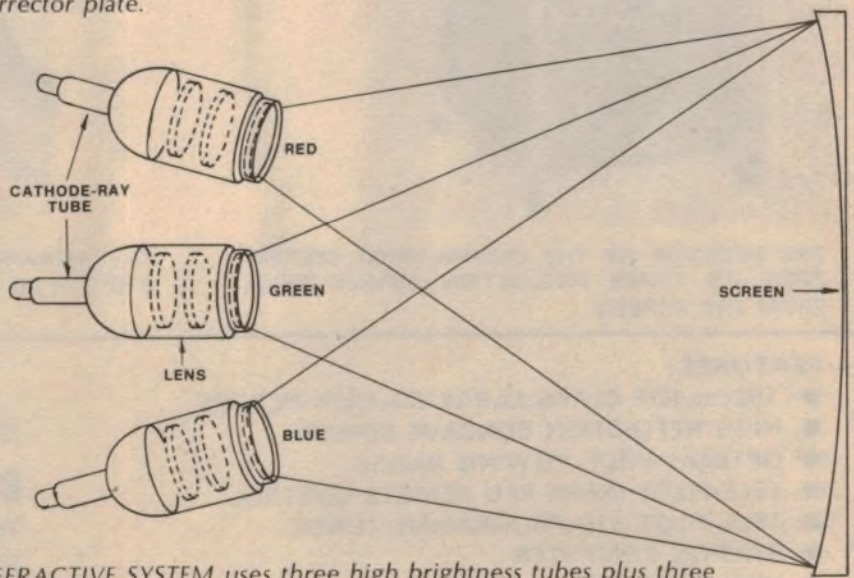
When I went into a lab, all fluorescent lights were on. But the picture at the far end of the room was bright and sharp. "You can measure 120 foot-lamberts in highlights on that picture," said Kloss. "We may run it slightly below that — say, in the 100 foot-lambert range. At that level, we've learned, we can get many thousands of hours of life out of the tubes; we don't know where the actual end of life is." Kloss is setting initial production plans at 100 a month, and planned to show his first commercial set with Novatron at the Consumer Electronics Show in Chicago last June.

The refractive-optics system

This approach is now being championed by Roger Howe, chairman of the board of US Precision Lens, which makes the revolutionary lenses that really put refraction systems in the super-bright category. But oddly, this approach, too, was launched by Henry



SCHMIDT SYSTEM uses an electron beam to form an image in each tube, and telescope optics to project enlarged colour pictures onto the screen. New, simple construction developed by Henry Kloss cuts costs and reduces parts to a minimum: neck with integral mirror, barrel, faceplate with phosphor target, and corrector plate.



REFRACTIVE SYSTEM uses three high brightness tubes plus three fast lenses to project red, blue and green images. The images combine on the screen to form the colour picture.

A NEW DIMENSION IN TELEVISION VIEWING GRUNDIG CINEMA 9000

BIG COLOUR SCREEN 152cm

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Kloss. The principle is simple. Put a lens in front of any light source and you project a picture. Many of the projection-TV sets on the market now — the one-eyed monsters — use a lens and a regular TV set to project a bright enough image to see in a darkened room.

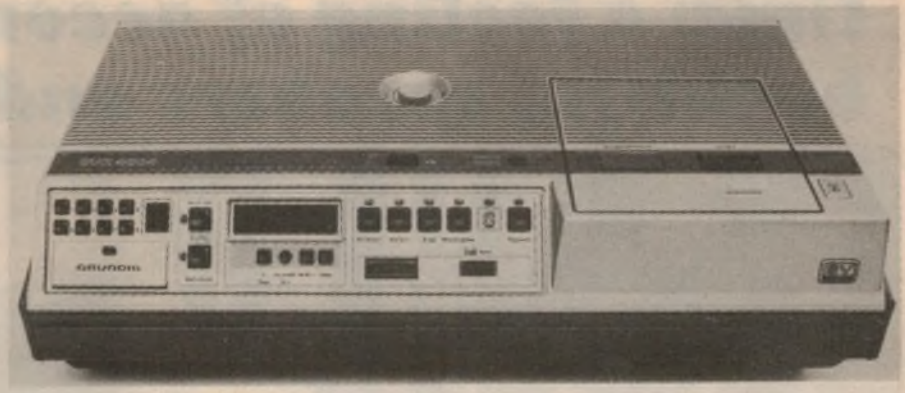
Can that simple system be improved? Henry Kloss began to wonder about that in the mid-1970s, after the Advent Schmidt-optics system was on the market. "Electrohome in Canada had some higher quality circuitry than other places and was interested in projection TV," he recalls. "Roger Howe at US Precision Lens was willing to try to make faster, cheaper lenses. There is an oversupply of tube-making equipment. These elements began to come together in my mind."

Kloss decided to make a system using three regular monochromatic tubes — one blue, one green, and one red — then combine them optically to make the full-colour image. With three tubes each giving off light, the total light output could be high. If a fast lens (one that transmits a lot of light) could be found, that would make it brighter still. So Kloss asked Clinton Electronics Co to develop a brighter, more accurate version of its monochromatic tube; Electrohome to work on circuitry; and Roger Howe to build a fast lens.

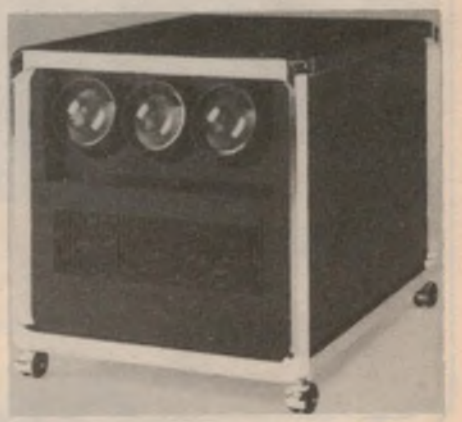
The lens US Precision developed was an f/1.4, injection-moulded of acrylic. Kloss used it to make the Advent 750, which has since been repackaged to become the 760. It was a successful product, and the first three-tube refractive home set on the market. Although not quite as bright as the Schmidt optics set, it was still bright enough for comfortable viewing.

The technical trick that made this possible was the development by US Precision of a way to make large, thick plastic aspheric lenses with optically acceptable surfaces.

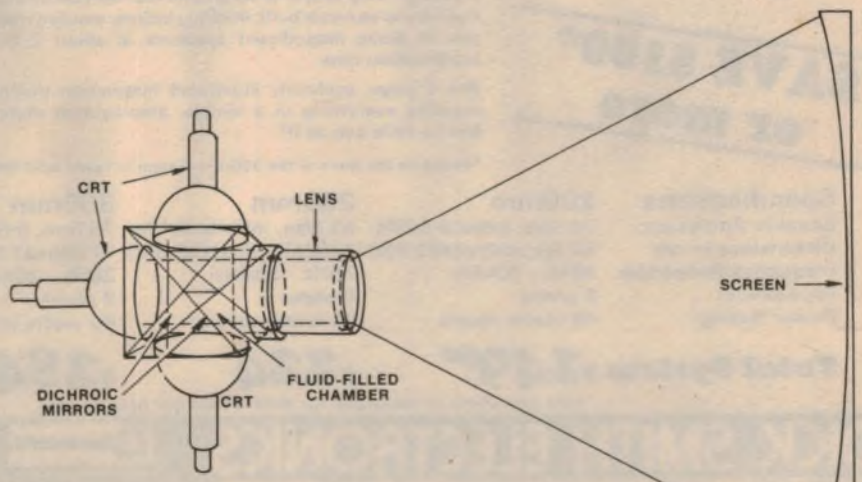
This development not only made lenses cheaper, but it had an additional advantage. It freed lens designers from the constraint of having to use lenses with spherical surfaces, as they must do with glass. By calling for aspheric lenses with complex shapes, designers could make extremely fast, simple lenses with fewer elements. And since the US Precision process is so much simpler than grinding glass lenses, the lenses could be far cheaper than those made of glass by the traditional method. Once US Precision had made the f/1.4 lens for Kloss, the company decided to



ABOVE: Grundig SVR 4004 video cassette recorder — an optional extra with Grundig's "Cinema 9000" giant-screen projection TV system. It can be remotely controlled.



RIGHT: the receiver of Grundig's Cinema 9000 system. It uses three in-line projection tubes: one red, one green, and one blue.



AQUABEAM SYSTEM uses dichroic mirrors to combine colour images from three tubes into a single beam, which is projected through a singe lens onto the screen. Art Tucker (at left) is shown holding the housing for the 3-tube assembly.

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Photograph shows speakers without front grilles.

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ABOVE: "Tele-Pilot" 310 infra-red remote control — supplied as standard.

THE GRUNDIG CINEMA 9000 is a two-piece unit consisting of a separate screen and a receiver with a high-brightness, in-line, 3-tube optics sytem. It is supplied complete with a multi-channel infra-red remote control unit.

An impressive feature of the remote control unit is the in-built digital clock which allows the unit to act as a time-switch. It will also automatically switch the TV to stand-by mode after about 35 minutes if no remote control commands are issued.

The mobile receiver is fixed to the floor about 2m from the screen which is normally wall mounted. Screen size is 125 x 96cm (or 152cm diagonal) — about eight times larger than the picture area of a 48cm TV.

Further details from Brewo Electronics, 104 Bathurst St, Sydney.

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see if it could push the technology still further. So it developed an f/1.0 lens, which has twice the light output.

Suddenly new possibilities loomed. A refractive set could be made with the new lens that could be twice as bright as before. "So now it's a real horse race between our technology and the Schmidt technology," says Howe.

The lenses sharply reduce the cost of projection television. Much slower glass lenses, such as are now used in the Japanese sets, cost as much as $200 each in quantity. But Howe says that any manufacturer who buys his new f/1.0 lenses at the rate of a thousand a month (a small number for a mass-market product) can get them for $155 for a set of three — enough to make a television set.

Howe led me into a viewing room with a projection set using the new f/1.0 lens. It produced a beautiful, bright, sharp, clear picture in a well-lighted room.

Howe's lenses could be an important factor in projection TV. They're now available off-the-shelf. So are super-bright monochromatic tubes from Clinton and other manufacturers. TV electronics can be bought as a package. So anyone who wants to can now put together an ultra-bright, relatively low-cost television set by simply buying all of the parts and putting them into a case.

The Aquabeam system

Back in the early days of projection television, many of the sets seen in US theatres, hospitals, military installations, and other commercial and industrial applications were built by an electro-optical expert named Art Tucker. Although Tucker had built many Schmidt-type systems (including a $28,500 system that produced a 12-metre picture for use in theatres in the late 1950s), he was concerned with several problems inherent in the design. For one thing, a Schmidt system must be engineered for a fixed picture size and a fixed projector-to-screen distance. And getting the three beams from the three colour tubes to converge is complicated.

Tucker had also built and sold several thousand refractive optics systems using glass lenses back in the '60s. They cost $6800 and were sold mostly to schools. But he decided a couple of years ago that this was not the ideal approach either and that a new kind of system was needed.

So he set about to try to develop a system that would combine the three beams of light before the lens, so they could be projected as a single beam through a single tube. This would allow a single system to produce an image of any size. Just move it toward or away from the screen, focus like a slide projector, and the image size changes. But to work properly, a lens must be close to the face of the cathode-ray tube whose picture it is projecting. "So how do I get the tubes to think they're close to the lens and still stuff the mirrors in between?" asked Tucker.

He did it in an ingenious way. Tucker made a plastic box with windows on all four sides (see diagram). Inside, he mounted two dichroic mirrors. A dichroic mirror reflects light of one colour or wavelength, while passing most of the light of different wavelengths. When the mirrors were arranged properly, the result was a head that combined the images from the three tubes into a single beam, which could be projected by a single lens.

But there was still one problem. When a light beam goes from glass to air or vice versa, it is bent sharply by a phenomenon known as refraction. Since various images were travelling through varying numbers of glass-air surfaces, refraction seriously distorted some of the images.

So Tucker devised another solution. He filled the box with a liquid with very special properties. It has precisely the same refractive index as the glass used on the face plates, for the internal mirrors, and at the exit pupil. Thus the glass effectively disappeared, there was no refraction of light internally, and refractive distortion was eliminated.

Tucker has just set up his new company, The Big Picture, Inc, in Titusville, Florida. When I was there, he was setting up production facilities: heavy injection-moulding equipment for the optical elements and housing of the projection head, electronics assembly areas, and so on. Initial plans call for him to manufacture 2000 sets that will sell for about $5000 and be placed in institutional settings — bars, hospitals, auditoriums.

Tucker figures that once he gets that many out in the field, he'll get enough practical experience to impress major TV manufacturers who might want to license his equipment. Ultimately, he hopes to manufacture only the projection head, selling it to the big home-TV makers for inclusion in their sets.

His units are impressive. He showed me sets that produce pictures considerably brighter than those from either the Kloss Schmidt system or the Howe refractive system. The liquid refractive agent directly in contact with the tube face helps keep the phosphor cool, so higher driving power can be used, which produces a brighter picture.

Home sets

What will it take to make a successful home set? The makers disagree — and each outlines a set of desirable qualities clustered around his individual approach. Kloss thinks the two-piece set with projector in the middle of the room and screen on the wall, much like the various Advent models he designed, will be most desirable, Many thousands of that kind have been sold.

Tucker thinks it has to be a one-piece unit. "It can't stick out from the wall more than 28 inches," he says. "Preferably, it should disappear when you're not looking at it. It can't have exposed wires running to it (that eliminates a projector in the middle of the room). It's got to look presentable as furniture. And you've got to be able to get it upstairs and through doors."

Howe has an ideal product in mind, too. "It should be comparatively unobtrusive, should be in one piece, and should sell for under $2000." While there is a difference of opinion as to whether a one-piece or two-piece system is most desirable, this does not necessarily make one approach more likely to succeed than another. Any of the three systems can be built into either type of unit.

How about brightness?

All three claim they have enough, and after seeing them, I agree. Says Kloss, "We've got enough brightness now, and don't have to talk in terms of foot-lamberts any more. We can be like the Rolls Royce salesman, who, when asked about horsepower, replied, 'It's adequate, Madam'."

Then why is Tucker trying to get more light — perhaps several times as much as the other two? At light levels now used, high-gain screens are also used to make the picture brighter. But the higher the gain, the narrower the viewing angle. Tucker wants to have so much brightness than he can trade some of it off for other desirable characteristics.

What size should a projection set be? Kloss thinks a 1.8-metre picture is desirable. Tucker says his projector will give you whatever size you want — an important point in favour of his set. Howe says 1.3 metres is ideal, but points out that with the three-tube refractive system the picture can be made any size. (Changing size can't be done by the customer; a set will come adjusted and converged for the size screen with which it is sold. But the factory can use the same package to make sets with any size screen).

What does the future hold? It seems likely that the new systems will launch a new era for large-screen projection TV, both at work and at home!

"CinemaVision" TC-6200A from National features one-piece construction, a 153cm (diagonal) screen, and a high-brightness 3-tube Schmidt optics system. A 26 function remote control unit allows the user to turn the set on or off, select up to 16 pre-set channels, and vary brightness and volume. Other features include provision to play either PAL or NTSC video tapes via a VTR, an aluminised screen surface, and an automatic station search facility. Further details from National Panasonic Australia Pty Ltd, 61 Anzac Pde, Kensington, NSW 2033.

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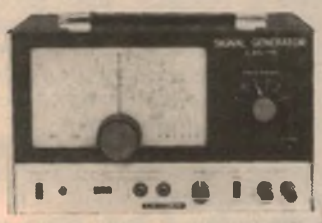

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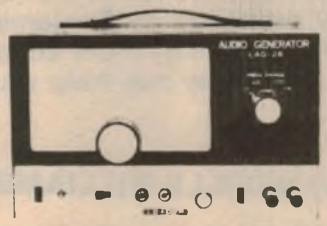

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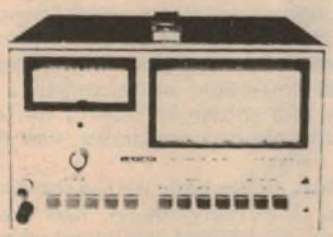

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Current — which way does it flow?

From the Museum of New York, this Currier and Ives print depicts the 1752 experiment by Benjamin Franklin which established a relationship between lighting and static electricity — altogether a rather hazardous experiment.

Which way does electric current flow in a circuit? From positive to negative, as originally proposed by Benjamin Franklin, or in the reverse direction, as maintained by many adherents of electronics? This somewhat historical survey may help you to get the matter in perspective.

by NEVILLE WILLIAMS

Electrical phenomena have been observed and documented over hundreds — even thousands — of years, although not understood at the time. The ancient Greeks, for example, were aware of static electricity, as manifest by the way in which a piece of vigorously rubbed amber would attract particles of dust and lint. In fact, the Greek word "elektron", meaning amber, is the root of our modern term "electronics".

Again, the Romans were aware of the peculiar behaviour of "loadstone", or magnetite, an oxide or iron which provided the key to the early mariner's compass. Even in those far off days, Roman writers were unsure whether their word for the effect had been derived from the island of "Magnesia", the source of the loadstone or "Magnus", the shepherd who allegedly discovered its strange properties. Sufficient to say that, between them, the words provided the root for our modern term "Magnetism".

Much later, from about the 18th century onward, European researchers began to study electrostatic and magnetic effects more deliberately and the conviction grew that there was a link, as yet unresolved, between the two. In 1752, Benjamin Franklin extended the speculation by demonstrating a further link between static electricity and atmospheric lighting — an experiment that, in retrospect, has been classified as one of the most foolhardy of all time!

Indeed, Franklin postulated that electricity was some kind of intangible fluid. When an object had more than its share of this fluid, it would attract (or electricity would flow into) another body which had less than its share. He also suggested that a body with surplus fluid should be regarded as being electrically positive, and bodies with less than normal fluid as being electrically negative.

A concentration of the "fluid" was seen as "static" electricity. Electrical fluid in motion came to be known as "current" electricity and, in line with Franklin's proposition, current was deemed to flow from positive to negative.

At that point in time, there was no special reason to adopt a contrary view and it was accepted as fact.

So the convention was established.

In subsequent years, Luigi Galvani (1780) and Allessandro Volta (1880) contributed to research which produced the first electrical cells (or "batteries" of cells). In due course, one connection was identified as the source of electrical "fluid" and variously branded "anode", "positive", "plus" or "+". The other connection was called "cathode", "negative", "minus" or "-".

Thus equipped, Hans Christian Oerstadt began a long series of experiments in 1807, which established a firm relationship between electrical current flow and magnetism:

When current from a battery flowed through a wire (from anode or positive to cathode or negative, of course) it produced a magnetic field around the wire. This could be sensed by a compass and shown to have a north and south polarity comparable with that of the Earth.

Thus, in the early part of the last century, the conventions had become firmly established and interlocked.

In successive decades, many famous physicists and engineers expanded the basic concepts and developed practical equipment, ultimately giving birth to a fledgling electrical industry, with batteries, generators, motors, lighting systems, communications systems and so on.

Associated with it was a growing mountain of textbooks, literature and academia — all conforming to the original assumptions about voltage polarity and the direction of current flow and magnetic flux. These relationships were epitomised in Fleming's classic right-hand and left-hand rules, which have graced electrical textbooks for more years than most can remember.

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APPLICATION BS610

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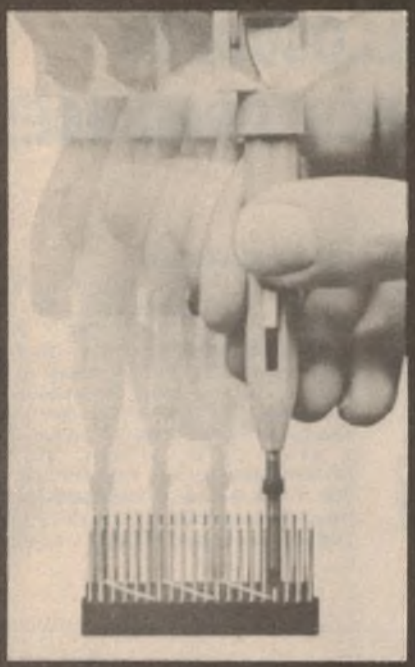

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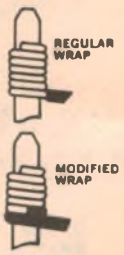

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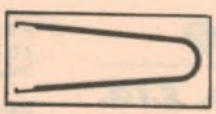

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But, around the turn of the century, Franklin's long-standing electric "fluid" concept began to be questioned by Rutherford, Bohr, Thompson and others, who put forward the then quite revolutionary electron theory. It had enormous implications.

They maintained that atoms were not, after all, the basic building blocks of matter. That atoms, in turn, were made up of still smaller particles (the real building blocks) notably "protons" with a positive electrical charge and "electrons" with an equivalent negative charge.

Each atom was like a miniature solar system with a nucleus of positively charged protons and (usually) an equal number of electrons spinning around it in specific orbits. The number and arrangement of protons and electrons determined the nature of the atom.

In certain substances, electrons in the outermost orbit could migrate from atom to atom. If, for any reason, there was an overall surplus of electrons in a particular area, it was equivalent to a negative electrostatic charge; a deficit of electrons was equivalent to a positive electrostatic charge. A discernable migration of electrons from one region to another was an electric current.

As a logical extension of this, a cell (or battery) could be regarded as a device in which internal galvanic (electro-chemical) action produced a surplus of electrons at one pole (negative) and a lack of such electrons at the other (positive) pole. In a rotary generator, a similar result was produced by magnetic effects. Similarly for an electrostatic generator or any other source of electrical energy.

The current which flowed when the two poles were bridged by an external wire was not some intangible "fluid", but simply a migration of free electrons through the wire.

NEGATIVE TO POSITIVE!

More to the point, this movement was from negative to positive!

The electron theory was not well received at first, partly because it challenged existing physical, chemical and electrical concepts, and partly because it appeared to contradict the "sacred" laws about polarity, current flow and magnetic flux. Indeed, it remained a "theory" for many years, until progressive developments rendered the traditional view untenable.

What gave particular point to the argument was the development of the thermionic valve, better known to the Americans as a vacuum tube or radio tube. As it happened, the operation of this vital new device was relatively easy to depict and comprehend and, of course, it depended on electrons migrating from atom to atom and even across free space.

In a thermionic diode valve, electrons emitted by a heated filament (or cathode) were attracted to an adjacent plate (or anode) within the evacuated glass envelope, whenever the plate was at a positive potential with respect to filament. On this property depended a diode's ability to function as a rectifier or detector.

In a triode valve, electrons were emitted from filament to plate in the same manner, except that the electron stream was subject to further control by an additional electrode (a "grid") mounted between the filament and plate. This made it possible for a triode to act as an amplifier or oscillator.

To understand the operation of wireless circuits using valves, it seemed quite natural to think in terms of electron flow: from the negative side of the supply to the valve filament (or cathode), thence across to the valve plate (or anode), and on through components in the external circuit back to the positive side of the supply. (Fig. 1.)

THE TEACHERS' DILEMMA . . .

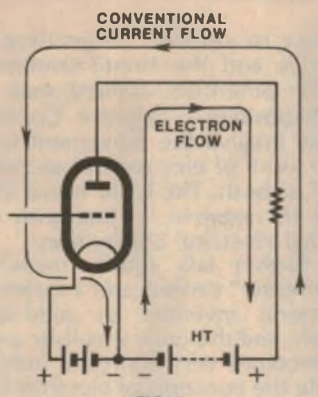


FIG. 1

In a simple triode valve circuit, electrons flow from the negative side of the (HT) high tension supply to the filament or cathode, across the evacuated space to the valve anode, then through the external anode circuit to HT+. This conflicts with the conventional current flow concept from plus to minus.

In wireless magazines and textbooks, arrows were commonly drawn on circuit diagrams to emphasise this quite fundamental concept.

Over the following decades, as the science and application of wireless expanded (call it "radio" if you like), an inevitable confrontation developed.

The wireless/radio fraternity had no real option but to develop their understanding on the basis of electrons and electron flow. But, to them, electron flow was current flow; how could it be any other way? Indeed, such was the logic of their position that they were confident that, one day, electrical types would have to see it that way!

But, in this, they were disappointed. Possibly because they were less directly concerned with electron physics, the electrical fraternity chose to retain their long established conventions governing current flow and magnetic polarity. What's more, they have never budged from that position.

BASIC CONFLICT

In the centre of things, teachers and lecturers were commonly obliged to explain electron (therefore current) flow in one direction, despite the fact that other members of the staff were talking about current flow in the opposite direction!

Publications like our own were also caught in a bind, particularly as electrical and radio interests began to overlap onto the common ground which is now all part of "electronics". As surely as we gave expression to the electron/current concept, just as surely would readers challenge us with chapter and verse to "prove" that we had our ideas and arrows the wrong way round!

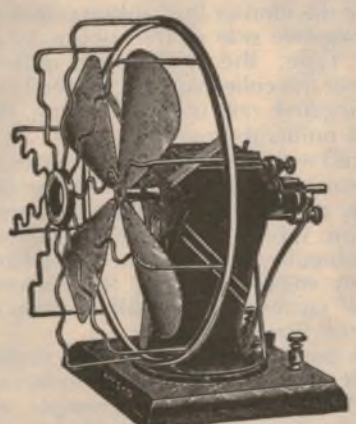
More or less of necessity, we adopted the following practices:

- The word current was used only in a generalised sense; eg, voltage and current.
- If the context required a reference to the direction of current flow, we added the word "conventional", thereby indicating that the statement was in accordance with the established electrical convention.
- In the context of radio (particularly valve) circuits, and where possible, we wrote in terms of electron flow.

This practice, also followed by many other electronics publications, minimised confusion and kept most people happy. Or, perhaps we should say: made them less miserable!

In general, we still follow the practice, but the emphasis has changed again since the advent of solid-state devices: diodes, transistors, integrated circuits, etc.

Unlike valves, their operation is not



On sale around the turn of the century, this electric fan was a product of the "fledgling electrical industry". One thing it couldn't cool was the then current argument about the nature of electricity: was it a "fluid" flowing in the accepted direction or a massive migration of electrons moving the other way?

CURRENT — which way does it flow?

at all easy to visualise. Depending on the device and the circuit configuration, the potentials applied may be variously positive or negative. Conduction may involve the movement from atom to atom of electrons or so called "holes" or both. The latter move from positive to negative, in line with the traditional electrical convention.

Add further talk about "majority" and "minority" carriers and a variety of other terms invented by solid-state physicists, and the once simplistic argument becomes very confused indeed. So, while the concepts of electron flow and movement remain as valid as ever, the urge to make an issue out of them has greatly diminished.

It may even be said that, if the original positive-to-negative convention was a guess, the view of electronics adherents in the valve era was, itself, an over-simplification of the mechanism of conduction!

No less to the point, solid-state devices are represented, in many cases, by circuit symbols which perpetuate the concept of conventional current flow. Whether he likes it or not, the modern electronics devotee is stuck with them.

It seems almost certain that this came about because the very early rectifiers were allotted circuit symbols which involved an arrowhead for the anode pointing in the direction of (conventional) current flow to a line representing the cathode. For the sake of consistency, this symbol has been maintained for all rectifiers, right through to the modern (?) germanium and silicon diode.

When the transistor arrived, virtually a derivative of the diode, its symbol extended the diode convention. As a result, the emitter lead always points to the negative side of the supply. In an NPN type, the arrowhead points towards the collector, which is fed from the negative rail. In an NPN type, the arrow points the other way.

Faced with this situation, followers of electronics are tending not to argue but simply to adapt to the traditional convention. Where there is the likelihood of ambiguity, they can do as we have already suggested: refer to "conventional" current flow, or talk in terms of electron flow, or both.

It is possible to come up with similes which purport to bridge the remaining gap. Some time ago, for example, we used the example of a nearly-full row of seats in a theatre; by moving the patrons (electrons) in one direction, vacant seats (holes) could be concentrated at the opposite end. A Tandy publication invokes an alternative picture of a tube nearly filled with liquid; as the tube is tilted to and fro, the liquid (electrons) flow in one direction while bubbles (holes) move in the other.

Whether such mental pictures are necessary, or even helpful, at this stage seems debatable. Having come to appreciate the reasons for the apparent confusion, it is probably best to simply accept the situation and conform to it.

Which just about wraps it up, except for one point: why is the cathode of a semiconductor diode commonly thought of or marked as the "plus" end? Traditionally, and in just about every other device, the cathode is regarded as the negative electrode. Why the difference?

In fact, the diode is not an exception. In terms of conventional current flow, its conduction is also from anode to cathode. The markings on a diode follow from the fact that they are most commonly used in rectifier situations, with AC input and DC output.

Consider the basic circuit of Fig. 2, which could represent a diode functioning as either a rectifier in a mains power supply, or as a signal detector, (ie, a signal rectifier) in a radio receiver.

An alternating voltage is typically fed to the diode from a winding, which may be part of a mains transformer or a tuning coil. During the half-cycles when the upper end of the coil is positive, the diode conducts and feeds that positive potential to the filter capacitor and to the upper output terminal. On the reverse half-cycle, the diode does not conduct, since a negative voltage is being applied to the anode.

In short, only positive pulses are

THE DIODE PROBLEM

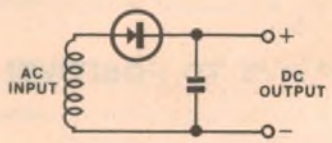


FIG. 2

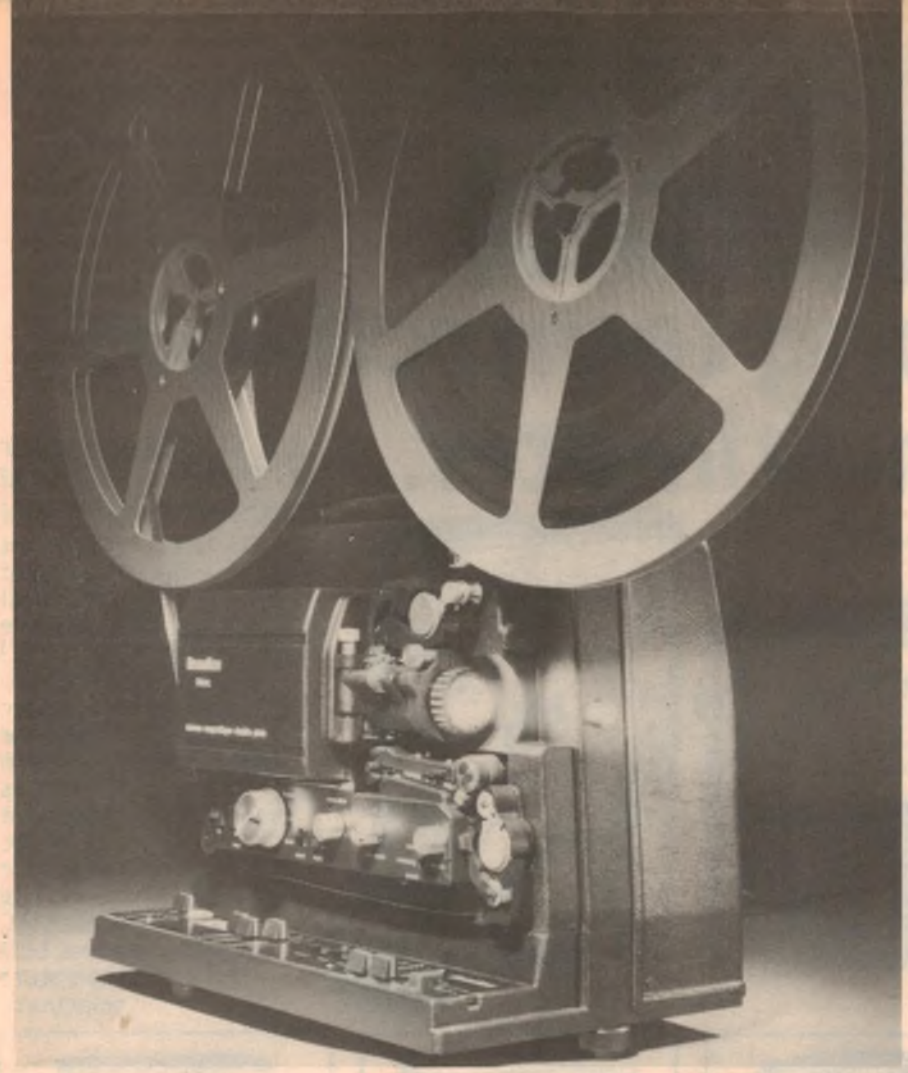
In a diode, the anode is represented as an arrow pointing, in the direction of conventional current flow, to the cathode. The latter is sometimes marked "plus" because in a rectifier circuit, as shown, it is at the positive side of the DC output.

applied to the upper output terminal. The pulses are stored and smoothed by the filter capacitor.

Without trying to go any further, the point we want to make becomes apparent. In a rectifier situation, as in Fig. 2, the DC output is derived from the cathode end; hence the marking convention.

If the diode in Fig. 2 was simply reversed, the diode would conduct on the alternative half-cycle and the upper output terminal would become minus — derived from the anode!

Home



Here is the second part of our rundown on the latest developments in home movie equipment. Having looked last month at the new breed of cameras, we now turn to the features and facilities offered by the new projectors. To round off the subject we also look briefly at developments in animated viewers or "editors".

by JAMIESON ROWE

As you might imagine, while all of these developments have been taking place at the camera end of the home movie market, things haven't been exactly stagnant at the projector end. Perhaps the developments haven't been quite as dramatic, but the latest projectors do offer some interesting new feature and performance advantages.

Probably the most obvious improvement over earlier models is in terms of light output. The output of most of the current projectors is well up on earlier models, due partly to the use of wider-aperture projection lenses and partly to the use of higher-power projection lamps.

Just about every model on the market is fitted with a lens of aperture larger than f/1.5, for example. Some of the higher priced machines offer a lens of aperture f/1.3 or f/1.2, while the top-of-the-line models generally provide an even larger f/1.1. Most of these lenses are zoom lenses, with the focal length variable over a ratio of from 2:1 to 2.5:1 to allow you to fill your screen with the picture over a range of projection distances.

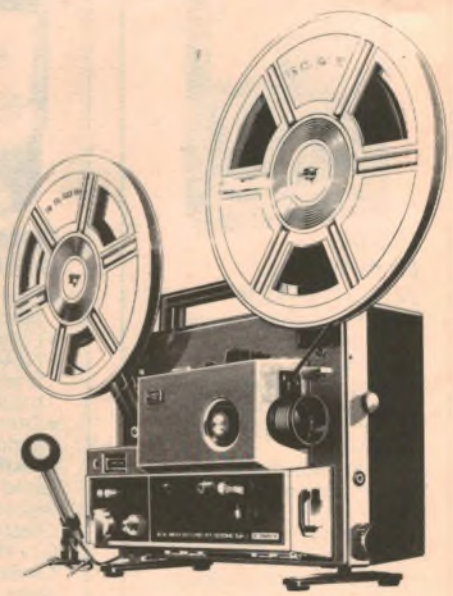
When it comes to lamps, a majority of machines now use a 12 volt 100 watt quartz-halogen lamp which provides a light output considerably higher than the 8V/50W lamp fitted to earlier projectors. A few machines use a more powerful 15V/150W quartz-halogen lamp, giving even higher output, while those at the top of the market (like the Elmo GS-1200) use an even more powerful lamp rated at 24V/200W.

Virtually all of these lamps are fitted with an integral "dichroic" mirror. This is a mirror which fully reflects and concentrates the wanted visible light, but is transparent for infra-red and heat radiation. The idea is to give high light output, while at the same time reducing heating of both the lamp itself and the film.

Many of the projectors with quartz-halogen lamps are also fitted with high/low switches, so that the lamp may be run from a slightly lower voltage when full light output is not required. This lets you extend the life of the lamp considerably — an important point because many of the Q-H lamps are quite expensive.

In addition to improved light output, many of the newer projectors also offer the ability to accept larger film spools. This lets you project longer without an interruption to change spools. Quite a number of the current models will accept 180m (600ft) spools, for example, in place of the 120m (400ft) or 60m (200ft) provided on most early machines. The 180m spool will let you project for up to 40 minutes at 18fps, or 30 minutes at 24fps.

A small number of projectors take



The Elmo ST-1200HD sound projector, which offers a 15V/150W lamp, two-track recording and replay, and 360 metre (1200ft) spool capacity.

TOP LEFT: The Beaulieu 708EL, known as the "Rolls Royce" of super-8mm projectors. Capable of superb results, it takes 720m spools.

Movies '79: the projectors

240m (800ft) spools, while an even smaller number will accept spools of 360m (1200ft) capacity: the Elmo GS-1200 and ST-1200HD, the Chinon SS-1200, and the Beaulieu 708EL. In fact the last of these goes one better again: it will take spools of no less than 720m (2400ft), which will run for no less than 2½ hours (160min) at 18fps, or two hours (120min) at 24fps!

In addition to conventional movie projectors designed to throw the picture up on a separate screen, a number of manufacturers are now making "integral screen" models. These look rather like a small table-model TV receiver, and are designed to project the picture onto the inbuilt screen from the rear. The idea is to reduce the "hassle" of showing your movies — you don't have to set up a screen and fully darken the room.

Both sound and silent models are made in the integral-screen format, and they have gained some popularity. However they have not really reduced the market for conventional projectors, probably because part of the appeal of home movies for many people is the ability to produce large, impressive pictures.

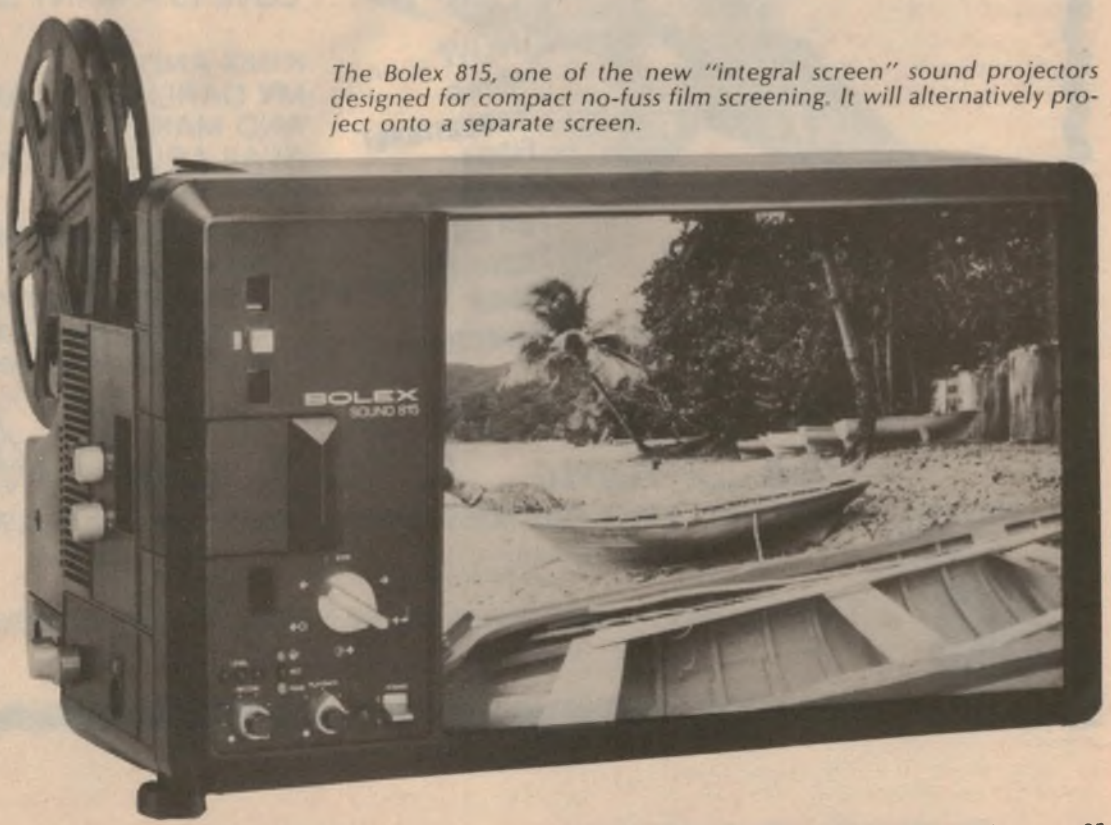
Actually many of the integral-screen models can also be used to project onto a separate screen, by opening a small flap.

When it comes to sound projectors in particular, probably one of the most obvious features offered by the latest machines is increased flexibility. Many of them are capable of all sorts of fancy things, with the idea of making it easier to assemble satisfying sound tracks.

Quite a few machines now allow you to record on or play back from either the main magnetic stripe track on the film, or the narrower "balance" track — which was originally intended purely to make striped film lie squarely in the picture gate of cameras and projectors. In most cases you can record on one track while playing back from the other, so you can make transfers back and forth.

This is a considerable help in assembling a sound track, as you don't have to risk the track you have already put together when you add in the next part.

A few projectors extend the two-track idea to provide a full stereo sound



The Bolex 815, one of the new "integral screen" sound projectors designed for compact no-fuss film screening. It will alternatively project onto a separate screen.

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The SS-1200, a recent addition to the Chinon range. It offers stereo sound and 360m spool capacity.

The Elmo GS-1200, which offers stereo sound, 360m spool capacity, four drive motors and a 24V/200W lamp.

capability. The results can be quite impressive, despite the fact that the two channels are inherently unbalanced. The "balance" track is much narrower than the "main" track, as it was not intended for recording and playback; this

The Sankyo model 500, which offers an 8V/50W lamp and 180m spool capacity.

means that the stereo channel using this track tends to have a significantly poorer signal-to-noise ratio than the other channel.

Another feature offered by many of the newer projectors is superimposition or "sound-on-sound" recording. This gives you the ability to control recording bias and erase power, so that you can partially record over the top of an existing recording without erasing it.

Some projectors also provide a feature known as programmable recording. This works in conjunction with a film counter, which is usually arranged to count in units of 18 frames (one second at 18fps). The idea is that you program the projector with the starting and ending counter readings for a new recording to be added to the film's track, and then it automatically switches the recording circuitry on and off at the right times.

Two of the projectors which offer this feature (the Bauer models T 525 and T 610) use a microcomputer for the programming, and allow you to set the recording "on" and "off" points "on the fly" — ie, during a preliminary projection. The microcomputer automatically allows for the average human reaction time, setting the start and finish points some seven frames before those at the recording head when you press the buttons.

The microcomputer also rewinds the film automatically, to a point 100 frames before the start of the programmed recording. It can also be used to automatically start an external tape recorder, four frames before the recor-

The firms who distribute them:

Listed below are the importers or distributors of the home movie equipment which is mentioned in this article or shown in the illustrations. In most cases the firms listed will not sell directly to the public; however should you have any difficulty in obtaining a piece of equipment, they will generally be able to advise you of the nearest dealer.

BAUER, MINOLTA: Photimport (Australia) Pty Ltd, 149 Milton Street, Ashfield NSW 2131.
BEAULIEU: Cinema Beaulieu division of International Dynamics, 23 Elma Road Cheltenham, Victoria 3192.
BELL & HOWELL, CHINON, RICOH: Maxwell Photo-Optics Pty Ltd, 55 Murray Street, Pyrmont, NSW 2009.
BOLEX: Wild Leitz (Australia) Pty Ltd, 45 Epping Road, North Ryde NSW 2113.
BRAUN NIZO: George's Camera Store Pty Ltd, 263 Elizabeth Street, Sydney NSW 2000.
CANON: Canon Australia Pty Ltd, 22 Lambs Road, Artarmon, NSW 2064.
COSINA: Tasmanex Pty Ltd, 374-376 Pittwater Road, Harbord, NSW 2096.
ELMO: C.R. Kennedy (Australia) Pty Ltd, 29 Mountain Street, Ultimo NSW 2007.
EUMIG: R. Gunz (Photographic) Pty Ltd, 63-73 Ann Street, Darlinghurst, NSW 2010.
GOKO: Camera Houses of Australia Ltd, 4/2 Harbord Road, Harbord, NSW 2096.
HANIMEX: Hanimex Pty Ltd, 108 Old Pittwater Road, Brookvale, NSW 2100.
POLAVISION: Polaroid Australia Pty Ltd, PO Box 163 North Ryde, NSW 2113.
SANKYO: Camera Distributors Pty Ltd, 108 Old Pittwater Road, Brookvale NSW 2100.

ding is to start — removing yet another source of error!

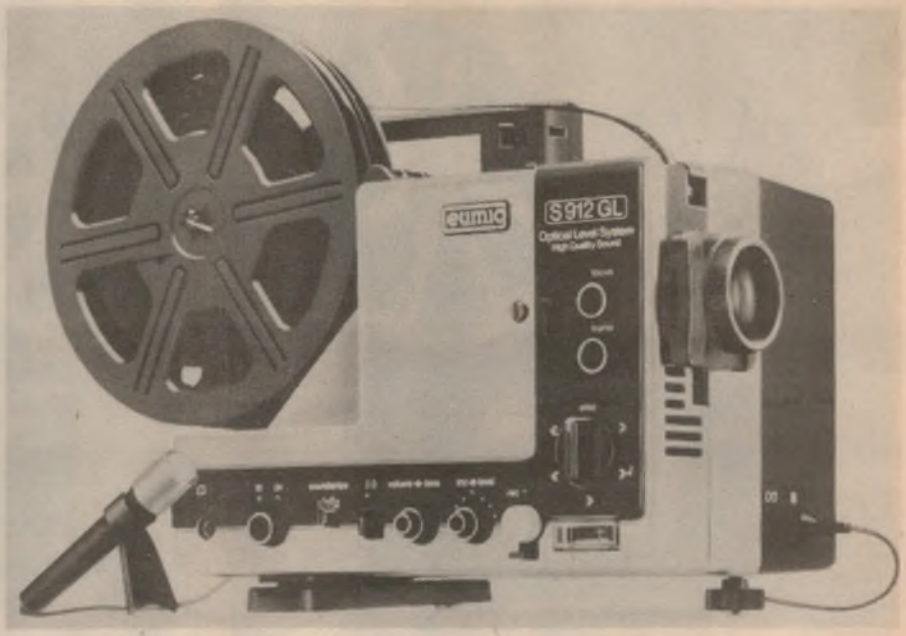
Apart from these functional features, most of the latest projectors offer improved sound performance as well. This has been achieved partly through improved stripe heads and amplifier electronics, and partly by a changeover to electronically-controlled DC motors for the film drive.

In place of the single capacitor-run AC induction motor used in most of the earlier sound projectors, many of the latest machines use at least two electronically controlled DC motors: one for the picture mechanism, and one for the sound drive.

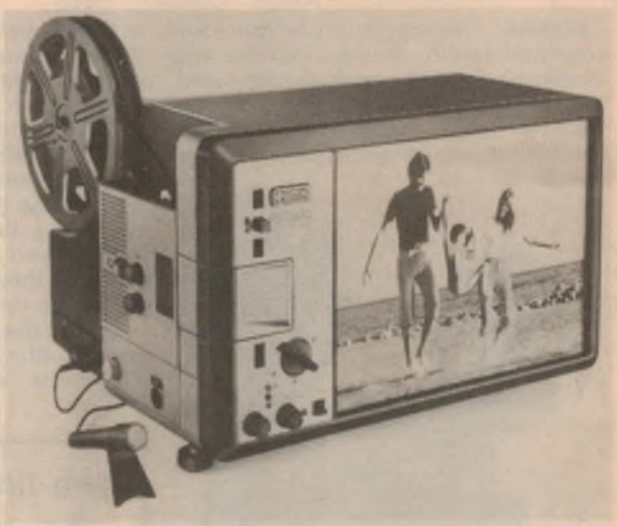
This brings a number of advantages, the most important of which is lower wow and flutter. Because the sound capstan and flywheel are driven by their own motor, rather than by the film itself, there is less wow both when the projector starts up and when it is running. Similarly there is less flutter because the sound drive motor is completely isolated from the pulsating load of the projector's intermittent mechanism.

Apart from lower wow and flutter the actual speed regulation also tends to be better, and less dependant upon mains voltage. It also becomes quite independant of mains frequency. The designer can also provide an electronic fine speed adjustment — very handy if you are blessed with "perfect pitch".

The use of DC drive motors also tends to have another benefit: lower hum. Many of the earlier projectors were plagued by hum, due largely to the sound head picking up leakage fields from the power transformer and induction motor. The changeover to DC drive motors removes at least one of these.



The Eumig S912GL sound projector, which offers a 12V/100W lamp, 180m spool capacity and "optical levelling": the front lens element is moved to centre the picture on the screen.



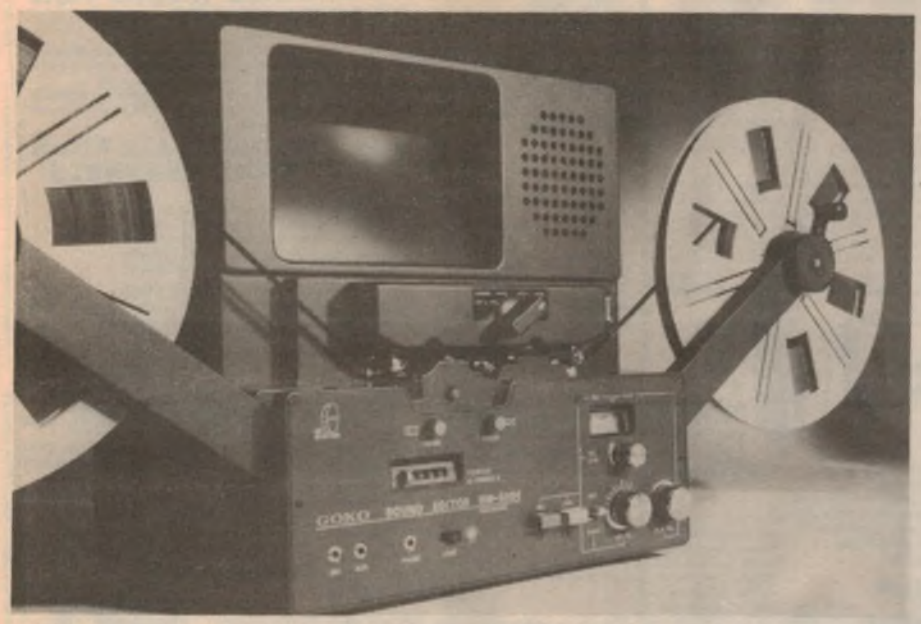
The Eumig RS-3000, another of the new "integral screen" sound projectors. Note the co-axial spool arrangement.

The Hanimex SR 9000 sound projector, a compact unit with a 12V/100W lamp, 120m spool capacity and a sound-on-sound capability.

Although perhaps the main developments in the home movie area have been in cameras and projectors, there is another item of equipment which has also been upgraded: the animated viewer, or "editor".

Unlike projectors and cameras, editors do not use an intermittent mechanism to "freeze" the film briefly in the gate. Instead the film moves continuously, with a rotating prism used to freeze the images optically. The early editors use a 4-facet square rotating

HOME MOVIES '79 — THE PROJECTORS



The Goko RM-5000 motorised sound editor, due in Australia by March. It provides full recording and replay facilities.

prism, which gave a good deal of annoying flicker.

Many of the new editors use a 16-facet prism, designed to give almost flickerless pictures. They also tend to have a viewing screen with an integral Fresnel lens, to give a significantly brighter picture as well.

Of course with the advent of sound, movie makers needed some way of listening to the sound track on the editor, as well as viewing the picture. The first response of the manufacturers was to produce small clip-on sound readers for the existing editors, with a pull-through replay head and a small battery-powered amplifier capable of driving an earpiece or headphones.

Unfortunately as most of the existing editors were hand wound, the results from these add-on sound readers were quite poor. In fact one needed to be quite skilled in order to decipher the garbled sound at all! Because of this a new breed of editors has begun to emerge — motor driven, and with the sound head built in.

At this stage there seems to be only two of these motorised editors available in Australia: the Elmo 912/S and the Goko PM2. Both of these allow the user to wind the film back and forth manually in the traditional fashion, as well as providing steady motor drive at either 18fps or 24fps. The Elmo viewer also allows you to vary the motor speed continuously between 10 and 30fps. Both units have an inbuilt loudspeaker.

The next step is to have an editor with full recording and mixing facilities as well. Such an editor is already on the way: the Goko model RM-5000, which is expected to be available in Australia by March 1980. It will provide full recording facilities, with VU meter, mixing between two inputs, provision for headphone monitoring, manual or automatic recording level control, and fine speed adjustments.

In short, it will provide just about everything you could want — a comment which seems to apply to just about all of the latest home movie gear.

Of course all the fancy equipment in the world won't guarantee professional results. You still need to devote a lot of time and effort into planning what you're going to film, and ensuring that your equipment is used to its full potential. But the right equipment can certainly help.

Finally, a few words about packaged films. Once you have a super-8 sound projector, you aren't just limited to showing your own home movies. You can also entertain your family and friends by screening super-8 prints of commercial movies, in the comfort of your own home. There are now many hundreds of such films available, for either hire or outright purchase.

Full-length features can be rather expensive to buy, running as high as $350 for a lengthy colour film. But many enthusiasts collect condensed or "digest" 20-minute versions, costing around $50-60 each.

One of the largest distributors of packaged films in Australia is the Home Talkie Company, of 268 Cleveland St, Sydney.

CHRISTMAS PRICE TUMBLE . .

was $29.50 NOW ONLY $14.50!

Yes, we've sacrificed these incredible mini-card liquid crystal display (LCD) calculators just in time for Christmas. Quit they go at less than half price! They have memory, square root, percentage keys, etc., and the batteries last for around 2000 hours (has auto shut-off). Ideal for the kids at school, you in the office or mum shopping. WHILE STOCKS LAST! (Cat Q-3022)

SAVE $10 ON CLOCK RADIO

Great for Xmas giving, or for yourself! AM/FM radio with digital clock. Wake up to music or buzzer. Was selling for $45.00 now reduced $10.00. Save now!

Cat A-4444

$35.00

PLAY WITH YOUR COMPUTER!

Try some of these program tapes. They're interesting and exciting. Compare our prices and be pleasantly surprised. For the Sorcerer AND the TRS-80. Call in soon!

FOR THE SORCERER.

MAGIC MAZE: A challenging maze game with ten levels of play. Hold your lantern and wander through the maze. How good are you? Cat X-3820 **$14.95**

PLOT: Get great graphics on your Sorcerer with this one. Super high resolution mode and quick low resolution on one cassette. Cat X-3821 **$17.95**

Z-80 DISASSEMBLER: Decode machine language programs including Sorcerer's monitor and ROM-PACs. Or use in ASCII mode which converts machine language to ASCII. Cat X-3822 **$17.95**

SHAPE MAKER: Construct special characters and fancy shapes with ease using this on-screen character editor. Detailed 12 page book. Cat X-3823 **$17.95**

DEBUG: Debug machine language programs by stepping through one instruction at a time. Several display options, etc. Cat X-3824 **$17.95**

FASTGAMMON: Backgammon players love this program. It provides a skillful opponent. Eight page instruction manual includes rules. Cat X-3825

This program only **$22.95**

FOR THE TRS-80

Hey, TRS-80 owners! Absorbing and interesting program cassettes miles cheaper than theirs. Look at these:

TIME TREK: (Cat X-3850) A version of the popular Star Trek or Space War.

STIMULATING SIMULATIONS (Cat X-3852) Ten original games – art auction, forest fire, monster chase, nautical navigation, lost treasure, business management, gone fishing, rare birds, space flight & diamond thief.

ELECTRIC PAINTBRUSH: (Cat X-3854) More than just a picture drawing tool, lets you paint patterns at machine language speeds.

BRIDGE CHALLENGER: (Cat X-3856) For all players from novices to experts, who would like to practice and improve their play.

ALL ABOVE:

$17.95 ea

(All above tapes are for level 1 & 11 4k RAM with exception of bridge; which is level 11 16k RAM).

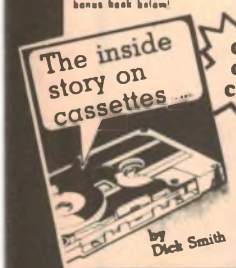
MICROCHESS 1.5 (Cat X-3858) Always ready for a quick blitz game, or a slow thoughtful one.

ONLY

$22.95 ea

NEW!

Dick Smith cassettes have been up-graded. Brilliant new packaging tells you they're different – find out for yourself just how good they really are! Try a couple of these quality tapes; better still, try ten (types can be mixed) to obtain the bonus book below!



C60 LN: $1.50 ea (Cat C-3350)
C90 LN: $2.00 ea (Cat C-3352)
C90 EDR: $2.75 ea (Cat C-3354)

BONUS:

Buy any ten Dick Smith cassettes, or any Dick Smith cassette deck or recorder and receive FREE a copy of our new book: 'The inside story on cassettes'. Tells you all about this incredibly versatile recording medium, and how to get the best from your tapes and tape recording equipment. Also available separately. Cat B-8035 50c

DON'T GET CAUGHT

(at about 8AM on Tuesday, 25th December as the kids unwrap their presents . . .)

Imagine! All those battery operated toys and no batteries. Wouldn't you be popular?

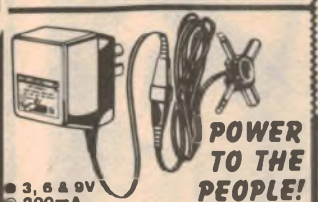
Remember to stock up now on budget Hi Watt batteries from Dick Smith. Cheaper by far than most brands, yet they're fresh and ready to go to work immediately. All popular sizes.

UM-1 ('D') size	Cat S-3001	25c	ea
UM-2 ('C') size	Cat S-3002	20c	ea
UM-3 ('AA') size	Cat S-3003	15c	ea
'AAA' size (tiny)	Cat S-3004	25c	ea
'006P' size (9V)	Cat S-3006	45c	ea

ALKALINE BATTERY PACKS:

If you prefer, we have famous Mallory Alkaline extra-long-life batteries available. (Two in each pack except 9V type).

'AA' size	Cat S-3280	$1.60	pack two
'C' size	Cat S-3282	$2.15	pack two
'D' size	Cat S-3284	$2.15	pack two
9V (006P) size	Cat S-3286	$2.50	each



POWER TO THE PEOPLE!

- 3, 6 & 9V @ 200mA.
- 4-way connector & reversible polarity
- Fully Approved!
- WAS $9.50 NOW

$6.90

Cat M-8525

Every home should have one – or more. This battery eliminator gives 3 voltages, is ideal for most small appliances. Another bargain from Dick – just in time for all those Christmas gifts!

AMATEURS

DON'T FORGET: Dick Smith will match or better ANY GENUINE ADVERTISED PRICE on Yaesu or Hy Gain amateur equipment!

MORE OF DICK'S BONZA BULK BUY BARGAINS – BEWDY!

FERRITE RODS:

Now's this one – 194 x 9mm ferrite rods normally sell for $2.00 or more. Our normal retail price is $1.50. But as a bonza bulk buy for a short time only: **90 cents!** Yes, way under price, with dozens of uses for the electronics hobbyist: aerials, chokes, filters, audio supressor circuits, etc. etc. While our super special lasts; first come first served. Don't miss out on this one!

Cat L-1401 **90c ea!!!**

YOU REAP THE BENEFIT!

A manufacturer of CBs went broke, so we bought the cases he had made. Must have cost double what we're selling them for! Hundreds of uses for the hobbyist, heavy aluminium case with punched panels as shown. Quick!

Cat H-2507

STRICTLY WHILE STOCKS LAST:

$7.95)

HELP! Calling manufacturers, importers, liquidators, agents, etc etc etc

If you've any bonza bulk buy bargains similar to the lines on this page, we're interested. You know what we're after: components, etc, which we can offer our hobbyist customers at big savings over normal retail prices. Turn your excess stock into cash by phoning Mark Sim or Gary Johnston on **(02) 888 3200.**

SAILING SAILING. . .

MIDLAND MARINE RADIO FOR SAFETY AT SEA . . .

This is the marine radio they're all talking about. Mighty Midland. It comes already fitted with the four marine channels and has provision for extra channels in the future – no crystals to buy!

No matter what your craft, you need the security that only the Midland 857M 27MHz marine radio can give you. At $115.00, you save nearly $25.00 (was $139.50). Buy now and save!

Cat D-1408

$115 INCLUDING ALL FOUR BOATING CHANNELS!

But that's not all!

Each purchaser of the Midland 857M receives, as a bonus, our unique go-anywhere carry case, which allows you to remove the transceiver from the boat to prevent theft. With the addition of an optional battery pack and whip antenna, you can also use your Midland as a 'walkie talkie'. And this case is free with your Midland (normally $25.00 extra!)

$25.00 VALUE FREE!

MARINE ANTENNA TO SUIT:

The Dick Smith 'White Swordfish' with exclusive any which way' base. Strong fibreglass construction, complete with cable and tuning coil. Mounts on any boat ('glass, steel, wood, etc etc.) Cat D-4071

EXCLUSIVE TO DICK SMITH **$49.90**

'CHANNEL F' CARTRIDGES —

Large shipment of cartridges just arrived – here's a chance to grab some before they disappear again! And you can save money on some!!!!!

A lot of people were disappointed when we ran out of the popular Fairchild 'Channel F' video entertainment computer cartridges. Now the good news: a large shipment has just arrived, putting good stocks of cartridges back in the stores. We've even cut the price on some of the more popular games! Don't delay: stocks won't last long! The following are back in stock:

● Dodge it (Cat X-1216) ● Hangman (Cat X-1218) ● Maze (Cat X-1204) And a brand new cartridge: BOWLING (Cat X-1221) **all above cartridges: $24.50 each**

Save a massive $9.50 on the following:

● Desert Fox (Cat X-1203) ● Blackjack (Cat X-1201) ● Magic Numbers (Cat X-1210) and ● Torpedo Alley (Cat X-1211)

$15.00 ea

CAR $$$$ SAVERS

COMPRESSION CHECKER:

Compression levels tell you a lot about your car's engine, without going into the 'works'. This model has rotary dial calibrated to 1800kPa, and simply pushes into spark plug holes.

$7.50

Cat A-8506

THIS ONE SOLD FOR $13.50 TOO: SAVE $6.00 FROM DICK!

NEON TIMING LIGHT:

If your timing is out, you're wasting fuel – and money. Check your timing easily and reliably with this neon timing light. Pistol grip for ease of use, pre-focussed super bright neon flash tube. Works with all ignition systems: just connect in series with No. 1 plug.

$9.95

Cat A-8507

THIS UNIT SOLD NATIONALLY FOR $13.50 – SAVE $3.55!

NOTE: As our prices are so far under normal retail, stocks are very limited. Don't miss out! Strictly first come, first served.

UHF TV IS COMING!

Get ready for it with a new UHF TV antenna from Dick Smith. High gain, easy to install, great value

Cat L-4028

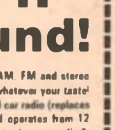
$19.95

How about a go-anywhere TV ant?

Dick has this little beauty. Ideal for mounting on caravans, campers, etc, or clip to the gutter of the holiday house. Suits all Australian channels.

Cat L-4026

$23.95

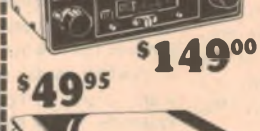


SOMETHING TO PLAY WITH OVER THE CHRISTMAS HOLIDAYS?

Try a TV game IC. We've bought an entire shipment of the famous AY-3-8500 IC from a major manufacturer and we're practically giving them away! Yes, we supply a data sheet to show you how to make a TV game, but at this price you could just about use them as fishing lures! They were selling for $19.75 each. Here's your chance to save a massive $16.00, while they last!

Cat Z-6848 ..... Not $19.75 ..... **NOW ONLY $3.75 each!**

Update your car hi-fi – for a new year of sound!



$149.00

We've searched the world to bring you this beauty. An AM, FM and stereo cassette player that will make your music come alive – whatever your taste! Slots in-dash fitting in the same space taken by a normal car radio (replaces the garbage the car manufacturers often give you!) and operates from 12 volts, negative earth. 4 ohm speakers suit this unit (not supplied). Also has ● tape fast forward ● local/dx switch for radio ● mono/stereo switch (great for noise reduction on FM in difficult areas.) Cat Z-6480

$49.95

Want a new set of speakers for the car? Dick has a huge range of car speakers, from around $2.00 to our superb co-axial and dual cone car speakers at around $30.00 pair. Call in soon – or check them out on page 23 of our catalog.

You can REALLY make your music zing with this car stereo power booster amplifier. It features a 60 watt (peak) circuit (30W per channel), with a frequency response of 25 to 20000Hz. You can use this with virtually any car stereo (it simply connects in series with the speaker leads; instructions provided) and operates from 12 volts. It's powerful enough to overcome road and other noises in virtually any car. Incredible! Cat A-8660

SEASON'S GREETINGS!

Dick Smith and staff wish a happy Christmas and a safe and prosperous new year to all.

And we hope to be of service to you again in 1980.

BUYING BY MAIL?

It's so easy! Simply list the items you want, with their catalogue numbers, and post it off with your cheque to our mail order centre (address at right). Don't forget to include post & packing (charges apply to total order value as per table at right).

Then watch your letterbox!

ORDER VALUE:	P&P
$5 (min) to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post.

If you prefer we will despatch your order by Comet Road Freight to anywhere in Australia for only $8.00 – that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air – you pay freight on delivery.)

CHRISTMAS GIFT IDEAS. . .

for technical people; for thinking people; for someone who's got everything!

SOLAR EXPERIMENT KIT – 25-IN-ONE

The science of the 21st century — solar power. Help them learn more about this fascinating field with our budget 25-in-1 solar experimenters kit.

$16.95

COMPLETELY SAFE! Cat K-2032

150-IN-ONE KIT

150 electronics projects – enough to keep even the keenest person busy for a long, long time. No soldering required with this simple kit – and it is battery operated so it is SAFE! Great value.

53.50

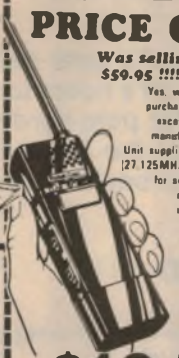
Cat K-2030

Comes in beaut carry case, too!

INCREDIBLE PRICE CUT!

Was selling for $59.95 !!!!!

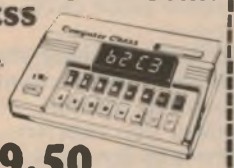
Yes, we've made a scoop purchase of manufacturer's excess stock – at below manufacturer's cost price! Unit supplied with one channel (27.125MHz) and has provision for second channel (xtals available.) All these units are brand new and work – but are worth our price in parts alone! Use in conjunction with CB transceiver for paging system!



Cat D-1100 *ONLY*

$12.50! Plus batteries

6 LEVEL COMPUTER CHESS



VALUE!

$99.50 Plus batteries

DICK BREAKS THE $100 BARRIER!

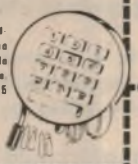
Yes, this incredible chess computer gives 6 levels of play from basic beginner through to very expert, large, easy-to-read LED display makes easy play. Battery or mains operated (optional) will give lasting enjoyment to the chess players in your family. Cat X-1250

PUSH BUTTON PHONE DIALS

We've sold hundreds of these – push button phone diallers ideal for experimenters systems. They remember the last number dialled (up to 16 digits) for easy re-call if the number is engaged.

4 colour coded wires for easy installation.

ATTENTION: Although these diallers fit perfectly into standard Australian telephones (no soldering required) present regulations do not allow you to use them for this purpose. Cat X-1175



$49.95

LOOK! NO WIRES!

Cat F-1010

WIRELESS INTERCOM

Improve communications around the home, office, factory, etc with this easy to install intercom. Easy? It's easier than that! Just plug them into a power point! That's all. Home to garage, office to factory, kids room to kitchen — the uses are endless!

$49.50 pr

IN A WORD: BRILLIANT!

3-way light: fluoro, spot and flasher for campers, in the car, home, wherever you need a portable lamp. Hand held or use shoulder strap supplied. Cat X-1084

$14.95

SUMMER TIME IS BARBIE TIME!

But it's also fire ban time. Don't let fire bans ruin your picnic plans. With a Solar Grill from Dick Smith you can have that outdoor barbecue anytime the sun is out — fire bans or not! This incredible space age cooker will do your steaks perfectly — also chops, snags, onions, tomatoes, etc etc. And you don't pay a cent for fuel! It will even boil the water to wash up! (A litre of water boils in approximately 9 minutes in sunlight!)

Cat X-2001

$95.00

(It might sound expensive but remember you never have to pay for fuel to use it!)

24 TUNE DOOR BELL

Remember the 'Chromachime'. We sold thousands! Here is a fully built up version of this popular circuit. 24 tunes, fully selectable. Comes complete with push-button for external mounting: so you don't have to buy one! Smart wood grain finish, ideal for mounting on or near door. Incredible value at our super introductory price:

(The Chromachime was $49.50 in KIT form, and without a front door push button! Incredible!!!).

Cat X-1130

$35.00

A CB FOR XMAS?

The CB scene has quietened down: it's now really worthwhile. If you've been put off by press reports, think again. CB for safety.

MIGHTY MIDLAND AM

$128.50

$89.50

Midland 882: Australia's most popular CB. Great range, great performance. Easy to operate, too. Makes a good 'start up' set. Cat D-1436

RIGHT: Popular magnetic base CB antenna. No holes to drill, sticks to roof of vehicle. Cat D-4412 $19.50 **$16.50**

Mighty Midland SSB — for when you're really serious. Tremendous range and performance, unique features. Midland SSB the Rolls Royce of CB radio. Cat D-1700

SUPER SSB

$239.90

$199.50

DON'T FORGET! We have a huge range of CB radios and CB radio accessories. For anything in communications, see the experts at your nearest Dick Smith Electronics store.

IT'S ABOUT TIME . . .

STOPWATCH/TORCH

Incredible! A stopwatch that can do splits, lap timing, etc down to 1/100 second, in a tiny case that also includes a torch! LCD readout has long battery life, highly accurate.

Note: due to demand stocks may be low until mid month! Cat X-1043

$39.50

PS: It's a clock, too!

VALUE FOR THE MOTORIST:

Quartz chronometer accuracy, large easy to read fluorescent digits. Operates from 12 volts, takes less power than your dash lights. Easy to instal, bracket supplied.

As shown, with case: Cat X-1047 **$24.50**

Unit without case (for installation in dash): Cat X-1045 **$19.50**

STILL THE BEST VALUE!

THE IMPROVED DICKTRACER Mk II — Australia's greatest value in a radar detector! Why spend $100 and more when all you need is a Dicktracer. Internal batteries recharge overnight from the cigar lighter so there's no trailing leads. Value!

$49.50 Cat A-8500

TOOLS MAKE GREAT CHRISTMAS GIFTS!

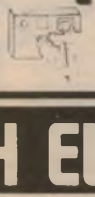
40PC SOCKET SET:

Ideal for the mechanic, home handyman, etc. Metric and SAE sizes suit all uses, with ratchet driver too! You'd pay dollars more elsewhere! Cat T-4670

$16.50

NIBBLING TOOL

Handy up if you've ever wanted to cut holes in thin sheet metal, PCB's, etc. Here's the answer: a handy nibbler. Cuts out holes, shapes, lines, etc in thin metal or plastic, etc. No handyman should be without one. Cat T-4940



$12.50

TOOL/HOBBY BOX

Talk about handy! This strong tool or hobby box locks for security (padlock not supplied) and opens out to reveal generous storage area with two storage trays for bits and pieces. Ideal for the electronics enthusiast especially, but also great for a host of other hobbies. Cat H-2600

$19.50

Just a few of the hundreds of great gift ideas from our tool and hobby centres at your store!

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!

TRANSISTOR ASSISTED IGNITION (See EA December)		
Complete kit including instructions	Cat K-3300	$32.50
Printed circuit board	Cat H-8367	$2.20
BUX80 power transistor	Cat Z-2150	$10.95
FAN SPEED CONTROL (See EA December)		
Short form kit (PCB components, no hardware)	Cat K-3090	$11.50
Printed Circuit Board	Cat H-8368	$1.60
SC141D Triac	Cat Z-4510	$1.28
(zippy box, etc, normal stock lines – or build it in to appliance.)		
NEW METAL LOCATOR (See EA November)		
Complete kit (excluding dowell & former)	Cat K-3504	$19.50
Printed Circuit Board	Cat H-8366	$2.40
INFRA-RED REMOTE CONTROLLER (See EA October)		
CQY89A infra red diodes	Cat Z-3235	$1.50
BPW34 photo transistors	Cat Z-1954	$3.50
Printed circuit boards (pair)	Cat H-8365	$5.95
PROCESS TIMER (See ETI October)		
Printed circuit board	Cat H-8623	$3.95
DISCO STROBE Mk 11 (see ETI September)		
Complete kit, including instructions	Cat K-3152	$34.50
Printed circuit board	Cat H-8572	$1.95
Flashtube	Cat S-3882	$2.95
Trigger transformer	Cat M-0104	90c
Discharge capacitors (each)	Cat R-2855	$3.75
Reflector	Cat K-6016	$4.50
WINDSCREEN WIPER DELAY (See EA September)		
Printed circuit board	Cat H-8364	$2.50
Other components for this project are normal stock lines		
AUTO CHIME (See EA September)		
Complete kit	Cat K-3502	$29.75
Printed circuit board	Cat H-8363	$3.70
TMS-1000 Integrated Circuit	Cat Z-6825	$16.50
INDUCTION BALANCE METAL DETECTOR (See ETI)		
Short form kit (not inc. dowell or former)	Cat K-3100	$36.50
Printed circuit board	Cat H-8578	$1.50
MASTHEAD AMPLIFIER (See EA August)		
Complete kit	Cat K-3232	$29.50
Printed circuit board	Cat H-8362	$2.50
OM350 integrated circuit	Cat Z-6185	$9.95
Diecast box	Cat H-2221	$3.00
Zippy box	Cat H-2751	$2.50
9kHz WHISTLE FILTER FOR TUNERS (See Feb EA)		
Complete kit, including instructions	Cat K-3496	$19.75

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 323 036
Crystal TV Rentals Pty Ltd
66 Crystal Street, Broken Hill NSW. Ph 6897
Decro Electric
Cnr Magellan St & Bruxner Hwy, Lismore NSW. Ph 214 137
Elektron 2000
44 Brown Road, Broadmeadow, Newcastle NSW. Ph 691 222
D & M Harrington
6/1 Machinery Drive, Tweed Heads South, NSW. Ph 364 589
Hutchesson's Communications
5 Elizabeth Street, Mt Gambier SA. Ph 256 404
Keller Electronics
218 Adelaide Street, Maryborough, Qld. Ph 214 559
M & W Electronics
48 McNamara Street, Orange NSW. Ph 626 491
Mellor Enterprises
Shop 2/15 Forsythe St, Whyalla Norrie, SA. Ph 454 131
Power & Sound
147 Argyle Street, Traralgon, Vic. Ph 743 638
Purely Electronics
15 East Street, Rockhampton, Qld. Ph 021058
Stevens Electrical
42 Victoria 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
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
Wagga Wholesale Electronics Sales
82 Forsyth Street, Wagga NSW.
Wellington Electrical Services
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Power line interference — another approach

The problem of power line interference to TV sets has been discussed in two recent articles; the Serviceman's notes for April 1979 and an article on an ultra-sonic detector (for pole hardware) in the September 1979 issue. This comment, by the engineer who inspired both articles, suggests other approaches, including an interference-immune TV set.

by R. G. AUTARD

For those who missed the Serviceman's article in the April issue it was a precis of a paper written by myself in the December 1978 Monitor — Proceedings of the IREE Australia- titled "Interference to VHF TV Services from Overhead HV Power Lines".

Naturally enough, the Serviceman's views reflect the thoughts of technically minded readers, bewildered by the fact that we have not cured this interference after 20 odd years of TV.

This attitude towards power lines and electricity authorities is perfectly understandable. However, the technical side of the subject, which is much bigger than most of us imagine, is only part of the story. Its importance rates well below the financial aspects, or to put in bluntly, your power bill. Rightly or wrongly, elimination of interference is financed by the vast majority of consumers who have never experienced power line interference.

Much to the annoyance of some people, supply authorities are not authorised to handle complaints direct from the public. The diagnosis and location of interference requires a great deal of expertise and equipment. The proper authority is the Postal and Telecommunications Department, who locate the source of interference and pass on the location of the troublesome pole to the electricity authority concerned.

The bulk of complaints are about TV interference with only a handful of radio complaints. Bonding the ball and socket joints of adjacent disc insulators as mentioned by The Serviceman and myself would probably halve the complaints, but the cost would be considerable. The remaining TVI would be much harder to find and cure.

A frequent suggestion is to put overhead voltage lines underground. Here again the cost may be prohibitive. In general, any big changes to the electrical distribution systems are so costly that alternative schemes come into favour. The following scheme would reduce power line interference to below car ignition and other competitors:

(a) Re-allocate TV channels to UHF in capital and large cities. This would reduce city TVI complaints to a very low level.
(b) Abandon channels 0, 1, 2 and 3. This would reduce the remaining complaints in country areas by a large amount.
(c) The loss of these channels could be made up by allocating UHF channels and using co-axial cable distribution of TV programs.
(d) Increase the use of repeaters, translators and community antennas in difficult areas.
(e) Reduce interference generated by slack span power lines in country areas by redesigning or bonding the metal parts of adjacent disc insulators.

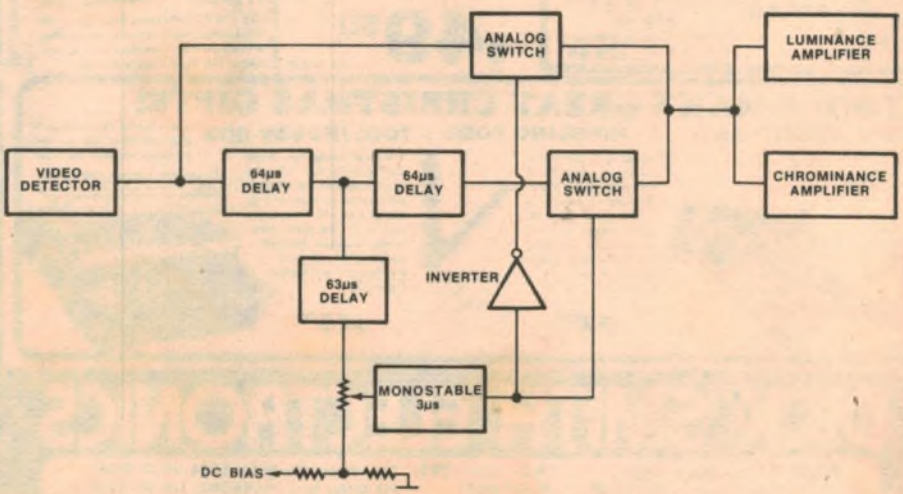
Another scheme for reducing the effects of TVI is a kind of video noise limiter. Interference from high voltage lines consists of short pulses of RF which die away in a few uS. While the pulse exceeds the peak black level the picture tube is cut off, but during the decay period which follows, the picture tube displays the mutilated colour, modulated by a mutilated luminance signal.

In the next scan line of an interlaced PAL system, the mutilated chrominance signal is modulated by normal luminance and displayed for the full duration of the interference pulse. (Monochrome and NTSC system receivers are both luckier because they display the interence pulse once only; as it occurs.)

The proposed limiter, which shows more promise than its audio counterpart, could overcome ignition, commutator, and power line interference. Its basic principle is to borrow a piece of good picture from another line, each time interference is received.

By delaying the signal by two lines, or 128uS, we have a choice of switching between the delayed signal and the present signal. Supposing we choose to display the delayed signal on the screen for normal viewing. The arrival of an interference pulse would then be arranged to switch the picture display to the present signal for a few micro-seconds while the interference persists. (It would be better if we could borrow information from another frame because the differences would be much smaller.) A basic block diagram of the two line delay system is shown.

To sum up: Rearranging the TV spectrum is a drastic and expensive way of overcoming TV interference from power lines but stopping the interference at its source is much more so. The development of an interference immune TV set seems to me to be the best solution. In the long run I suppose we will just put up with things the way they are — but it makes you wonder, doesn't it?



A block diagram of the proposed video interference suppressor. The displayed signal passes through two delay lines but the analog gates switch the delay out just before an interference pulse is due to be displayed on the screen.

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Commander Decker and Ilia ▼

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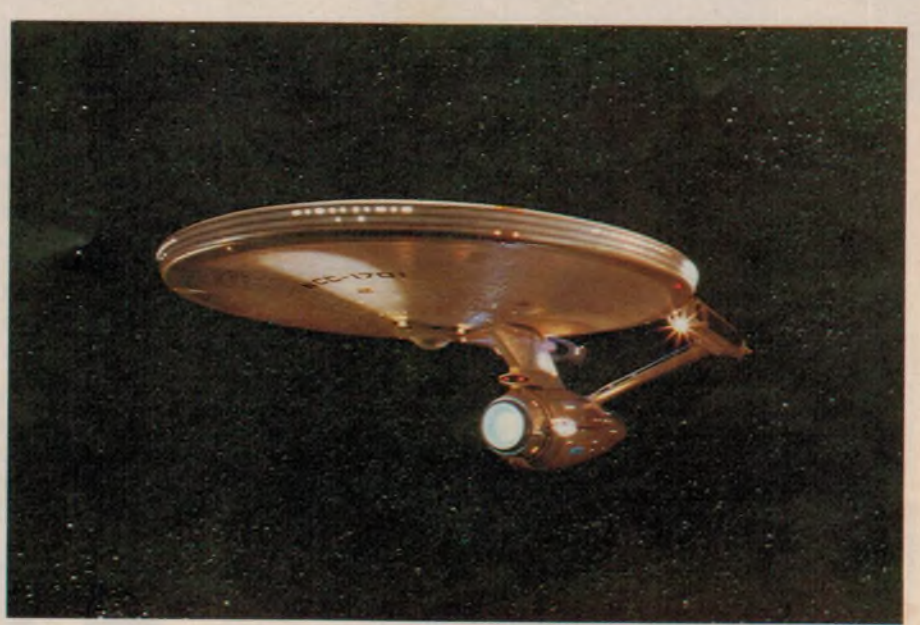

USS "Enterprise" — defending Earth ▲

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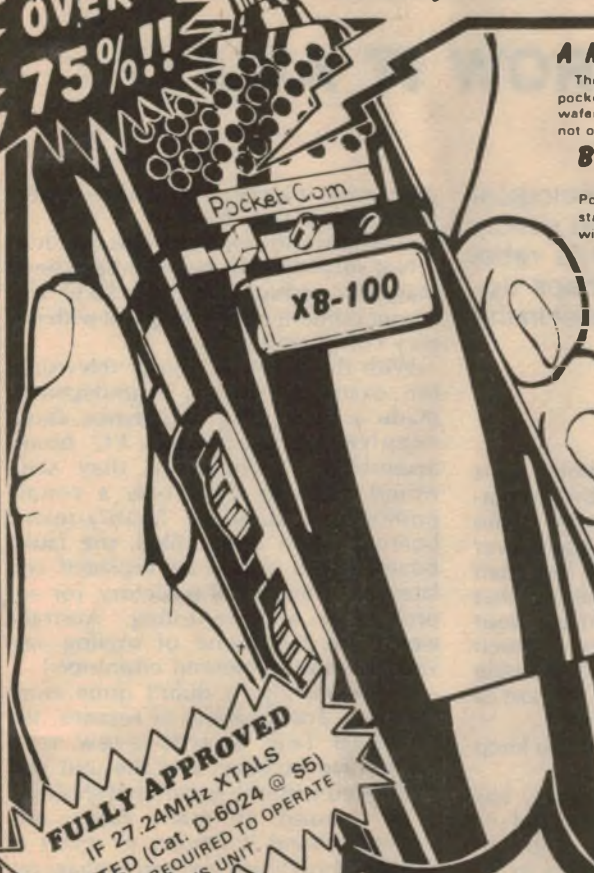

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FORUM

Conducted by Neville Williams

REPAIR, UP-DATE OR THROW IT AWAY?

One of the mounting pressures in our modern technological society is to develop, exploit and adopt what is new — and simply to discard the old. Inevitably, there are those who tend to rebel against this philosophy, preferring to maintain and perhaps up-date what they already have. But is this a proposition, at least in the realm of electronics?

What triggered the question was a couple of letters from readers who were obviously keen to take advantage of recent technological developments, without having to scrap otherwise satisfactory equipment. It was with no great displeasure that I had to discourage them from cutting loose with screwdriver and soldering iron — but their letters did cause me to think at greater length about the whole question.

In the 1930s, when I first entered the industry, radio receivers were relatively expensive, due largely to the cost of components and after-sales back-up. Factory labour at the time was cheap, with much of the work being done by under-21s, who could be hired and fired without ceremony, according to seasonal needs. In my first job as an assembler/wirer, I worked a genuine 48 hours per week for the grand sum of £1 ($2.00) gross. When railway fares went up, I had to plead for a rise; otherwise it would have cost me 2/- a week to remain employed!

Later, I was promoted to testing and servicing and, while this carried a salary margin, it was not such as to prevent me from spending as much time as necessary to salvage disasters — even to completely stripping and re-building sets that had been fouled by a burned-out power transformer!

To discard a receiver, in those days, was unheard of. They were traded-in, patched up and re-sold, until they became a total liability. After that, they would be taken over and stripped for parts by some impecunious enthusiast.

That was in the 1930s. Since that time, the relative cost of labour has risen enormously and this has affected manufacturing and servicing quite differently, radically changing the balance between the two.

In the factory, rising labour costs have been more than offset by automation to the extent that portable radio receivers can currently be bought over the counter in Australia for less than $10. Allowing for 15:1 inflation, that would have been equivalent to about 6/- (60c) in the early thirties — much less than we had to pay for a single valve and about one-sixtieth the cost of a budget-priced mantel radio.

No wonder we were at pains to keep them talking!

But repair work, by its nature, has always been labour intensive and its cost has simply followed wages up. Today, if you summon a tradesman to do anything at all, his bill is likely to start at $15-$20, plus so much an hour thereafter. It simply means that there is now a whole range of gadgets and appliances — including small radios — that it is uneconomic to repair. It is quicker and cheaper to buy a new one. And, if the new one fails under guarantee, it is cheaper for the supplier to replace it than fix it!

"Harry started to change it over to colour, then decided against it!"
"Radio-Electronics"

It seems odd but that's the way it is.

Not surprisingly, attempts have been made to reduce the skill level and labour content of servicing but with not very convincing results.

With the arrival of colour television, for example, various manufacturers made a great song and dance about supplying replacement PC board assemblies. Servicemen, they said, would need to carry only a certain number of standard factory-tested boards. When a set failed, the faulty board would simply be replaced and later returned to the factory for re-processing and re-testing. Australia would be the home of smiling servicemen and contented customers!

Unfortunately, it didn't quite work that way. For a variety of reasons, the planned few boards grew into prohibitive numbers and the unit cost multiplied with the logistics of shuffling them around. In many cases, servicemen found it simpler to revert to the time-honoured method — diagnosing and fixing the trouble themselves, leaving only the "dogs" for the factories.

With colour receivers still relatively young and still relatively costly to replace, it is economical to repair them — but it won't always be that way. Sooner or later, they will begin to make their appearance on council tips, along with discarded refrigerators, stoves and washing machines.

In some other areas of electronics, the stories one hears about back-up "service" are nothing short of staggering.

The most recent to come our way concerns a friend who installed a new industrial camera for use in the manufacture of PC boards and panels. When trouble developed with the electronic exposure control, he lodged a call for service. Yes, the camera could be fixed by changing over a (not too complicated) PC board assembly for a mere $560!

Taken completely aback, he stalled for a couple of days to consider the situation. It appeared almost certain

that the trouble involved a couple of components on the board, worth about as many dollars but the supplier was quite adamant in his attitude:

We are not set up to repair boards. All we can do is to supply a changeover board as quoted. If you fiddle with it yourself, we will not recognise any future obligation to provide service!

Not very nice.

If it is costly (or uneconomical) to repair many items of equipment, it is likely to be even more so to modify or up-date them — at least on a commercial level.

Arrangements for after-sales service are normally built into the original marketing plan, with spare parts coming from the original production over-run. The mechanics of repair are concerned mainly with correction of the outstanding fault and return of the item in its otherwise existing condition. Morally and officially, that's where the manufacturer's obligation begins and ends.

UP-DATING? UGH!

By contrast, any undertaking to up-date a piece of equipment carries the implication that it is being re-processed to ensure a higher order of performance or convenience. New parts may be involved, plus the man-hours necessary to install them and to ensure that the re-worked equipment meets the higher performance expectations. In the majority of cases, the effort is simply not worthwhile on a cost/benefit basis.

For the owner who is also a competant technician, the situation may be quite different. If the time involved is ignored, equipment can often be maintained, re-built, restored or up-dated with not too much cash outlay — but cases like this are the exceptions rather than the rule. Not too many consumers have the qualifications, the time and the patience to tackle such a task.

Curiously, a great deal of such expert activity has to do with nostalgia and trendiness, rather than any kind of anti-throwaway philosophy. Period homes, period furnishings, period cars and period bric-a-brac are "in" — as a conscious departure from what is modern.

But the cars that are most lovingly restored are very old vehicles that are not in any sense competitive with the present-day family car. The ones in between tend to be passed over as second-hand, clapped-out, rusted bombs! Some time in the future they will regain respectability — when most of them have long since been buried or melted down.

And in the radio/TV sphere, there is no great interest in old valve sets and the "passing parade" of veneered plywood cabinets. Nostalgia ignores them in favour of "wireless" from the twenties era.

But I digress.

A more immediate problem involves those typified by the correspondents mentioned earlier. They have equipment which is still currently in use, they want to up-grade it to include a recent development but they lack the expertise to cope with the job on their own. Can the magazine provide the necessary information by way of a project?

Unfortunately, the general response to such a proposition has to be in the negative. Most electronic equipment comes in a wide variety of brands, models, nationalities, shapes, sizes and circuit configurations. It would be a Herculean task to determine whether a proposed internal modification would be practical for them all, and/or the number of variations that might have to be allowed for.

It would be most unlikely that any one model could serve as a representative example of what precisely needed to be done. Almost inevitably, some enthusiasts, motivated to "have a go", would find themselves in deep trouble. It would be all too easy to end up with equipment which was unserviceable in the old form and unworkable in the new!

We would certainly not want to be a party to that kind of situation.

Take, for example, the case of the reader who is keen to modify his present cassette deck to take the new metal-coated tapes.

TYPICAL LETTER:

Dear Sir,

It has occurred to me that the imminent vogue for metallic cassette tapes will leave a great many of us with decks fitted with quite adequate tape transport systems but with obsolete tape heads and circuitry.

Would conversion be viable? If so, how much would be involved and would it be within the capabilities of a mediocre home constructor? (Another Playmaster project, perhaps.)

Thanks for the comprehensive mag and don't be bluffed into scrapping your "newcomer" articles. We aren't all qualified technicians you know!

Regards, T.T. (Doyalson, NSW)

If I were to offer the short answer, I would simply say to T.T.: "Forget it!"

To be more explicit, there is not much future for a magazine like "Electronics Australia" in trying to tell readers how to modify commercial equipment. This would be especially true for "mediocre home constructors" (your phrase) and for equipment with as many makes and models as cassette decks.

Conversion of a cassette deck for metal-coated tape would present a whole array of problems. For starters, one would require a higher powered bias/erase oscillator and a higher powered recording output stage, plus

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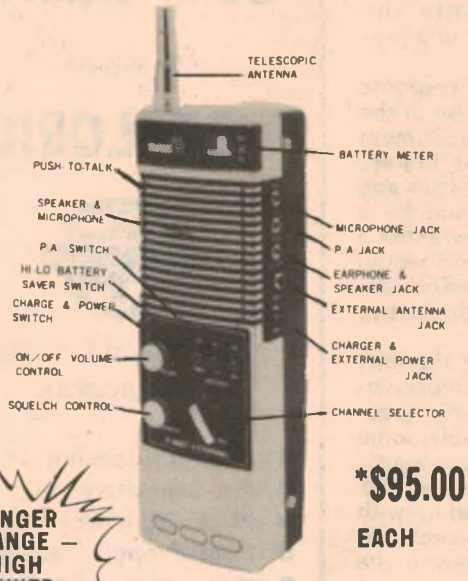

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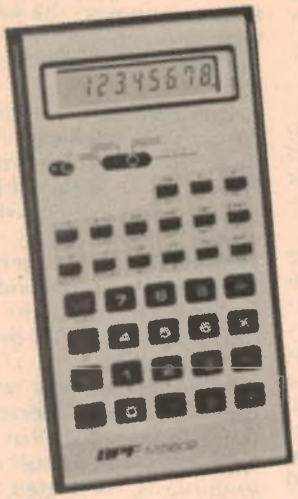

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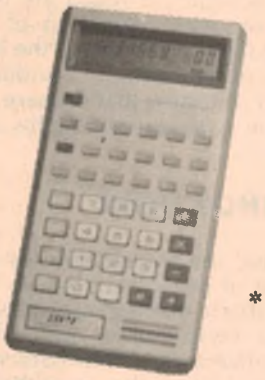

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erase and recording heads capable of handling the additional energy without magnetic saturation. It would be unrealistic to expect substitute components to be made available for a significant number of decks, and equally unrealistic to expect "universal" conversion kits.

Nor would the problem end there. The circuitry in existing decks will have been peaked and tweaked to get the best out of the original heads and the then-available tape. It may not be optimum for new heads and new tape.

In short, the amplifier circuitry, including response, compensation and bias, would have to be reworked in an effort to realise the potential of the new tape. It would also have to be reworked (with appropriate switching) so that the deck would perform correctly with conventional tape!

Finally, we return to the matter of mechanics. As frequency response is pushed up, head alignment and tape travel become progressively more important. It does not follow that mechanics adequate for a top response of 12-15kHz will cope with 20kHz.

As I see it, metal-coated tape is not an end in itself. It is an important forward step in technology which has challenged manufacturers of cassette equipment to effect an across-the-board upgrading of specifications — right through to reduced wow and flutter and hifi at half speed. In achieving this, they are pushing the cassette system technology to new limits.

It makes interesting reading, it's nice to own it and something to brag about. But I suspect that the majority of cassette users, with access to a good conventional deck and good conventional tapes, can already make recordings which match up pretty well to their subjective acuities.

My advice to T.T. is to settle back and enjoy what he has until such times that he can trade it in on something obviously better.

NOISE IN FM RADIO

In rather similar vein comes a letter from a reader in Padstow, NSW, who says:

Dear Sir,

I have read with interest the two brief snippets you published about stereo FM noise and how it is easily overcome by fitting " a little black box".

Having been plagued by this impulse noise problem on my FM mono car radio, I can imagine how much worse it must be in stereo. I am sure that many readers would welcome a constructional article on such a noise reduction system.

I believe that impulse noise suppression ICs are available overseas and an article by your magazine could encourage suppliers to import them here.

B. F. (Padstow, NSW)

I am not sure how much of the discussion B.F. may have seen but a letter in "Forum" in May (N.H. North Carlton, Vic, p.25) is very relevant. Reacting to earlier correspondence, N.H. makes the following points: impulse suppression devices are basically palliatives, not cures; they may require internal modification to the receiver; they call for critical setting up procedures.

As with cassettes decks, there are so many makes and models of automotive FM receivers, so many different vehicles, and so many different listening situations, that we have little inclination to encourage readers to get involved in electronic surgery. External, add-on units are one thing; "black boxes" which have to be wired into the innards of existing commercial receivers are quite another.

We would be much happier if our current exercise with inductive ignition cable resulted in a cure for ignition impulse noise, at least from the parent vehicle. But even that hopeful cure is proving rather elusive.

A poor lookout for television

It is mildly annoying when an aircraft, flying nearby, causes television pictures to flicker and dance. However, few people get up-tight at present because the effect may last for only 10 or 15 seconds. But Thomas B. A. Senior of the University of Michigan in Ann Arbor, and research colleague Depak L. Sengupta warn that similar video modulation caused by giant windmills will not be so obliging. The interference will persist while ever the blades are turning and it will be particularly bad if the TV broadcast happens to be on the UHF band.

Sengupta believes that the annoyance level could be such as to inhibit the installation of giant wind turbines on some otherwise suitable sites. But, more than mere annoyance, he sees windmills as a positive hazard in locations where they might affect the signals from airport guidance and landing aids.

Research by Senior and Sengupta has centred around a 100kW windmill, with 37.5m blades, which has been constructed by NASA near Sandusky, Ohio. If the USA is to exploit wind power on a large scale, it is imperative that the potential for RF propagation interference be understood and allowed for.

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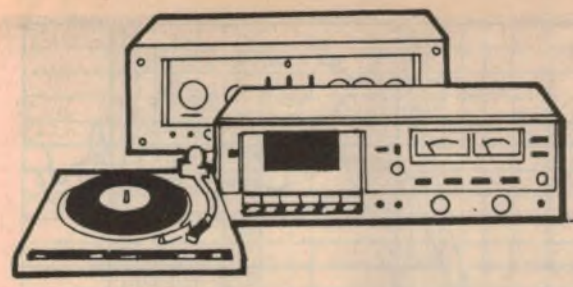

Hi Fi Topics

A NEW GENERATION OF DYNAMIC SPEAKERS FEATURES OIL-COOLED, OIL-DAMPED VOICE COILS

Every now and again, one comes across a reference to loudspeakers which use a "magnetic fluid" in the air-gap surrounding the voice coil. What is magnetic fluid and in what way can it contribute to the ultimate performance of a dynamic driver? Is it an important technological development or a gimmick?

If one were to accept at face value the claims in advertisements and publicity hand-outs, the answers to such questions would never be in doubt:

Magnetic fluid simplifies assembly of drivers with tight tolerances, and reduces the number of rejects; it helps protect the voice coil from overheating; it increases power handling capability; it improves damping of the voice coil and cone assembly; it suppresses contortions of the voice coil; it cuts distortion, controls resonances, improves performance, flattens peaks, reduces transient ringing. It allows given power requirements to be met by smaller drivers, and simplifies crossover network design.

And so on.

The claims sound so impressive that the reader might almost wonder how we have possibly managed, to date, without this magical fluid!

Up till fairly recently, the idea of putting any foreign substance in the voice coil air gap of a dynamic driver was a technical "funny", if only because there was no way in which it could be retained. It would very smartly be sprayed or smeared all over the place by the rapid to-and-fro movements of the voice coil and cone.

Well . . . almost anything would! The writer recalls an experience from younger days, when he was called out to service a receiver which had become mysteriously silent for no apparent reason. There were no faulty components, no short circuits, and no open circuits. It ultimately transpired that the handyman set-owner had traced a rattling noise to the paper cone in the loudspeaker "that seemed loose". He had laid the speaker on its back and dribbled glue "down into that space there". Immediately following the treatment, the speaker sounded "much smoother and sweeter" but, next morning, the set wouldn't work at all!

How could it, with the voice coil glued solidly to the pole faces?

While the story has its funny side, there is also a point to it. While the glue was still viscous, it would undoubtedly have inhibited "rattling", whether due to loose turns or to contact between the voice coil the pole face. It may also have improved speaker damping — a property that was lamentably deficient in many early radio receivers. Unfortunately the cure, while prophetic, was also rather short-lived!

The idea behind the current generation of magnetic fluids was originally developed by NASA as a possible means of controlling rocket fuel in part-empty tanks under the weightless conditions in space. In the absence of gravity, fuel might be induced to aggregate and flow in response to magnetic fields — provided it could be given appropriate magnetic qualities.

It was found that liquids could be given this unlikely property by mixing into them minute particles of a magnetically sensitive solid — particles so small that they would remain in permanent colloidal suspension. Under the influence of a magnetic field, the particles would move in a particular direction, shuffling the liquid molecules along with them. It was as if the liquid itself was magnetically responsive.

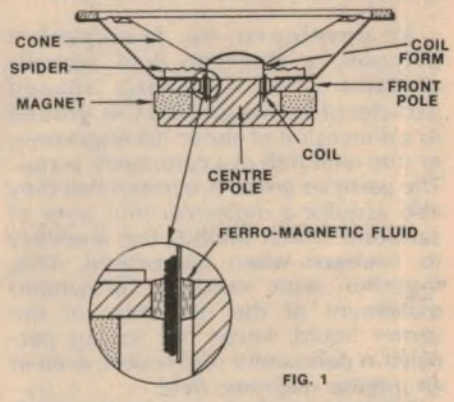

FIG. 1

Not drawn to scale, the sketch shows how ferromagnetic fluid is retained within the normal air-gap by the magnetic field between the pole faces.

In the event, NASA found other ways around their fuel problem and, for a while, magnetic fluid was largely an interesting idea in search of an application. Then, around 1969, the Ferrofluidics Corp (Burlington, Mass., USA) began to promote it in connection with special purpose seals, bearings and dampers.

Ordinary fluids tend, in the long term, to creep out of bearings and past seals and may cause troublesome contamination in critical equipment. But by using a "magnetic" fluid (hydraulic fluid, lubricant, etc) and by setting up a magnetic field between the bearing faces, the fluid can be retained much more effectively, by magnetic attraction.

In due couse, it was realised that this very property would enable a magnetic fluid to be retained within the voice coil gap of a dynamic loudspeaker,

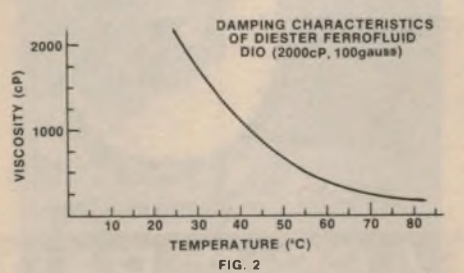

FIG. 2

Variation of viscosity with temperature is a problem which remains to be solved, if damping is to remain constant.

without any kind of physical containment. The liquid would simply distribute itself between the inner and outer pole faces and the voice coil structure, resisting any tendency to be carried away from the intense magnetic field. As such, it would have the potential to lubricate, cushion and damp the mechanical movements of the voice coil, with possibly beneficial results. (See Fig. 1).

In addition, it could be expected to conduct heat from the voice coil to the magnetic structure and frame, thereby offering some protection against voice coil damage under conditions of near-overload.

IRON OXIDE PARTICLES

As developed for loudspeaker purposes, a magnetic fluid typically contains tiny, irregularly shaped particles of iron-oxide (Fe3 O4), ground to a dimension of about 100 Angstroms, or one millionth of a centimetre across. The particles are so processed that they also acquire a molecular-thin layer of surfacant which inhibits the tendency to coalesce when magnetised. This, together with random (Brownian) movement of the molecules of the carrier liquid, keeps the ferrous particles in permanent suspension, even in an intense magnetic field.

Contrary to what might be expected, the actual concentration of solid matter in the carrier fluid does not need to be very high (eg 2%) so that the physical properties of the fluid remain susbstantially unchanged.

Needless to say, the characteristics of the carrier liquid are vital if it is to fulfill its role in the overall driver design:

- It should exhibit the greatest possible heat conductivity. At present, six times the conductivity of air is a typical bench mark.
- The shear/viscosity characteristics must be such as to apply the appropriate amount of damping to the voice coil of particular drivers. Manufacturer's data indicate that typical magnetic fluid can be adjusted in the range 100-10,000 centipoise at 27 degrees C, according to requirements.
- The particle loading must be low enough so as not to prejudice the shear characteristics when subject to a magnetic field. At the same time, loading must be high enough to ensure that the liquid is retained in the gap under all possible signal drive conditions, or under any likely handling (even accident) stress.
- It must not evaporate or harden during the anticipated service life of the loudspeaker.
- It must not interact with adhesives, finishes or other materials involved in the magnet/voice coil assembly.
- All the above properties must be maintained as far as possible over the full range of ambient and working temperatures. Fig. 2 suggests that considerable further work needs to be done in this area.

Pouring oil on troubled tweeters!

With magnetic fluid in the air gap of a cone tweeter, a troublesome 1kHz resonance (upper curve) was eliminated (lower curve). See text.

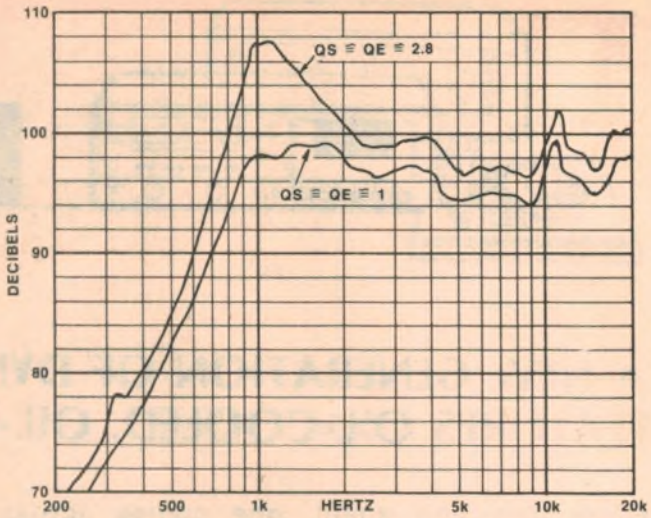

FIG. 3

Ferromagnetic fluids are available involving various carriers, such as diesters (probably the most widely used) fluorocarbons (more costly) and synthetic hydrocarbons. Silicones are also under consideration.

At present, magnetic fluids suitable for use in loudspeakers are all quite expensive. A typical brochure from the Ferrofluidics Corporation lists 100-Gauss Ferrofluid on diester base at $US1075 per litre. The equivalent 200-Gauss Ferrofluid is $US1612 per litre, with other fluids exhibiting higher Gauss levels, lower viscosity, etc, available on special order.

Fortunately, the amount of magnetic fluid required in any one driver is quite small and therefore the cost, while significant, is not prohibitive — provided there is no waste. To this end,

AR systems use ferromagnetic fluid

According to Max Roberts, Managing Director of Acoustic Research Australia, the tweeters and (upper) mid-range drivers in all current AR loudspeaker systems use magnetic fluid in the voice coil gap for purposes of damping and heat conduction.

At the expensive end of the AR "Vertical Series", the AR9 and AR90 are four-way systems in which the tweeter and upper mid-range drivers rely on magnetic fluid for damping — and more importantly for heat conduction. AR say that, at the power ratings involved (400W and 300W respectively) compact, wide dispersion drivers are only practicable by reason of the magnetic fluid.

The AR91 (pictured) and the AR92 are three-way systems in which the mid-range driver has to work down to 700Hz and this posed a potential problem with the back of the unit sealed and with the magnetic gap also sealed with fluid. AR overcame the problem by using fluid only between the voice coil and inner poleface, thereby combining the benefits of damping and heat conduction with adequate air movement.

For further details of the AR range of loudspeaker systems: Acoustic Research Australia, 3 Ford St, Greenacre, NSW 2190. Tel: (02) 642 3993.

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.

The range of new generation Peerless loudspeakers includes the fully assembled *PAS series* plus the money-saving *PLK kit-sets*. Both series contain drive units with the following characteristics.

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☐ Large ceramic ferrite magnets for high power handling. ☐ Specially coated cones reduce colouration to a minimum. ☐ Cones are supported by a single-roll foam or rubber surround to maintain excellent linear motion. ☐ Bass response is clean and tight at all listening levels.

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☐ Sealed back units prevent interaction with the woofer. Distortion and colouration are reduced to a minimum. ☐ The rear side of the cone is coated with a special damping material to eliminate colouration. ☐ Specially impregnated polyurethane cone rim provides high degree of linearity.

Peerless Tweeters

☐ Dome tweeters designed for the highest accuracy of reproduction with low distortion flat response and wide dispersion. ☐ The sealed back isolates the tweeter from interference. ☐ Specially developed dome fabric ensures no degradation of performance even after prolonged heavy loading. ☐ Assembly mounted on a precision diecast plate where rigidity ensures permanent alignment.

Peerless Dividing Networks

☐ 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.

Power handling

The power handling capacity is high and conservatively rated at 100W RMS, however, due to the high efficiency of Peerless speakers, the recommended amplifier power is between 25-100W RMS.

Whether you settle for the smart timber-veneered PAS assembled series or the PLK kit-set, you're getting the same Danish-made Peerless quality – a quality selected by many of the world's most reputable names in loudspeakers, for inclusion in their own speaker systems.

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the Ferrofluidics Corp. has evolved dispensing equipment for use on assembly lines, which meters the required amount of fluid to both sides of the voice coil former, rapidly and with high repeatability. Depending on the grade of liquid and size of speaker, the cost might range from something under 10c per unit to something over 40c.

Naturally enough, the initial application or magnetic fluids has been to existing designs, mainly of quality mid-range drivers and tweeters, where the cost increment is not likely to be prohibitive. However, as already mentioned, close attention has to be paid to other chemicals or substances which may come in contact with the magnetic fluid and with which it may interact.

In any case, magnetic fluids are not suitable for use in drivers which have voice coils wound on paper or on other even partially absorbent materials. Over a period of time, such material will absorb the fluid, gradually "wicking" it out of the air gap, despite the magnetic attraction. The end result may be only residual fluid in the gap and a voice coil assembly that has grown heavier than it should be!

TYPICAL BENEFITS

Where an existing design is compatible, or can easily be made so, beneficial results may well be achieved. For example, recurring problem exists with tweeters, which commonly exhibit a system resonance in the vicinity of 800-1000Hz. To protect tweeters and to prevent them from "colouring" the sound of a multi-way system, it is more or less essential to use an inconveniently high crossover frequency, or a very high slope filter, or a special trap circuit tuned to the resonance.

Practical tests have demonstrated that the problem can be alleviated significantly by the use of a magnetic fluid in the air gap. The viscous drag, right on the voice coil itself, can provide an essentially resistive damping which can dramatically reduce the Q of the major resonance mode. Fig. 3 shows the response of a 7cm cone tweeter with and without ferromagnetic fluid damping; note that the Q has been dropped from a troublesome 2.8 to unity. The information comes from a paper by John King (Essex Group Inc., Cleveland Ohio) presented to the AES Convention, Los Angeles, in May 1977.

It seems highly likely that some dome tweeters, which exhibit a very high Q system resonance, would stand to benefit even more from magnetic fluid damping.

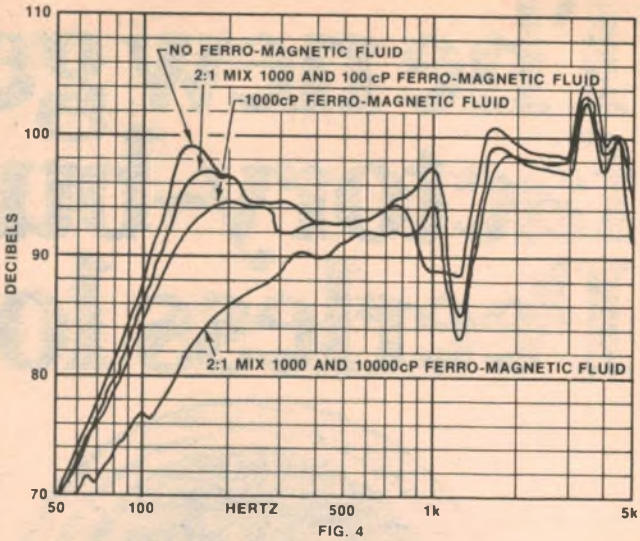

FIG. 4

These curves for a 13cm mid-range driver show how its natural resonance at 140Hz is progressively damped by adding magnetic fluids of higher viscosity. With the 10,000cP mix it is obviously over-damped.

Sealed mid-range drivers tend to suffer a similar problem in the 150-200Hz region and this is also amenable to magnetic fluid damping. A second set of curves from the same paper (Fig. 4) shows how such a resonance can be controlled by the choice of fluid with a suitable viscosity; this for a 13cm mid-range driver.

Yet another curve for this, or a similar driver, shows that the addition of magnetic fluid reduces the voice coil temperature to about 0.6 of what it would otherwise be. (Fig. 5). This could be seen as offering a wider margin of insurance against possible voice coil burn-out. Alternatively, and in some cases, it might permit an increase in actual power rating.

The use of magnetic fluids with woofers and full-range drivers is less attractive, partly because of the amount of fluid involved, and partly because the system resonance is subject to control by the drive amplifier and by the enclosure design. However, the advantage remains of greater heat conduction from the voice coil and the protection which that offers.

In terms of power sensitivity, the addition of a magnetic fluid to an existing driver has only minor effect, the loss due to extra damping being partly offset by greater (permeability) magnetic conduction across the gap. A loss of 1dB is suggested as typical.

As distinct from "retrofitting" or adapting existing designs, it would

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An equalizer can improve speaker balance and ideally blend, according to your taste, the character of your speaker with the character of your room – thus your speaker performance is greatly improved.

3 **Highlight an instrument**
A musical instrument, a band of instruments, or a vocalist can be emphasised on a recording to aid in learning a specific tune or admire and enjoy the playing of a particular instrument.

4 **Optimise system balance**
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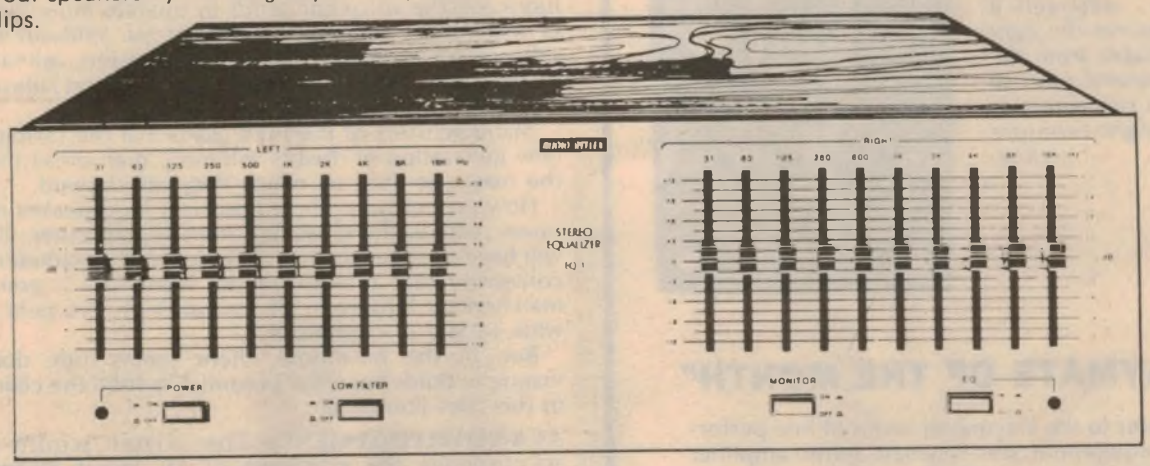

What the critics say .....

HI-FI & MUSIC, May 1979 – "The Audio Reflex equalizer has been carefully designed for general use in systems owned by audiophiles who require that 'something extra' in hi-fi systems."
CANADIAN STEREO GUIDE, Winter 1979 – "Separation between the two channels was excellent, being better than – 64dB across the range. THD was also exceptionally low, as was equipment generated noise."
THE FM GUIDE (Canadian) 1979 – "Quality, that was only hinted at with the original material, can be brought out through proper use of this well-designed, modestly priced, and simple-to-operate frequency equalizer."
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Next Month

Don't miss our article on buying a Cassette Deck . . .

Our article gives a rundown on just about every feature you are likely to find on any cassette deck. Which features do you really want? Get hold of the January issue for the answers. And on the same theme, check out the hifi reviews!

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PLUS MUCH MORE

As always, the issue is full of interesting features. So don't miss out. And why not treat yourself to a 12-month subscription while you think about it. See page 144.

Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned above.

HIFI TOPICS — continued

Voice coil temperature rise for a typical mid-range driver with and without magnetic fluid in the gap. As indicated earlier, AR take full advantage of this effect in their latest high-power systems.

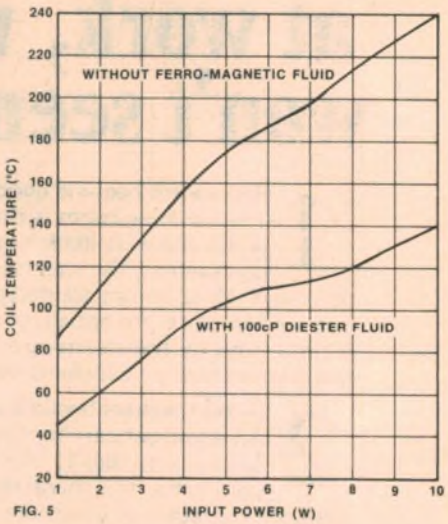


FIG. 5

seem that a whole new design approach is open to loudspeaker manufacturers, particularly in respect to tweeters and mid-range drivers, where high power handling has to be combined with small physical dimensions.

To date, dynamic drivers have relied on the outer suspension and "spider" to maintain the voice coil centred in the magnetic gap. This sets a limit on minimum design clearances, makes heavy demands on assembly techniques and is a potential cause of buzzes and rattles if there is any subsequent sagging.

When magnetic fluid is used, magnetic attraction will ensure that there is a layer of liquid on the pole faces. Since the liquid also happens to have very commendable qualities as a lubricant, the voice coil tends to operate more like a piece of machinery, sliding in a bath of oil. Without the same reliance on purely mechanical suspension, tolerances can be tightened, assembly can be simplified, and failures due to voice-coil problems reduced.

Manufacturers of the fluid claim that the savings on this new generation of drivers will more than offset the cost of the magnetic fluid on which they will depend.

How promptly and how positively loudspeaker manufacturers react to the challenge remains to be seen. Designers will have to adapt to a whole new set of parameters and be convinced that promise in the laboratory is going to be matched by long-term performance in the field under a wide variety of conditions.

But, in the meantime, there seems little doubt that magnetic fluids have the potential to fulfil the claims made in the sales literature.

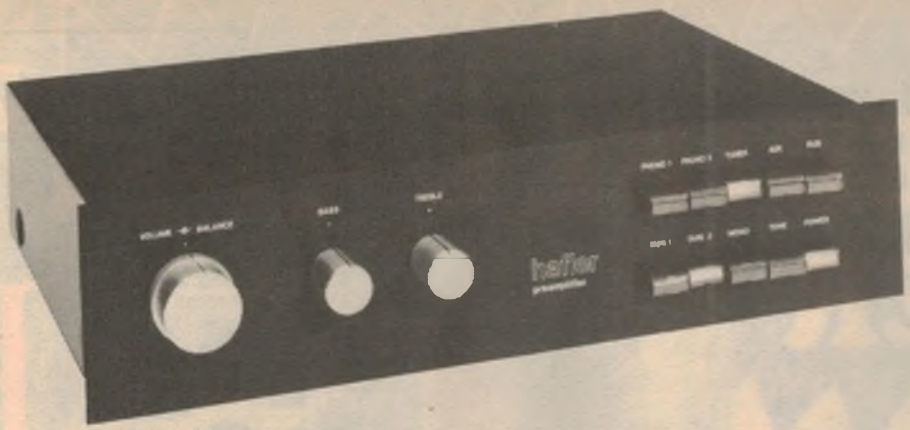
ACKNOWLEDGEMENT: The writer would like to acknowledge the assistance of Mr Stuart Barton, Chief Engineer of Magnavox (Aust) Pty Ltd, in providing copies of references used in this article. Magnavox are currently investigating the use of magnetic fluids in new, locally produced drivers.

SURROUND SOUND FROM IBA

Although conventional quadraphonic systems are very much a non-event, research continues in Britain as an extension of the original "Ambisonic" concept.

On September 23, the Independent Broadcasting Authority broadcast a two-hour "surround-sound" concert from the Portsmouth FM transmitter, as originally recorded in the Winchester Cathedral.

IBA's latest surround system is a three-channel matrix system which has excellent stereo compatibility and much better definition that the earlier "2½ channel" method.



CONCEPT AUDIO PTY LTD advise that the supply position for the Hafler DH-101 preamplifier should begin to improve from the Christmas period onwards. It was released in Australia during July, but demand has consistently exceeded supply since then. While presenting a rather plain face to the world, the new preamplifier lays claim to a very high order of performance and utility.

Recommended retail price for the DH-101 is $375 in kit form and $475 fully assembled. For a further $135, Hafler provde their DH-102 pre-preamplifier, designed to fit inside the DH-101 and to provide the additional gain necessary to operate directly from the output of a low impedance moving coil cartridge.

A companion unit is the DH-200 power amplifier, rated to deliver a generous 100W per channel (continuous) and with highly commendable characteristics in other respects. It comes in kit form for $655 and ready built for $755. For further information on the Halfer range: Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale NSW 2100. Phone (02) 938 3700.

HIFI INDUSTRY ASSOCIATION office bearers for the current year are:
Chairman — Les Black of Pioneer Electronics Aust. Pty Ltd.
Vice Chairman — Peter Lee of National Panasonic (Aust.) Pty Ltd.
Promotions Executive: John Watts of Superscope (Asia) Pty Ltd.
Treasurer — Graham Timmins.

The Hifi Industry Association currently represents about 25 member companies, marketing more than 60 major brands.

PHILIPS have introduced a new family of round-frame 8-inch woofer speakers intended for use in sealed enclosures not exceeding 25 litres, and with impedance values of 4 and 8 ohms. The AD80601/W and AD80602/W have a resonance of 42Hz and typical ratings in a 25 litre enclosure of 50-4000Hz, 50W, and a sensitivity of 96dB at 1m with 5W drive. The AD80651/W and AD80652/W have a resonance of 39Hz and ratings of 50W, 50-5000Hz in a 25 litre enclosure; sensitivity 3.8W. The AD80671/W and AD80672/W are rated at 60W, 40-3000Hz, sensitivity 9W. Power ratings for all three can be doubled under appropriate conditions. For further details: Bruce Druery, Philips Press Office, 15 Blue St, North Sydney, 1092.

BASF AUSTRALIA PTY LTD say that a linear video recording system (LVR) is in an advanced stage of development with mid-1980 as a likely release date. The system will offer a 3-hour playing time on a small cassette, with good picture quality. A feature of the LVR system is high quality sound, giving it a distinct advantage over currently available video cassette recorders. BASF see the role of their new LVR as not only for recording off-air TV, but for making home movies with quality sound.

TOSHIBA (AUSTRALIA) PTY LTD have built up their line of Micro HiFi components to a total of 10, giving them a claimed leadership in this growing field.

Latest additions include the 30W + 30W "12" series, comprising the SC-M12 stereo power amplifier, the SY-C12

stereo preamplifier, the ST-10 stereo tuner and the PC-D10 "metal position" cassette deck. The "10" series comprises the 20W + 20W integrated stereo amplifier SB-A10, combined with the tuner and cassette deck as above. Toshiba (Australia) Pty Ltd are at 16 Mars Rd, Lane Cove, NSW 2066.

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For the first time, Dick is offering the superlative performance of his top Hi Fi system, incorporating the superb Dick Smith 55 watts rms per channel stereo amplifier, the 12" Playmaster 3-way speaker system with in-built control for the midrange and tweeter and the Sanyo belt drive turntable with servo control, magnetic cartridge, base and cover - at a price that will astound you **PLUS** a matching stereo AM/FM tuner (worth $239) absolutely **FREE!**

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BUT THAT'S NOT ALL! THIS TUNER WORTH $239 ABSOLUTELY (When you buy the system) FREE

DELUXE AM/FM TUNER

SPECIFICATIONS: 1 FET, 1 stage RF amplifier, 3-gang variable capacitor, 5 stage limiter, PLL MPX ★ Frequency range 88-108MHz ★ Sensitivity IHF 1.9uV ★ S/N ratio 70dB (mono) ★ Total harmonic distortion 0.2% (mono) @ 1kHz, 0.3% (stereo) @ 1kHz ★ Frequency response 30Hz to 15kHz ★ Separation 40dB @ 1kHz. The AM section has a frequency range of 525-1605kHz. Audio variable from 0-750mV.

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PLUS FREE TUNER WORTH $189

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SPECIFICATIONS: FM tuner section Frequency range 88-108MHz ★ IHF sensitivity 1.8uV ★ Selectivity 60dB ★ Stereo separation 40dB @ 1kHZ ★ Frequency response 30-15,000Hz AM section Frequency range 530-1605kHz ★ Sensitivity 48dB ★ Selectivity 35dB @ 1kHz ★ Semiconductors 1 FET, 3 ICs, 5 transistors, 3 diodes and 1 LED Dimensions (same as amplifier) 400(w)x135(h)x290(d)mm

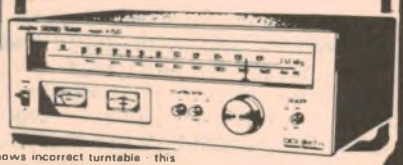

Illustration shows incorrect turntable - this system incorporates the Sanyo as shown in the 55 watt system illustration

DICK SMITH ELECTRONICS

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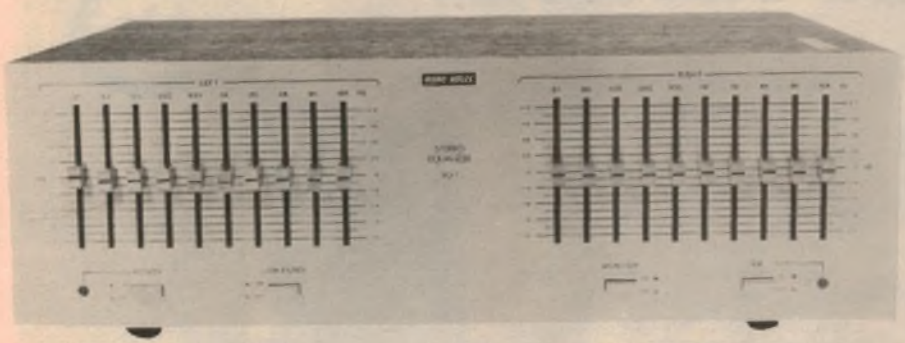
DSE654

Audio Reflex EQ-1 10-band Graphic Equaliser

These days it is recognised that ordinary tone controls are inadequate to compensate for room and loudspeaker deficiencies. Graphic equalisers are far more suited to the purpose. One such device is the Audio Reflex EQ-1 Graphic Equaliser which has 10 bands and 20 separate controls.



The Audio Reflex EQ-1 splits the audio spectrum into ten bands with centre frequencies of 31Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz and 16kHz which are the usual frequencies for 10-band equalisers. Each band is controlled, boosted or cut, by a separate slider in each channel, making 20 in all.

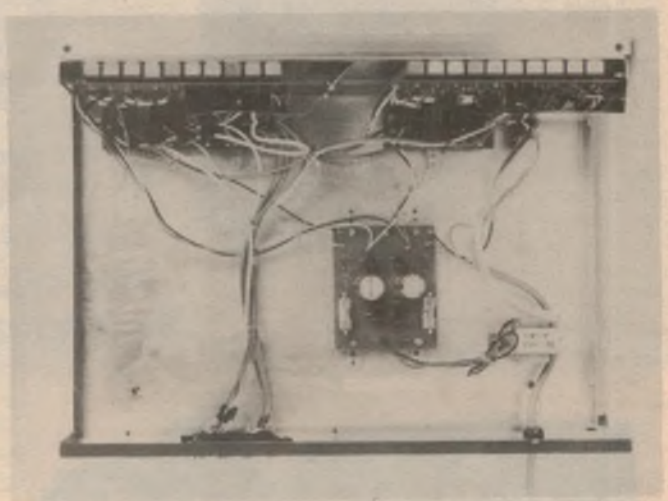
Each slider control has a quoted range of +12dB at the centre-frequency and has a centre detent to enable a flat response to be obtained.

Normally, a graphic equaliser such as this is connected to the "tape monitor" terminals of a stereo amplifier. If the system includes a cassette deck, this is then connected to the duplicate "tape monitor" terminals on the equaliser. The equaliser has unity gain (nominally) so that it can be switched into or out of the system with no change in overall gain, provided controls are centred.

Dimension of the Audio Reflex EQ-1 are 420 x 138 x 300mm (W x H x D). These large dimensions are necessary mainly because of the large array of slider controls.

Styling and presentation of the EQ-1 leave little to be desired. Our sample has some of the slider knobs crooked and some of the sliders were a little rough in action. We could excuse this as it is probable that our sample was a much-used one.

Inside the large chassis is a lot of unused space with most of the circuitry accommodated on two printed circuit boards which also mount each group of ten sliders. The overall circuit is quite conventional using operational amplifier ICs in gyrator configuration. The "gyrator" is an op amp circuit which effectively transforms a capacitor into an inductor which can then be used in a series-tuned feedback circuit to provide each band.



As with all graphic equalisers using op amp gyrator circuitry, the inside is virtually empty.

As such, the gyrator circuit is well proven and has become the standard configuration in graphic equalisers. What is not realised by high fidelity enthusiasts, is that the resulting circuit is inexpensive to produce — much less costly than cassette decks, for example. That is not borne out in the price even though this particular unit, the EQ-1 is something of a bargain, relatively speaking.

On test, the Audio Reflex EQ-1 performed well. All specifications were met or exceeded: Signal-to-noise ratio with respect to 1V RMS was 93dB unweighted. With the same reference level, separation between channels was 84dB at 100Hz, 76dB at 1kHz and 58dB at 10kHz, measured with 4.7k loading the undriven input. Again, with respect to the same reference, harmonic distortion was .015% at 100Hz and 10kHz and .02% at 1kHz.

When the controls are set at 0dB, the gain of the equaliser is -0.5dB. An 8 volt output signal can be obtained before more than 0.05% distortion is produced. This overload voltage is far in excess of what would be delivered to the equaliser from the amplifier tape output.

Listening tests revealed no performance problems. For the most part, the EQ-1 is virtually noiseless — switching the equaliser in and out of circuit produced no audible increase in noise.

Our summary can be short: The Audio Reflex EQ-1 works as claimed.

Recommended retail price of the Audio Reflex EQ1 is $299 including sales tax. Warranty is three years on parts ane labour. Further information can be obtained from retailers or from the Australian distributors, A.G.S. Electronics (Australia) Pty Ltd, 7 Orchard Road, Brookvale, NSW 2100. (L.D.S. & J.C.)

Peerless Loudspeaker System

Of all the loudspeaker systems sold today, probably the most popular is a three-way system with a volume of about 50 litres. Right in the middle of that market sits the Peerless PAS50 system which is a sealed enclosure with three drivers. Frequency response is quoted as 30Hz to 20kHz (DIN) and power handling is 100 watts on program signals.

It is not surprising that systems with a volume of around the 50 litre mark are so popular. They are of reasonable size and efficiency and have a good bass response and power handling. This is no accident, as all these parameters naturally come together in this size of enclosure to provide what is possibly the best all-round compromise, for the designer as well as the buyer.

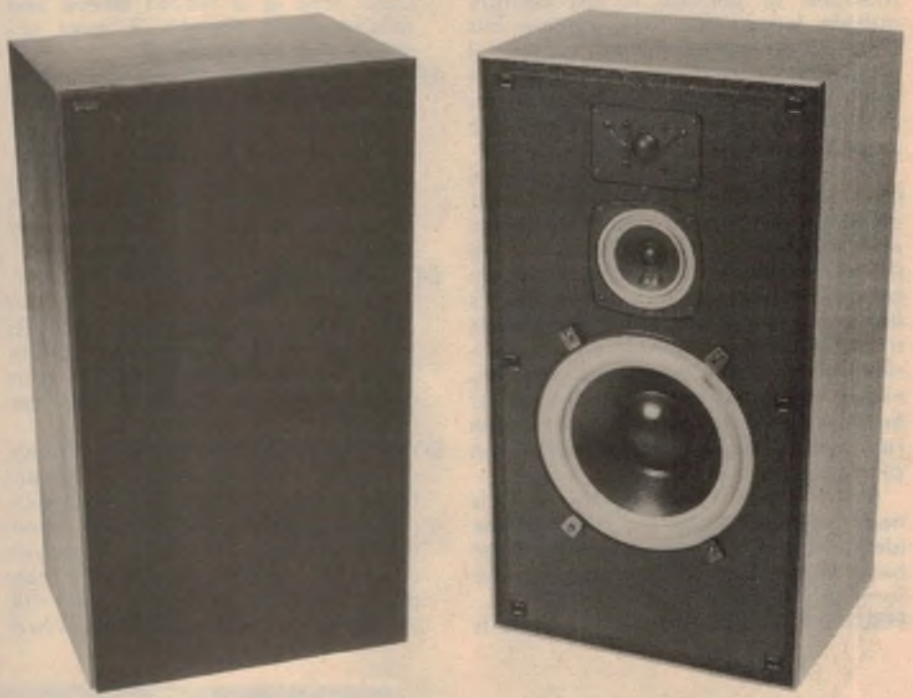
The woofer in this Peerless PAS50 system is a rugged looking unit with an effective diameter of about 170mm and a large foam roll surround. The midrange also has a roll surround and an effective cone diameter of about 75mm. The tweeter is a 25mm dome unit. All three drivers are made by Peerless, of Denmark.

The enclosure is intended to be floor-standing, but it could be mounted on a deep sheld. Overall dimensions are 360 x 660 x 290mm (W x H x D), the cabinet being made of chipboard with a synthetic veneer on four sides. The grille frame is removeable to reveal the three drivers. The enclosure is well-sealed — considerable care has seen to that. There was no way we could inspect the inside of the enclosure to look at the crossover details or driver construction.

However, according to literature supplied by the distributors, the crossover networks use "air-cored chokes for maximum power handling and minimum distortion and special electrolytic crossover capacitors for long term reliability." Crossover frequency from woofer to midrange is at 400Hz while the crossover to the tweeter is at 5kHz.

On the rear panel there is a recess for a pair of spring-loaded terminals which are colour-coded for polarity (red for positive). However, apart from the Peerless logo on the grille cloth frame, there is no labelling of any kind on the loudspeaker. We think that some labelling, giving the brand, type number, specificiations (particularly impedance and power handling) plus name and address of the distributor should be somewhere on the enclosure, back or front, so the information won't be lost. After all, it is normal for delivery dockets and warranty cards to be misplaced after a few years. (Other loudspeaker manufacturers, please note).

The impedance curve is quite smooth and does not present any potentional problems of incompatibility with solid state amplifiers. The lowest impedance value occurs at 100Hz, at just over nine ohms. Apart from this, there are virtually no dips at all in the whole curve. The main system resonance is close to 50Hz and is well damped.



The Peerless PAS50 is an infinite baffle system with three drivers.

Peerless quote the frequency response of the PAS50 as 30Hz to 20kHz under the DIN specification. A supplied (typical) third-octave pink noise response indicates that the response is flat from 40Hz to 20kHz within +6dB. Our tests would appear to confirm this latter claim. The bass is very well maintained down to below 40Hz and is fairly smooth over the entire frequency range.

The midrange seems particularly smooth, a statement which cannot be made about many three-way systems. And in the treble end, there are certainly no complaints.

On all types of music, we found the Peerless PAS50 eminently satisfactory. It has reasonable efficienty and can be driven to satisfactory room levels with an amplifier rated as low as 25 watts per channel. Or on the hand, it can handle the full output (on program) of a 100 watt per channel amplifer. Bass boosting is unnecesary but modest boost can be handled.

If these units are to be floorstanding, it is probable that they would benefit from the addition of a stand to raise them about 200 to 250mm above floor level.

Most of this review then, is complimentary. The Peerless PAS50s do perform well and should satisfy the needs of most listeners. There is a catch though. At $574 per pair, these Peerless systems are not cheap. Even so, we concede that buyers will be satisfied with their purchase.

Further information can be obtained from the Australian distributors for Peerless loudspeakers, G.R.D. Group Pty Ltd, 698 Burke Road, Camberwell, Victoria, 3124 or from the showroom at Danish Hifi, of the same address.(L.D.S.)

Matsushita does it again . . .

The World's smallest full-sized phono player!

So you'd like a turntable that doesn't dwarf the rest of your hifi gear? That you can store in your record cabinet when not in use? A compact turntable that employs state-of-the-art technology? Well, be patient. You should be able to buy one within a few months!

by NEVILLE WILLIAMS

The turntable in question is the new "Quartz, Linear Tracking Direct Drive" Technics model SL-10. At the time of writing, there are no samples in Australia, or perhaps in any country outside Japan. But press release kits have been supplied to technical magazines around the world and, on Matsushita's usual form, it won't be too long before production units will be available for evaluation.

The SL-10 will mate naturally with the new generation of compact hifi amplifiers, tuners, etc, which Japanese manufacturers have released during the past year or so. While this may have been a motivating thought, it seems likely that the SL-10 is also a by-product of fresh thinking generated by consideration of computer disc systems, video disc players and digital audio systems. All of these have broken right away from the traditional phono playing deck.

But while, as a package, the SL-10 is new, even revolutionary, many of the ideas which it brings together have been around for a long time, in one form or another.

FOLD-UP, STOW AWAY: This idea is about as old as the pre-electric phonograph but the SL-10 wins hands-down in the matter of size. In plan view it occupies about the same area as a record sleeve and should stand upright in most ordinary record shelves.

ULTRA-COMPACT: Small turntables and scaled-down pickups have been featured in portable record players for decades but the clearance dimensions, when playing a 30cm (12in) record are likelyto be greater than for the SL-10, full-size turntable and all.

DC OPERATION: Electronically controlled DC motors for disc and tape decks are no longer news as such but the SL-10 provides deliberate access to the circuitry so that it can operate directly from a 12V car battery!

DYNAMIC PICKUP BALANCE: Fifteen years ago, we were using an All-Balance arm which could be set up to play a record in any attitude, even upside-down. The SL-10 features complete dynamic balance. It can play a record quite happily while still standing on end in the record cabinet!

LINEAR TRACKING: Quite a few players have dispensed with radial arms, with their inherent tracking error, in favour of a linear tracking system: Beogram, Harman Kardon, Revox, Technics, etc. The SL-10 follows suit, but with special claims about the accuracy and smoothness of the microprocessor-controlled linear transmission. The system eliminates tracking error and the need for anti-skating force correction.

AUTOMATIC OPERATION: Old hat, featured on all prestige turntables! The SL-10 has it, too but carried a logical step further in being interlocked with an acoustically sealed lid.

So the list goes on: a quartz-locked, direct-drive motor; optical sensing for the presence of a record, its size, and the position of start and finish tracks; automatic speed setting; moving coil cartridge; in-built moving coil preamplifier; pressure device to hold the disc firmly on the turntable, etc.

As I said earlier, the story of the SL-10 is not so much the novelty of the in-

The new Technics SL-10 phono deck (left) ranged alongside other units in the Technics "Bonsai" range. In the centre is the AM/FM tuner, resting on the cassette deck. On the right is the power amp (top), control unit (middle) and power supply. There is no reason, of course, why the SL-10 should not be used with an existing system, where space is at a premium.

dividual features, but in the fact that they are all brought together in the one unit — a unit which is about as small as it's ever likely to be, while still being able to get the best out of a present-day 30cm analog recording.

Whether by accident or intent, the SL-10 has been announced just 10 years after Matsushita/Technics released the World's first direct-drive turntable, the SP-10. According to the manufacturers, the SP-10 exhibited less wow and flutter and a more constant speed than cutting lathe motors of the era. It was followed, six years later, by the SP-10MKII and by the high-torque quartz-locked SP-02, designed to fit Neumann cutting lathes. In the meantime, direct drive turntables have become almost a way of life for quality-conscious audiophiles, with most manufacturers featuring them in their range.

The new Technics SL-10 is no longer presented as a playing deck with a lift-up perspex dust cover. It comes as a complete die-cast cabinet which opens into two halves. The lower half, as expected, contains an integral platter/DD motor, together with its quartz phase-locked control circuitry. The upper half contains the linear tracking tonearm, its drive control system and a dedicated microcomputer which monitors and controls the arm travel.

Also built into the lid is a record stabiliser which holds the disc firmly against the centre of the turntable, instead of relying on gravity. The stabiliser turns with the disc and carries a stroboscope, which is visible through a dark perspex window in the lid.

To use the SL-10, one places a record on the turntable and closes the lid, sealing the record into a chamber which is acoustically much more isolated than normal from the listening environment. Internal damping provides a further barrier against outside vibration.

On pressing the play button, an optoelectronic sensor checks for the presence of a record and then checks its size. If it is a standard 30cm (12in) album, the sensor sets the speed at 33rpm, unless a manual over-ride is operated. Similarly, 18cm (7in) records are played normally at 45rpm.

The optoelectronic sensor also identifies the start groove and later the finish groove, lowering and raising the playing head without imposing any mechanical loading on the groove or stylus. If, for any reason, the lid is lifted during play, the mechanism automatically returns the pickup to its rest position and switches off, allowing the record to be removed, without any other intervention.

While normal operation of the player is about as simple as it can possibly be, additional facilities are available for those who may need them.

Buttons with left-pointing and right-pointing arrows allow the arm to be shuffled in either direction above the surface of the disc, a calibrated scale on top of the cabinet indicating just where it is. The arm can be moved slowly or rapidly, depending on how hard the buttons are pushed, but it will not travel beyond the playing groove area.

On pressing a cue button, the arm lowers and begins playing at that point.

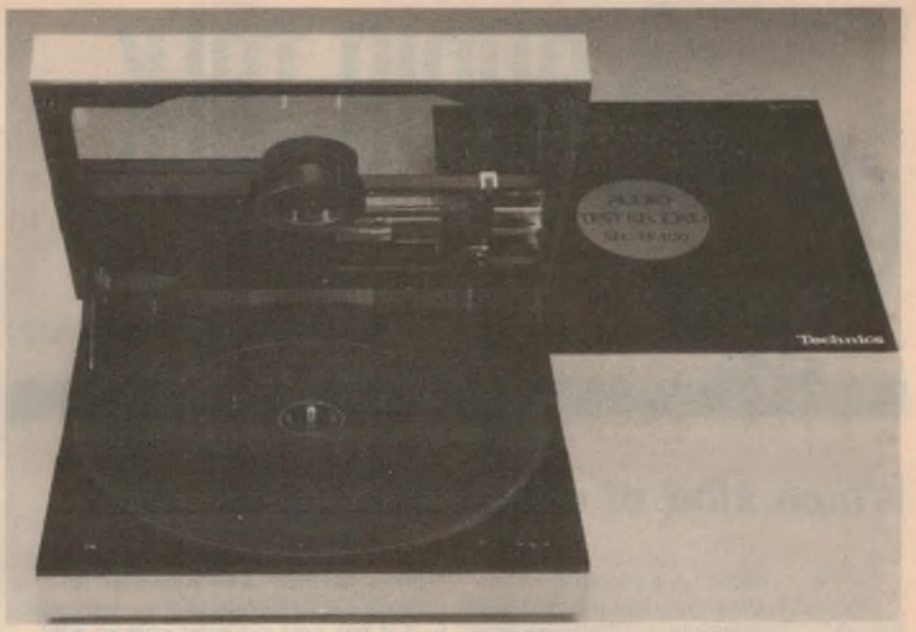
In this turntable, the user never touches the playing arm. All cueing is done by means of the external buttons, thus minimising the risk of mishandling, and of physical damage to cartridge or groove. An electronic muting circuit silences the system at the moment of lift-off and until the stylus is properly seated in the groove, thereby eliminating all cueing noise.

Facilities are available to provide automatic repeat playing of a disc, or to repeat that part of the disc which has already been played.

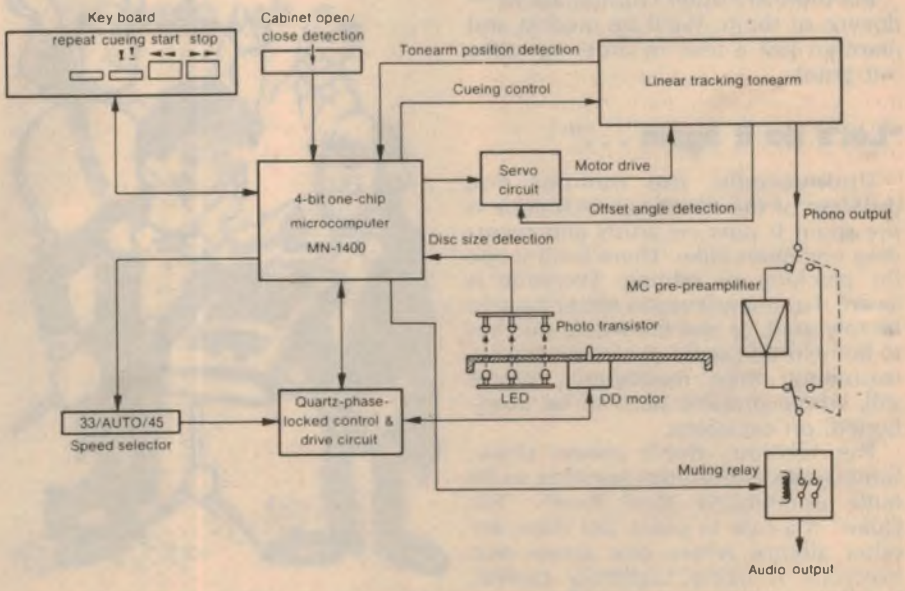
The SL-10 is supplied complete with a new slide-in moving coil cartridge, developed from the Technics MC305. It features a core-less, twin-ring coil structure and a pure boron pipe cantilever to produce what the makers as "an extremely linear, flat frequency response and superb tracing ability".

The built-in MC preamplifier allows the SL-10 to be used with conventional magnetic input systems, but the preamplifier can be bypassed, if desired, to access directly the output from the cartridge.

When available, the Technics SL-10 turntable will be distributed through National Panasonic (Australia)) Pty Ltd, 57 Anzac Parade, Kensington 2033.



The SL-10 phono player compared with an ordinary record sleeve. Details are rather obscure but the record stabiliser, arm and tracking system are in the lid.



The internal circuitry and "brains" of the SL-10. Note the LED system which checks for the presence and size of a record to set speed and enable the play system.

AUDIO TALK

by NEVILLE WILLIAMS

Which kind of disc is the best?

Fact is — there isn't any best!

Until such time that digitally encoded domestic discs take over (assuming they will some day) audiophiles are faced with three distinct technologies competing for their dollar:

- Discs transcribed from top quality analog tape equipment;
- Discs transcribed from digitally encoded tape masters;
- Direct cut discs, where the signal has been derived directly from the console, with no intermediate recording.

Which is the best?

In fact, there is no simple answer to the question. One can only respond with the time honoured phrase: it all depends . . .

If there were no other considerations, one might have to come down in favour of direct cut, because it minimises the number of processes through which the signal must pass, en route to the consumer. That should be a big plus.

But there are other considerations — dozens of them. We'll be modest and mention just a few, in order to make our point.

"Let's do it again . . ."

Undoubtedly, the number one problem of the direct cut technique is the strain it puts on artists and recording engineers alike. There is no scope for patching or editing. Everyone is aware that imperfections either have to be tolerated, or else the whole side has to be recorded again. It can be tedious, frustrating, even maddening. Worse still, whole projects have to be abandoned, on occasions.

The tensions don't always show, some artists and groups seeming to be quite uninhibited. Real Time's "For Duke" is a case in point. But there are other albums where one senses that everyone is being frightfully careful, lest they mess it up — again!

After a few minutes of that, the "direct to disc" endorsement on the jacket loses its trendy charm, particularly if it has cost the best part of $20!

Tape mastering obviates much of this tension, with modern digital encoding way ahead of the older analog method on the basis of performance figures. There is virtually no wow or flutter, negligible frequency error, negligible distortion, a very wide dynamic range, and no degradation from editing, dubbing or storage. The risk of degrading the signal would seem to be very small indeed.

No less important, having the recording on master tape allows the levels to be observed to the last decibel, for the best possible "fit" to the dynamics of the lathe and the disc. Cutting can be done at half-speed and the groove spacing computer-controlled to pack the grooves towards the outside of the disc, while still giving the clearance needed for crescendo passages.

"Cheer up Claude, we're on overtime!"

"Telarc", for example, seem to exploit this advantage to the full. Looking at the clearance they leave around heavily modulated grooves, you wonder how they're going to fit all the rest in, without scribing grooves in the label!

An engineer, recording a signal direct off line, has none of this flexibility and none of this assurance. He needs a lot of skill, and "a little bit 'o luck", for everything to come out spot-on.

Well then, are digitally mastered discs the best?

No, scream the direct-cut enthusiasts. Those with sufficiently keen ears can sense a certain subtle this, that and the other, which betrays the fact that the analog signal has been chopped up into bits and then put back together again. Digital discs are good but they're not like the real thing!

It's difficult to assess such highly subjective statements, particularly if some of the people with super-sensitive ears also happen to have a vested interest in direct cut! All I can say is that, along with a lot of other audiophiles, I remain blissfully unaware of any such intrinsic limitation, either in digitally sourced analog discs, or complete digital systems.

"It ain't necessarily so"

Personally, I find it difficult to escape the conclusion that digital mastering offers the most practical and satisfying way to produce an analog disc. Certainly, some superb records have been made in this way, but there have been some very ordinary ones too — I suspect for a variety of very ordinary reasons. Once again, the "Digital" endorsement is not much comfort, if you don't like what you finally hear.

But while there is a lot of competitive emphasis on direct and digitally sourced discs, it is noticeable that many conventional analog system recordings still earn enthusiastic reviews, overseas and locally.

How is this possible with an often-insulted, "out-dated" system? Easy!

The fact is that a top quality analog master tape can also be most impressive, with negligible wow and flutter, good frequency response, low distortion, low noise and good dynamic range. If it is transcribed directly and carefully to a disc, its desirable qualities are substantially preserved and you get a top-flight disc as a result. Indeed, many labels seen during the past few years have been based on this "tender loving care" approach.

An inherent problem with analog tape mastering is that the latitude for error is relatively small. Too much signal on peaks can overload the tape; too low a recording level overall allows the softer passages to sink into the noise region. The problem can be alleviated by a variety of signal processing techniques but these tend to be anathema to the purist consumer.

A great deal depends, of course, on the nature of the material to be recorded. If the dynamic range is characteristically small, fitting the signal to the dynamics of analog master is no great hassle. In these circumstances, the advantage offered by direct or digital technology may be subjectively quite small.

Time and again, in reviewing ordinary catalog releases, I've commented favourably on the quality but added a remark to the effect: "it's not surprising, considering the tightly controlled dynamics of the original performance". It's when one strikes a disc with very clean sound AND wide dynamics that the proverbial hat can be removed in deference to those responsible!

However, to argue only about the recording system is to omit other factors no less significant to the end result. Consider, for example, the recording venue and the microphone techniques used to intercept the sound.

The classic "purist" approach is to use a single stereo microphone to gather the total sound with, preferably, as little interference as possible with the signal en route to the recorder. At best, it can yield an authentic, spacious sound; at worst, solo voices and instruments can almost be lost in the remoteness and ambience, unaided by the visual clues that someone present at the actual performance would have. A record like this can be utterly frustrating, irrespective of supportive argument in the jacket notes.

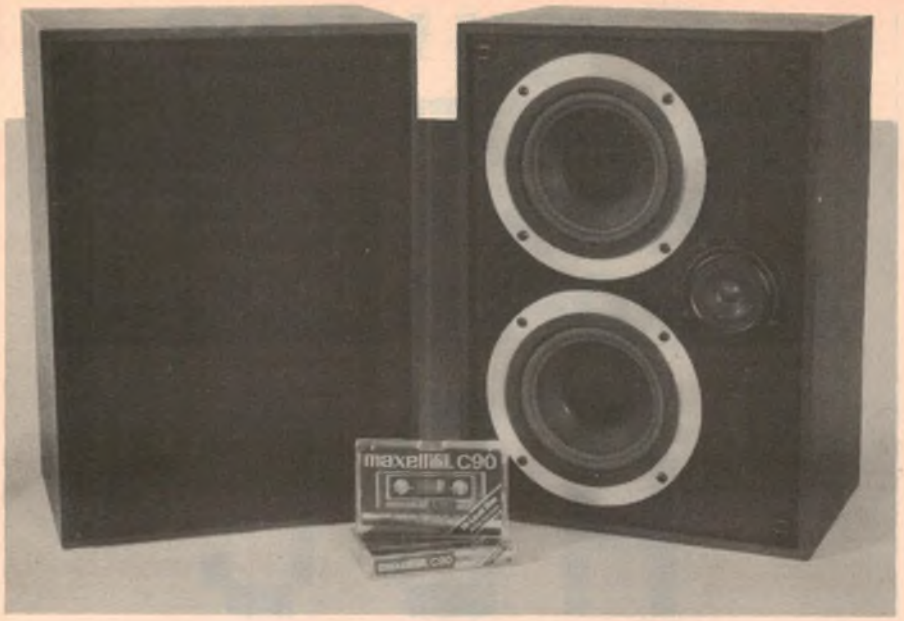
"I got plenty o' nuttin"

At the other extreme are those engineers who are not happy unless they are working with 20 or 30 microphones and as many channels in a massive mixer. The result can vary all the way from startling intimacy of sound to an acoustic mess!

All these qualities can — and do — appear irrespective of the recording method, and they'll undoubtedly continue to do so as we move into the era of the digital disc. We'll simply be able to hear the rights and wrongs of the performance, the venue and the miking more clearly than ever!

Just to complicate things further, the established record makers, at the moment, have a substantial monopoly on the most experienced artists and the appropriate venues, together with an army of highly experienced technical personnel. Those, who have thus far pioneered the direct cut and the digital market, have had to do so on a shoestring budget — and it sometimes shows.

What it all adds up to is that the "best" records for any given listener are those which afford him/her the greatest listening pleasure. If that, for you, rests only on the way in which the signal has been transcribed, one thing is certain: you're hung up on technology!



The prototype Playmaster 3-13L enclosures, with and without grille and compared in size to a compact cassette. At the top is the woofer-thru mid-range driver and, below it, the passive radiator. To the right is the tweeter, crossing over at 1500Hz: three cones and a cubic content of just over 13 litres. Dimensional and constructional details are shown on the facing page.

by NEVILLE WILLIAMS

A BIG SOUND FROM TWO SMALL ENCLOSURES

So you are pushed for space, with no room to stand large loudspeaker enclosures? But you still want big sound, be it for jazz, orchestral or classical organ? Then read on: this brand new build-it-yourself Playmaster loudspeaker system may be the solution to your problem — without costing you a fortune! We've called it the Playmaster 3-13L.

What immediately impresses about the new system is its modest overall size: in round terms 390mm x 270mm x 195mm or 15 x 11 x 7½ inches. As such, a pair of 3-13Ls can rest easily on a mantel shelf or book shelf, or be attached directly to a wall or partition.

But, despite their modest dimensions — and their modest weight — the new 3-13Ls can produce agreeably big sound, with rumbling bass and crisp transients. During some of our listening tests, we had them standing on top of a couple of full-size enclosures and it was hard to believe that the small systems alone were making all the noise!

How were they being driven? We'll get around to that a little later.

The new Playmaster 3-13Ls are the outcome of an approach made to us, a few weeks back, by the Australian manufacturers of ETONE loudspeakers. In recent years, the company has built up quite a connection in the field of public address and music loudspeakers, as well as supplying local drivers for big-name imported music systems. However, they have been keen to diversify into the Australian do-it-yourself hifi market.

This is understandable, considering the huge numbers of systems which are assembled by local hobbyists every year. Topping the list easily is the still-current Playmaster 3-75L, followed by its smaller counterparts, the 3-53L and the 3-26L — the figure in each case indicating the approximate internal volume of the enclosure in litres.

These still-current systems are based on imported drivers and cross-over networks, all so solidly entrenched and so economically priced that it seemed pointless to encourage a local manufacturer to mount a head-on challenge. Well then, was there some other approach that would be worth looking at?

Yes there was: a system that would meet the needs of music lovers who want big, full-range sound from even smaller enclosures. Such systems are available from specialist hifi dealers — at a price — but they are not represented, to any extent, on the do-it-yourself market. Perhaps it's not surprising.

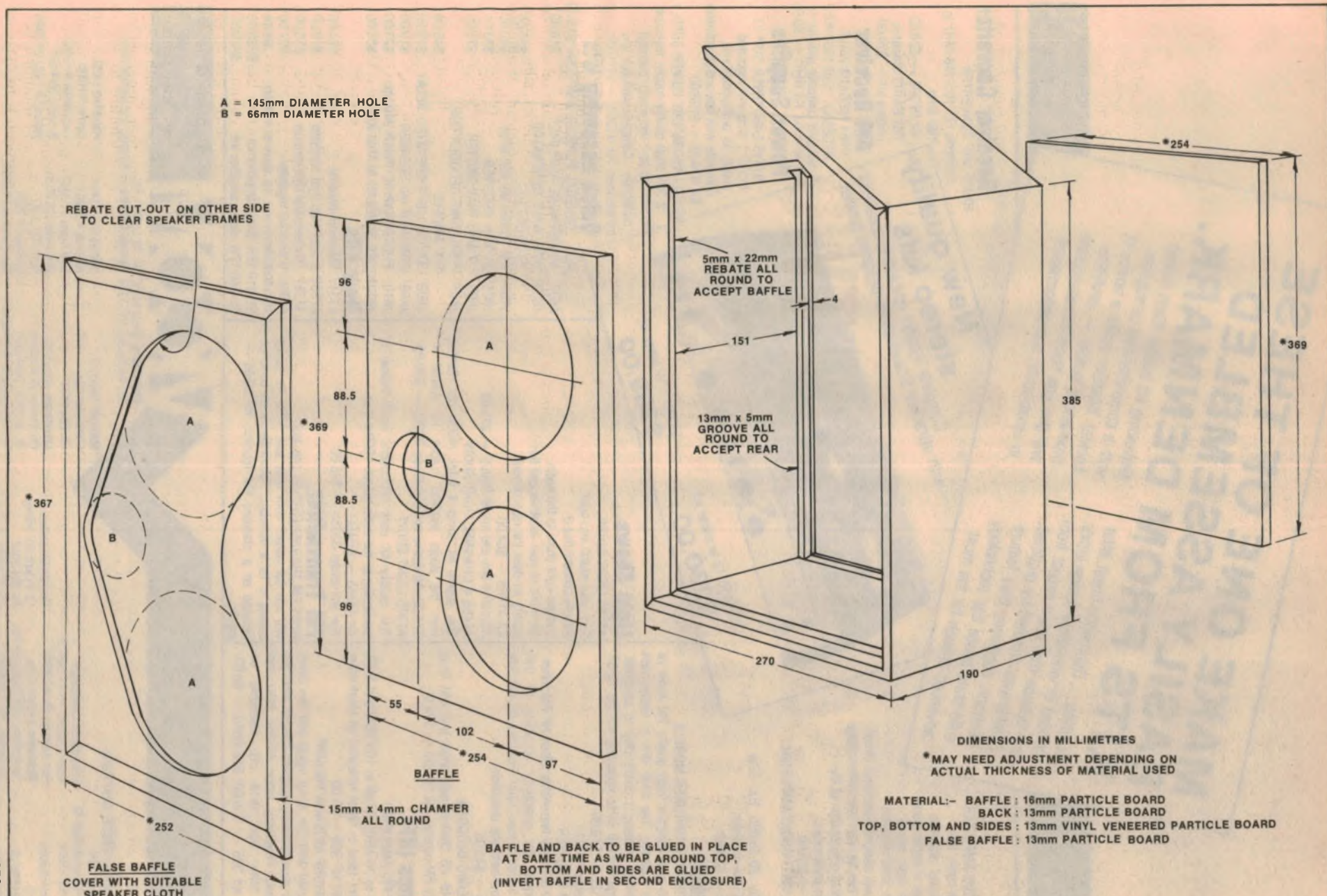
The fact is that there is far more to producing a full-range compact system than merely scaling down a successful large one. The usual result of such an approach is an equivalent scaling down in performance, particularly at the bass end, with a severe reduction in bandwidth and power handling, and a sharp increase in distortion at anything but a very modest level. It can be very disappointing indeed.

If one is to obtain good bass response and a good power handling capability from a compact enclosure, it is essential to treat it as a distinct exercise — and one logically based on work on vented systems done right here in Australia by Thiele and Small. Cutting across decades of guesswork and folklore, the two aforesaid engineers have set down firm relationships between bass driver parameters, enclosure volume, system efficiency and bass roll-off. Results using their methods are predictable and reliable.

Amongst other things, they pointed up the weakness of starting with an off-the-shelf driver and then hopefully trying to devise an enclosure to suit it. Failure to understand the attendant problems, in past years, has largely been responsible for vented systems being dubbed "boom boxes".

They needn't be and shouldn't be!

The proper approach is to make an



PLAYMASTER 3-13L LOUDSPEAKER SYSTEM

FIG. 1

1/SE/-

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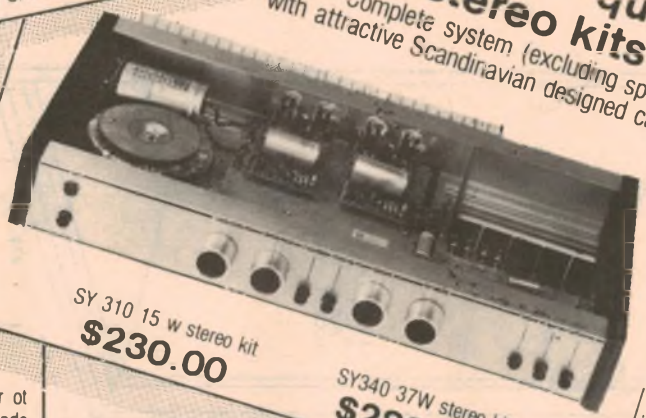

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initial decision about the desired bass roll-off and the permissible enclosure size, and then to work forward to the type of driver that will be necessary to complement the stated requirements. If the driver parameters turn out to be impractical for one reason or another, you modify the requirements and try again.

And that is where we started with Etone engineer Nick Kay. Knowing that many commercial compact systems roll off around 80Hz, we suggested that the "corner" frequency (-3dB) should be at 50Hz or below. This should ensure good, foundational bass, particularly as the system would be further assisted, in a listening situation, by the proximity of walls, etc.

As a further requirement, we wanted an enclosure considerably smaller than for the existing 3-26L, and certainly well below 20 litres. We would accept the Thiele/Small dictum that acoustic efficiency would have to be sacrificed to reconcile small size and extended bandwidth. After all, we were after a special-purpose system and if it needed a few more watts to drive it, that should not be too great a problem these days.

Etone's first response was an on-paper design which involved a specially made 6-inch woofer and a matching enclosure having a large port formed by a partial shelf across the lower end. We didn't like it very much, partly because of the volume added by the port, and partly because it would not lend iself to simple fold-around enclosure assembly. Why not a conventional port tube, of more modest dimensions?

Unfortunately, that seemed not to meet the requirements of the Thiele/Small formulas, relative to the driver/enclosure combination envisaged.

Out of the seeming impasse came the suggestion to use a passive radiator instead. In essence, this usually involves the housing and cone of a woofer, minus magnet and voice coil, mounted in a second hole in the baffle. It serves the purpose of a vent or port, except that the mass and springiness of a physical cone assembly substitutes for that of the air within a port.

We liked the idea immediately. It would conserve space, allow a simple cabinet structure to be retained, and offer the visual advantage of an extra (and very active) cone. And this is what we settled for, after the appropriate amount of calculation and experiment. The bass driver would be a specially designed unit, to be designated Etone type 608; it would be mated with a passive radiator type 600 and accommodated in an enclosure with a volume in the range 13 to 14 litres — half the size of the 3-26L! Estimated corner frequency would be 50Hz, as originally envisaged.

Although illustrating a somewhat larger enclosure, the diagram emphasises the extreme simplicity of the fold-around method of construction.

So much the bass end.

Consideration of the 608 cone assembly suggested that it should not be expected to perform too high up and a crossover at about 1500Hz was indicated — meaning that the tweeter had to operate down to at least this region. This tended to rule out the usual dome tweeter, unless we were prepared to specify an accurate high-slope filter or trap to counter possible tweeter resonance around 800-1000Hz.

Rather than get involved in an exercise that would have added markedly to the cost of a stereo pair, we settled for an Etone cone tweeter type NT2FS and a straightforward crossover network giving a nominal 6db/octave roll-off for the woofer and a nominal 12dB/octave roll-off for the tweeter.

When the units were actually interconnected, it became immediately obvious that the output from the tweeter would have to be reduced drastically to match that of the woofer. In fact, it is fed from the active line through 6.8 ohms and shunted by 2.7 ohms, giving a loss of about 13dB.

Even allowing that the tweeter may be more than usually sensitive, the figure does indicate the kind of sacrifice that must be made in woofer sensitivity, in the interest of bigger bass from smaller enclosures. The fact is that most modern enclosures trade sensitivity for bass response, on the grounds that adequate drive power is available from modern solid-state hifi amplifiers.

What does this mean in practice?

In a typical,not-too-noisy home situation, a pair of 3-13L enclosures will provide adequate, even loud volume when driven by an amplifier delivering a genuine 20 + 20 watts on program material.

If you want to "show off" a bit and/or turn up the bass a notch or two, then a twin-40W or a twin-50W rating would be more appropriate. In fact, it should meet all ordinary requirements for domestic listening.

But for the "big" sound we spoke about earlier, go for an amplifier in the twin-70W to twin-80W grouping. That would be about their limit, running with the bass and treble controls set for "level". With drive of this order, compact systems like the 3-13L will not cope with artificially boosted bass — nor will they cope with spurious cone excursions caused by turntable rumble or eccentric grooves.

What if you don't have even a 20+20W amplifier? Well, the options are fairly straightforward:

- Build the 3-13L and settle for wide-range listening at a very modest level;
- Search out a compact loudspeaker system that emphasises sensitivity rather than bass response. Drivers in low-cost radiograms usually exhibit this approach.

Circuit details of the crossover network. The capacitors shown are non-polarised electrolytics. Note speaker polarity, involving a plus sign or a red dot.

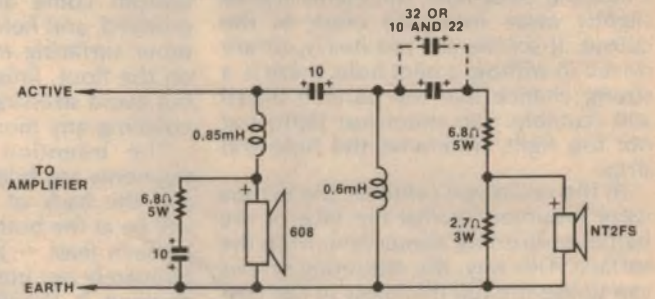


FIG. 2

- Settle for a larger loudspeaker system which may well combine adequate bass with higher sensitivity. The Playmaster 3-26L, for example, offers 3dB higher sensitivity, equivalent to a 2:1 increase in amplifier power output. The 3-53L and the 3-75L are somewhat more sensitive again.

The prototype enclosures which appear in the lead photograph were produced for us by H.S.C. Timber Industries Pty Ltd, of 25 Pritchard Place, Peakhurst, NSW 2210. (Phone 02 534 1746). They have a simulated wood finish, a black lacquered baffle face and a removeable grille of black open weave fabric stretched over a particle board frame.

The dimensions shown in the drawing of Fig. 1 were taken off the

prototypes and should be representative, in that they were selected by a cabinet manufacturer to ensure economical use of particle board sheets.

We envisage, however, that 3-13L enclosures will be handled by various suppliers throughout Australia and New Zealand, in both kit form and built up. They will doubtless be produced by various cabinet makers, with their own ideas about details and finishes. We would not want to prejudice their discretion but certain points must be stressed:

- Panel sizes may be varied slightly to suit available materials but the internal volume of the enclosure must not be reduced below the 13.2 litres provided for in our drawing. Equally, it should not exceed 14 litres.
- Materials should not be lighter than specified. The construction must be rigid, airtight and rattle-free, with the drivers held snugly and securely against the baffle face.
- The drivers, passive radiator and crossover network must be as specified.

And here a further word about the loudspeaker mounting arrangements:

Assuming the baffle is of particle board, use screws which are of no heavier gauge than necessary, and drill a suitable pilot hole for them, angled slightly away from the edge of the cutout. If screws are too heavy, or are driven in without a pilot hole, there is a strong chance that the particle board will crumble. Nip them just tight, but not too tight, otherwise the hole will strip.

In the prototype cabinets, the drivers were mounted against the face of the baffle, protruding about 5mm from the surface. This way, the mounting screws can utilise the full thickness of the particle board to hold the drivers firmly in place. However, it does mean that a frame grille must be used to keep the cloth clear of the cones.

Alternatively, some manufacturers may choose to recess the baffle to accommodate the drivers flush with the surface. This permits the use of a foam grille but it can also reduce drastically the thickness of material available to the mounting screws. In such a case, it may be desirable to mount at least the main driver with bolts and nuts, using access through the passive radiator hole to secure them. Better still, cement nuts on the rear side of the baffle, so that bolts can be used for all three.

However mounted, it is absolutely essential to provide some kind of a gasket between the speaker frames and the baffle surface to ensure a continuous airtight seal. Air leaks produce a dissipative energy loss, which can defeat the whole function of the passive radiator. No matter how good it looks, surface/surface contact between drivers and baffle is not reliable.

Plan ahead so that the join will be out of sight when each cabinet is placed in position on a shelf.

As on past occasions, we used Engels 5C adhesive-backed foam strip, sold by hardware merchants as a draught excluder. Alternatives are adhesive backed felt, or resort to non-hardening caulking compound, or a liquid silicone rubber.

Such details aside, it is likely that all kits will be presented and assembled in much the same way. The sides, top and bottom come already cut and pregrooved, and held together only by the other surfacing material. Lay them flat on the floor, finished side downwards, but avoid stressing or flexing the outer covering any more than necessary.

The intention is that, when the segments are folded around the baffle and the back of the cabinet, the join will be at the bottom — or where it will be seen least — when the enclosure is ultimately put into use. That is why our drawing is shown upside-down, with the bottom flap yet to be closed.

If the enclosure is to be used in an upright position, plan to have the main driver at the top and the tweeters to the outside (in the case of a mirror pair) so as to gain as much separation as possible. If to be used on its side, have the tweeter towards the top and the main drivers to the outside. On this basis, plan how the baffle and back are to fit.

We would recommend that most of the inside surfaces of the enclosure be padded with ordinary Innerbond, of nominal thickness about 2cm. A piece measuring 1m x 0.5m cut into strips 1m x 45cm, would just about cover the sides, top and bottom of each enclosure, with a couple of strips left over to attach to the back, clear of where the divider network will sit.

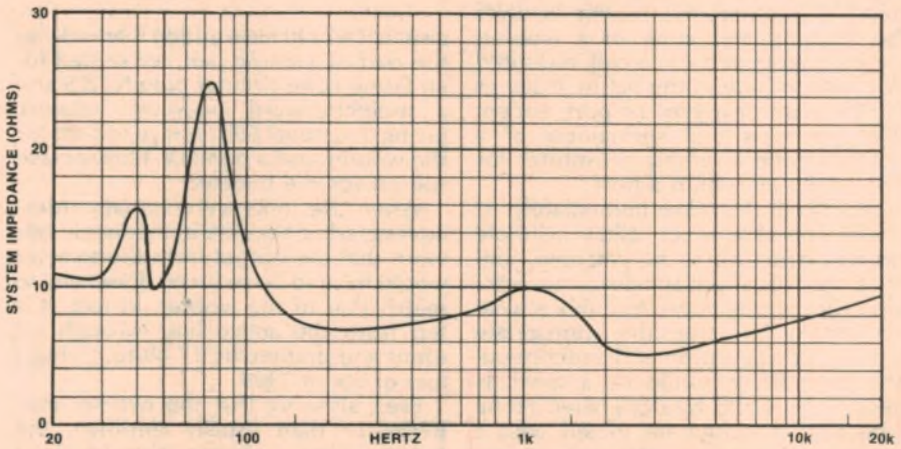
Attach the Innerbond securely to the relevant surfaces with thumb-tacks before the enclosure is folded up. It must not be stuffed into the box as an afterthought, as it would then become space filling.

When all is ready, run PVC glue ("Aquadhere" etc) into all V-grooves and slots and smear it to wet all the mating surfaces. Also wet the edges of the baffle and back plate. Slip them lightly into position and carefully fold the sides and bottom up around them, bumping them into position with the ball of the hand. With the final joint firmly closed, hold it tight with straps of adhesive tape and leave overnight.

Before proceeding further, carefully examine the enclosures to ensure that the glue has filled and sealed all corners and joints. If you detect a possible leak, prop up the cabinet as necessary, run glue into the space and leave to harden long enough to ensure that it will stay put.

Also check the output terminal arrangement. Provide a gasket if a plate or fitting is involved and seal any other possible leaks with caulking.

This done, the crossover network can be attached to the inside rear of the cabinet, working through the aperture for the passive radiator. Attach the leads to the respective drivers, and to



The impedance V frequency curve of the 3-13L. It falls below the nominal 8 ohm figure in some areas but not enough to be unusual. Note the double-hump centred around 50Hz — characteristic of a vented (or passive radiator) system.

the output terminals, making sure to observe polarities, as marked. Then screw the drivers and passive radiators into place, and the job is done.

As an alternative to the above, the enclosures could be hand-made using particle board, cleats, pins and glue. Use the diagram as a general guide to dimensions but make due allowance for the volume occupied by internal cleats.

Finally, a few words about the crossover network, originally designed by Etone and subsequently adapted for the 3-13L system. The circuit is shown in Fig. 2.

The woofer is fed through a simple 0.85mH inductor intended to produce a

The prototype crossover network, assembled on a disc of particle board. The 10uF polystyrene capacitor in the foreground would normally be an electrolytic.

roll-off through -3dB at 1500Hz. To make the woofer look like an 8-ohm resistor and secure the desired roll-off, an R/C network is shunted across it, as shown.

The network feeding the tweeter is more complex, being designed to give a 12dB/octave roll-off below the crossover, while also reducing the effective tweeter output. The resistor ratings may seem modest, in the light of the drive power figures mentioned earlier, but past experience with domestic speakers indicates that they should be adequate for program type signals.

Normally, the divider networks will come as part of the loudspeaker kit package but, if you have a special reason to do so, it should be practical to build your own. The inductors could be wound on a non-metallic bobbin made up from a scrap of broom handle (25mm dia, 20mm long) fitted with two cheeks (50mm dia) made from plywood or Masonite. For 0.85mH wind on 189 turns of 18B&S gauge wire or 19SWG enamelled wire. For 0.6mH, you will need 152 turns of the same gauge.

THE COST

At the time of writing, the 3-13L has not been costed by kit suppliers. However, it seems likely that the price for complete system kits will be in the region of $150-$170 per pair.

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with dwell extension and full protection!

Electronic ignition is in but CDI systems are out. Our new transistor-assisted ignition system with dwell-extension has all the advantages of CDI without the disadvantages. Our new circuit results in a hotter spark at high engine speeds and is directly compatible with electronic tachometers.

by LEO SIMPSON and RON DE JONG

Some four and a half years ago in July 1975 we published the circuit of a Capacitor Discharge Ignition system which has proved extremely popular and with the recent surge in petrol prices is selling more strongly than ever in kit form. However, even back in 1975 and even prior to that we were unhappy about some aspects of CDI.

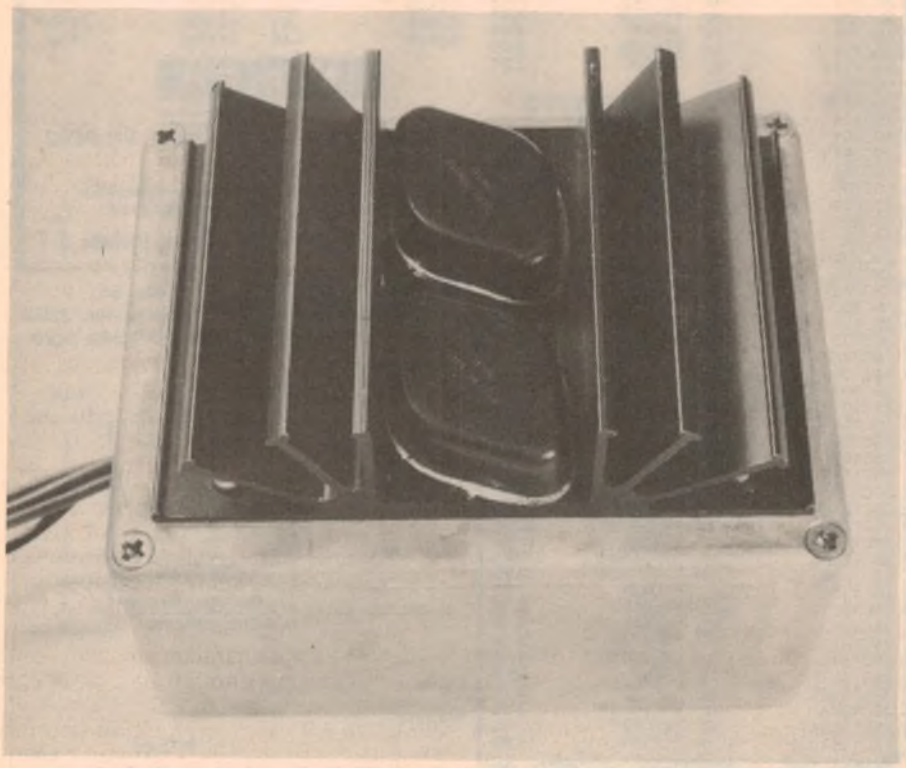
Now, in December 1979, the time has come to close the book on CDI systems and present a viable and appealing alternative — a transistor assisted ignition system with dwell extension. But let us state that while this new circuit is more satisfactory in every respect than CDI systems, it and other automotive add-ons are not the ultimate answer to obtaining best economy, performance and minimum pollution from car engines.

The ultimate answer, as far as the petrol engine is concerned, will undoubtedly involve some sort of microprocessor circuitry (which will have the high falutin' term of "on-board computer") controlling a breakerless electronic ignition system together with fuel injection. That answer is probably a few years off yet, so let us revert to the present.

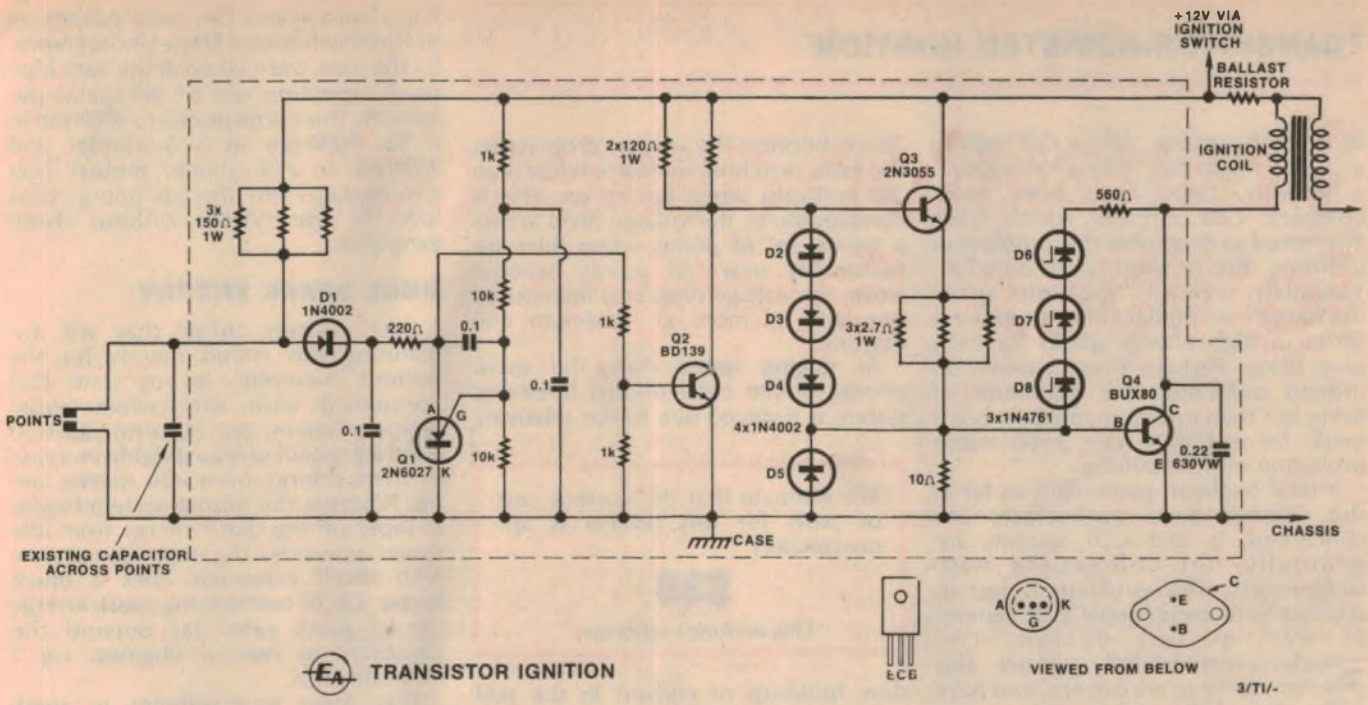
Well, why is Capacitor Discharge Ignition now "beyond the pale"? The first problem regards reliability of the circuit itself. It seems that, even now, some people are troubled with malfunction of the circuit we published back in July 1975 (File No 3/TI/12). It is not possible for us to judge whether these few cases are due to poor assembly, normal component failures or a fault in the original design. But, for the record, some constructors have had trouble.

Apart from reliability of the circuit itself, the most severe problem with CDI systems is " crossfire". For those not familiar with this phenomenon, crossfire is the result of the higher energy and very fast rise-time of CDI systems combined with the normal stray capacitance and leakage resistance across the distributor cap and between spark plug leads.

Every time a designated spark plug fires there is the possibility of a weak spark occuring in other cylinders due to the high energy available from the coil. The engine behaviour when crossfiring is occuring can range from slight "pinking" behaviour to very rough running, particularly when accelerating or lugging up hills.



Looks are unimportant, utility is the name of the game. That hefty heatsink helps dissipate the heat generated by the constant current source, Q3.



HOW THE CIRCUIT WORKS:

The heart of the circuit is the BUX80 which is a rugged transistor rated at 10 amps with a collector emitter voltage rating of 800 volts and maximum power dissipation of 100 watts. It is intended for use in converters, inverters, switching regulators and motor control systems. The BUX80, Q4, does the arduous job of switching the coil current. It is protected against excessive voltages by a 0.22uF capacitor and by a string of 75V zener diodes and a 560 ohm limiting resistor between base and collector. Q4 is switched on and off by Q3 which, together with a diode string D2,3 and 4 and its three paralleled 2.7 ohm emitter resistors, is set up as a constant-current source at 1.3 amps. The base of Q4 is driven at this relatively high current to ensure that its saturation voltage is 300 millivolts or less.

Constant-current source Q3 is turned on and off by Q2 which, in turn, is controlled by the points. Ignore Q1, for the moment, as it does not control the primary switching function but provides the dwell extension feature.

Three 150 ohm resistors in parallel provide a current "wetting" through the points to keep them clean in the fume-laden atmosphere inside the distributor cap. Assume, at the beginning, that the points are closed. This means that Q2 is held "off" and so Q3 and Q4 are "on" and current is passing through the coil.

Now the points open and Q2 is turned on by base current via the three paralleled 150 ohm resistors, D1 and series 220 ohm and 1k resistors. Q2 then turns off Q3 and Q4 which interrupts the coil current and develops a high voltage across the coil primary. And so on. Diode D1 and associated 0.1uF capacitor form a "points debounce" circuit to prevent erratic triggering.

In the normal course of events, the points will eventually close again, so that D1 ceases to be forward-biased, turning Q2 off and Q3, Q4 on again to recommence the cycle. But Q1 modifies that cycle by turning Q2 off 0.6 milliseconds after the points open. Q1 is, in fact, a programmable unijunction transistor (or anode gate SCR) which works in the following way.

When the points are closed, the anode of the PUT (programmable unijunction transistor) is held close to zero while its gate is held at a little less than half the supply voltage. When the points open, the anode will be lifted up to almost the full battery voltage while the gate, by virtue of the 0.1uF capacitor tied between gate and anode, will be forced up to about 1.5 times the battery voltage.

This 0.1uF capacitor then discharges via the voltage divider made up of two 10k resistors and a 1k resistor. When the capacitor is discharged to the point where the gate voltage is 0.6 volts less than the anode voltage, the PUT triggers on and removes the forward bias from Q2. Q1 stays in the latched condition until the points close again.

So the PUT enables transistors Q3 and Q4 to turn on much sooner than they otherwise could if controlled directly by the points.

The only remaining components requiring comment are the diode D5 and the parallel 10 ohm resistor. The resistor effectively ties the base of Q4 to its emitter and thus improves its abilities to withstand high voltage. D5 protects the base-emitter junction against reverse biasing.

Excessive crossfiring can result in bearing damage and even the collapse of piston crowns. And contrary to what many CDI fans believe, crossfiring is not only a problem in V8 engines but can also effect six and even four-cylinder engines.

It is possible to minimise the effects of crossfiring by carefully spacing the spark plug leads but with many engines this may lead to only a modest improvement. After all, crossfiring can be a problem with V8 motors using just the standard ignition system. So CDI can really cause havoc with these motors.

Another problem with CDI is involved with erratic firing of lean mixtures. Later model cars which conform to ADR27A often have very lean fuel-to-air mixtures which are more likely to result in misfiring with CDI. This is because of the very short spark duration with CDI. If there is not an optimum fuel/air mixture swirling in the vicinity of the spark plug gap at the time of the spark then a misfire will occur.

This misfiring characteristic with lean mixtures can be enough of a problem in later model cars using just the conventional Kettering ignition system. They are often hard to start and rough

in normal running. Add a CDI system and they might run "like a hairy goat".

Recently, there have been more complex CDI circuits which have attempted to overcome this problem of misfiring due to short spark duration. Variously termed "multiple spark discharge" or similar, they produce a series of high energy sparks for each plug firing. Perhaps these systems do indeed overcome the problems of firing less than optimum mixtures but it could be that they have even worse problems with crossfiring.

A final bugbear, particularly as far as the keener auto enthusiasts are concerned, is that CDI systems are generally not compatible with tachometers. This problem is just as applicable to commercial CDI systems as well as our design. The manufacturers blithely ignore this problem, as far as we can see, and have even referred dissatisfied customers to our magazine for a suitable preamplifier circuit to enable the tachometer to be used. For the record, we have not published such a circuit.

CDI does have a place but not with the four-stroke engine. They are more applicable to magneto-based ignition systems as used on two-stroke motors for lawnmowers, motorcycles and outboard motors. There, the ability of capacitor-discharge ignition to fire fouled plugs is a significant feature and crossfiring is not a problem.

Our new transistor-assisted ignition system offers significant advantages over the conventional Kettering system and our previous transistor system described in August 1975 (3/TI/13). For a start, as with other electronic systems, it relieves the points of the heavy burden of coil current switching while still passing enough current through them to keep them clean.

This means that once the system is initially set up it will not be necessary to readjust the system until wear of the rubbing block becomes significant. In practice, this means that every 15,000 kilometres or so, the points should be regapped and the timing readjusted. So, in essence, the car will stay at peak tune for much longer periods than would otherwise be the case and long term economy will be improved.

Starting performance of the new transistor assisted ignition system can be expected to be on a par with a freshly tuned Kettering system. However, in the conventional Kettering system starting performance normally deteriorates as the points become worn, so as time goes on, the transistor system is superior.

At low engine speeds, the spark energy of the transistor system will be comparable with a freshly tuned Kettering system with new points fitted. This is because the voltage drop across the main switching transistor is less than 300 millivolts when turned on. This is comparable to the voltage drop across a typical set of points when they are reasonably new. As points become worn, the voltage drop may increase to one volt or more at maximum coil current.

As engine speed rises, the spark energy of the conventional Kettering system is reduced due to the relatively slow build-up of current in the coil primary. Our transistor-assisted system maintains spark energy at a high level even up to very high engine speeds by using "dwell extension".

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

$35

This includes sales tax.

DWELL EXTENSION

The term "dwell" refers to the time the points are closed and is measured in terms of degrees of distributor camshaft rotation. Our circuit provides for dwell extension by switching on the coil 0.6 milliseconds after the points open. This means that we have artificially determined spark duration at 0.6 milliseconds.

By comparison, the typical spark duration of a capacitor-discharge ignition system is about 0.2 milliseconds.

The photographs of the oscilloscope waveforms shows the performance of the system. The first photograph shows the coil waveform without dwell extension.

At the instant of points opening the coil voltage rises very quickly until the spark discharge occurs, at which the voltage falls to a relatively low level while the coil secondary resonates with its distributed capacitance at about 10 to 15kHz. When the spark is extinguished, the remaining coil energy is dissipated by resonance in the primary circuit at a much lower frequency.

In practice then, the spark lasts for less than one millisecond. Our circuit takes advantage of this fact by fixing the spark duration at 0.6 milliseconds. In the second oscilloscope photograph, the effect of the dwell extension can be seen. Since the main coil transistor is turned on again 0.6 milliseconds (approximately) after the points open, there is no time for the low frequency coil primary resonance to occur.

But notice that the amplitude of the coil primary voltage is much increased. This clearly shows the useful advantage of dwell extension. These photographs, by the way, were taken at the very high spark repetition rate of 300 sparks per second. This corresponds to 4500rpm in a V8, 6000rpm in a 6-cylinder and 9000rpm in a 4-cylinder motor! That also explains why the coil energy is so low for the system without dwell extension.

MORE SPARK ENERGY

Lest readers think that we are featuring this circuit merely for the hotfoot fraternity, let us state that compared with the conventional ignition system, our transistor assisted ignition system gives a useable increase in spark energy from idle speeds and up. Whereas the normal system begins to taper off the spark energy from idle speed upwards, the transistor system with dwell extension does a much better job of maintaining spark energy up to spark rates far beyond the capability of normal engines. Fig 1 illustrates this.

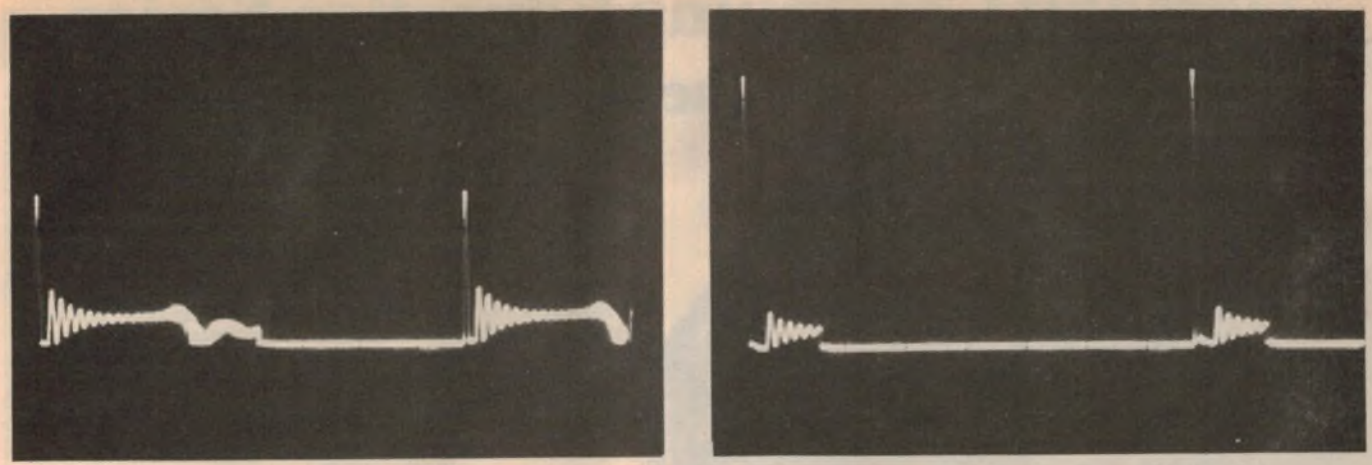
This great improvement in spark energy comes about in two ways. Consider the fact that a normal coil and ballast resistor system takes about 15 milliseconds for the current to rise to saturation (and thus provide maximum spark energy). Since in a 6-cylinder motor the points points provide an approximate 50% duty cycle, this means that if sparks are required less than 30 milliseconds apart, the coil current will not reach saturation level. And a 30 millisecond period coincides with a spark rate of only 33 sparks/second or only 667rpm for a 6-cylinder motor.

COIL NOT FULLY DISCHARGED

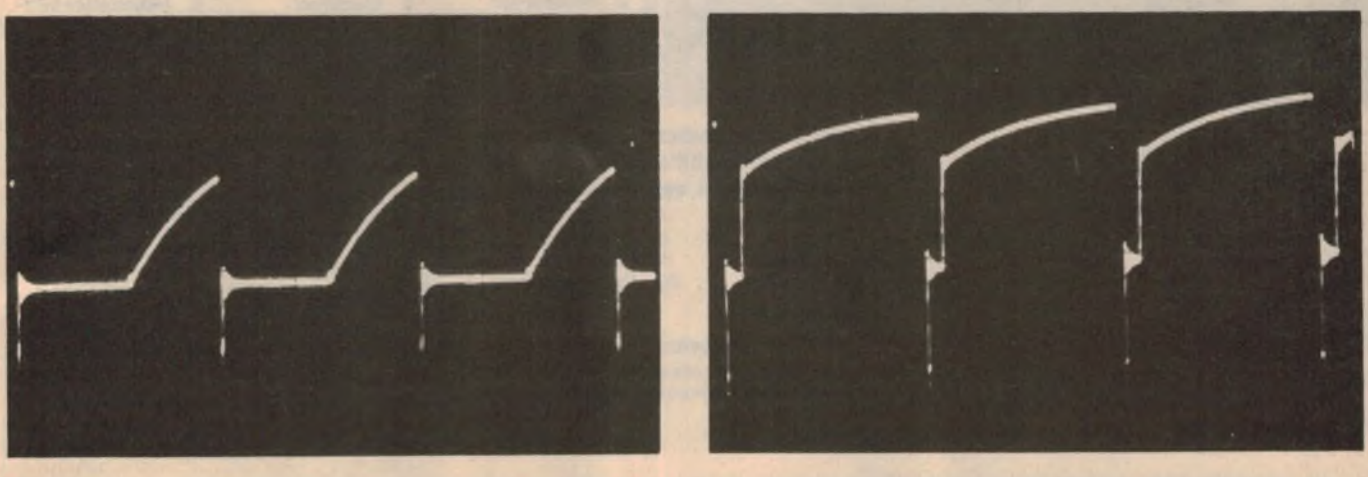
The main reason for the improvement is not so much the extra time for the coil current to build up but the fact that the coil transistor is turned on before the spark extinguishes naturally and primary coil resonance occurs. The fact is that when the coil transistor is turned on again the coil energy has not been fully dissipated. In fact, after the spark extinguishes there is considerable energy remaining in the coil which is usually dissipated in useless primary resonance.

One benefit of a high energy transistor ignition system which has not so far been mentioned is its ability to refire a spark plug after the spark has been blown out by a turbulent mixture. So not only does this system have an advantage over CDI with longer spark duration but it is also able to re-ignite a spark that is blown out (provided it all happens within 0.6 milliseconds).

Other features of this transistor assisted circuit are comprehensive protection of both the ignition system components and the electronic circuitry itself and the ability to drive a standard tachometer without any modifications.



These two photos show the coil primary voltage from the circuit without (left) and with dwell extension. Cro settings: 50v/div and 0.5ms/div.



These two photos show the coil current without (left) and with dwell extension. Cro settings: 2 amps/div and 2ms/div.

Is there a catch to all this? Are there no disadvantages of this new transistor ignition system compared with conventional or CDI systems? Well there are a few side-effects of the new system but you could hardly class them as major drawbacks.

For example, because of the dwell extension feature, the coil is maintained in saturation for a much higher proportion of its operating time. So the average current passing through the coil is about 80% higher. Or, to put it another way, the coil current is increased from about 2.5 to 4.5 amps.

In addition, the transistor drive circuitry draws about 1.5 amps so the total current drain of the transistor-assisted system is around six amps versus 2.5 amps for the conventional system.

The extra current drain is unlikely to pose much of a problem for the car electrical system but the extra coil current does mean that the coil runs hotter. This should not be a problem for the oil-filled coils on modern cars. Even so, the coil should ideally be placed so that it receives some of the cooling air from the fan.

On the plus side, because of the comprehensive protection features of the circuit, the transistor assisted system is unlikely to cause catastrophic failure due to voltage breakdown which can occur with CDI systems.

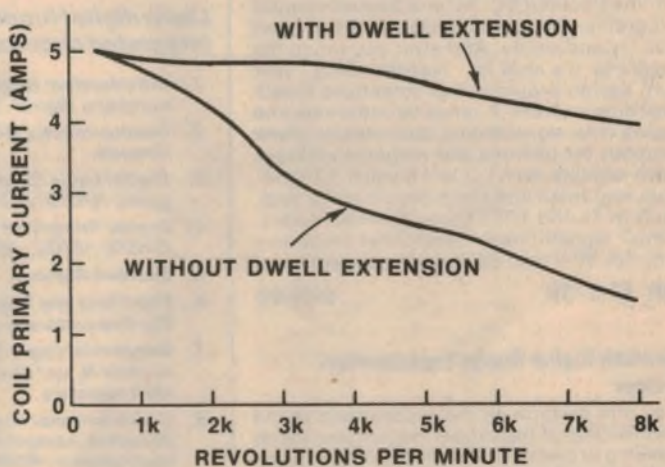


Fig 1 (left). This shows how the dwell extension feature maintains coil current and, therefore, spark energy up to very high engine speeds (in this case, for a 6-cylinder motor).

As far as most enthusiasts are concerned, the only drawback of our new transistor-assisted ignition system is the necessity to gain access to the battery side of the ballast resistor. This can be difficult on cars which have the ballast resistor incorporated into the wiring harness, as on Holden cars, for example. More about this later.

Well that explains some of the thinking behind this new transistor-assisted ignition system. You can refer to the section on circuit description to find out the details of operation. It is a fairly complicated circuit but it should be reliable as all components are operated well within their ratings and are able to sustain high temperatures.

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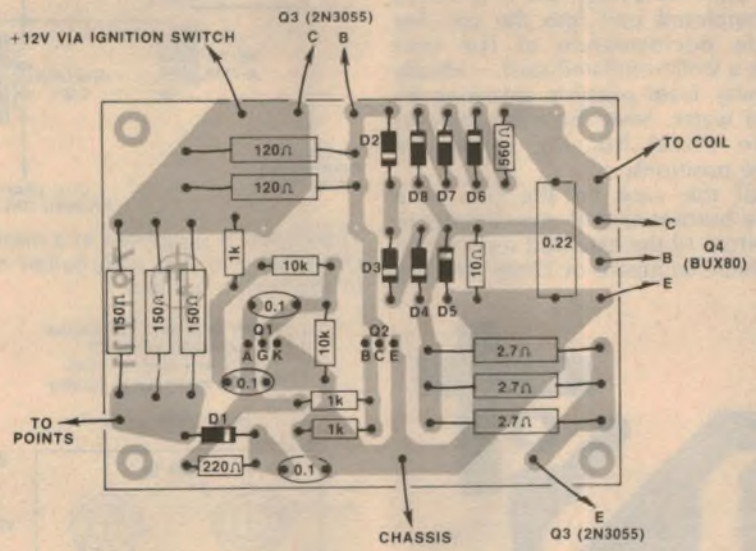
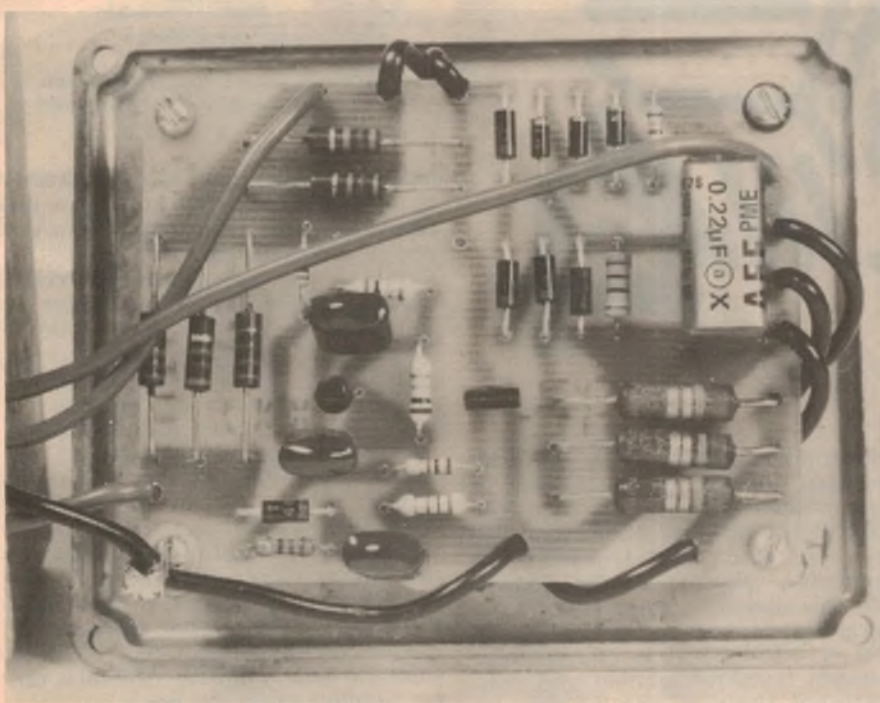
TRANSISTOR-ASSISTED IGNITION



The 150-ohm, 120-ohm and 2.7-ohm resistors are all 1W units; the 0.22uF capacitor across the BUX80 (Q4) should be rated at 630VDC or 250VAC.



CONSTRUCTION

The entire transistor ignition circuit is housed in a rugged diecast aluminium box. We used an Eddystone box measuring 93 x 56 x 119mm; but any diecast box which can comfortably accommodate the PC board and power transistor heatsink would be suitable. All the components except for the power transistors are mounted on a small PC board measuring 91mm x 68mm and coded 79TI11.

The two power transistors are mounted on the lid of the diecast box together with a suitable heatsink. The heatsink we have used is available from Dick Smith Electronics. Actually almost any heatsink which can accommodate two TO-3 devices is suitable provided it can fit comfortably on the lid of the diecast box and has a reasonable thermal resistance; ie a radiating area at least as large as that of the heatsink we have used.

If the heatsink does not come pre-drilled you should first drill it using a TO-3 mica washer as a template. After drilling, remove any burrs by using a large diameter drill. Next, position the heatsink on the lid of the diecast box in such a way that it does not interfere with the lid-securing screws and then punch suitable drill centres in the lid and drill and deburr the holes in the previous manner.

With the heatsink free of any metal shavings or other grit, a thin layer of thermal conducting compound or silicone grease can be applied in the area underneath the transistors and on the mica washer. Some heatsink compounds may contain beryllium, a highly toxic substance, so apply the compound carefully with a cotton bud and avoid skin contact with it. Mount the transistors with the mica insulating washers and plastic bushes in position and then check that the case of both transistors is insulated from the heatsink and lid using a multimeter or other continuity checker.

We used plastic TO-3 transistor covers on both transistors. These are essential both to eliminate the possibility of short circuits and also to isolate the rather high voltages which are present on the case of the BUX80 transistor.

Now the components can be soldered onto the PC board. The only problems which might be encountered here are with the orientation of the

PARTS LIST

1 PC board coded 79TI11, 91mm x 68mm
1 diecast aluminium box, 118 x 93 x 56mm, Eddystone 6908P or similar.
1 dual TO-3 heatsink (see text)
3 metres red 4mm auto cable
1 metre black 4mm auto cable
4 25mm brass standoffs
2 sets of TO-3 mounting hardware, ie. mica washers insulating bushes, screws and nuts.
2 TO-3 transistor insulating caps

SEMICONDUCTORS
1 BUX80 transistor
1 2N3055 transistor
1 BD139 transistor
1 2N6027 PUT
5 1N4002 diodes
3 1N4761 75V zener diodes

CAPACITORS
1 0.22uF 630VW or 250VAC
3 0.1uF metalised polyester (greencap)

RESISTORS (½W or ¼W)
2 x 10k, 3 x 1k, 1 x 560 ohm, 1 x 220 ohm, 1 x 10 ohm, 3 x 150 ohm (1W), 2 x 120 ohm (1W), 3 x 2.7 ohm (1W).

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.

diodes, the PUT and BD140 transistor, so pay special attention to the wiring diagram. Note that parallel combinations of 1 watt resistors have been used in some cases. This was done because they are cheaper than equivalent 5 watt wirewound resistors and their surface temperature rise is not as great. Even so the 1 watt types can still become quite hot so mount them slightly off the board to avoid the possibility of charring the PCB.

Wires to the transistors and to the various external connections are heavy gauge 4mm auto cable. This won't fit easily into a standard PC hole so we suggest that you could either redrill the holes to an appropriate size or use PC stakes. If PC stakes are used make sure they fit tightly into the PC hole so they can't fall out when a wire is soldered onto them.

Mounting holes for the PC board should now be drilled. The PC board is mounted on the lid using brass or plated standoffs, screws, nuts and shake-proof washers. The holes will pass through both the lid and the heatsink, so ensure that the mounting screws don't interfere with the fins on the heatsink first. Before installing the PCB, wire up the leads to the power transistors. Use one-metre lengths of wire to provide the chassis, points, coil and battery connections to the PCB. When the unit is actually installed these lengths can be trimmed down and suitable lugs or connectors attached. The earth cable is also connected to a lug on one of the standoffs so that the circuit will be earthed via the case as well.

Clamp the cables before they exit from the box using a cable clamp; if necessary build up the cable thickness with insulation tape to give a tight fit. The cable should exit via a grommeted hole at the side of the box.

The only remaining task is to install the completed unit into the car. For reliable performance of the unit choose a well-ventilated spot — ideally well away from possible splashing by mud or water. Near the front grille or on the wheel housing would be suitable positions.

Install the case by the use of a suitable bracket or drill several holes in the bottom of the case and secure it to the vehicle by means of 12mm x No. 10 self-tapping screws. With the unit mounted, the various connections to the car electrical system can be made.

For this purpose we recommend that you use two eyelet/solder-lug assemblies, attached to the ignition coil. This allows the connection of the coil and points leads to be readily made and it allows quick changeover between transistor ignition and conventional ignition should this be necessary. Some systems make use of a slide switch or octal plug to facilitate changeover but poor reliability of these methods led us to opt in favour of the lug assemblies.

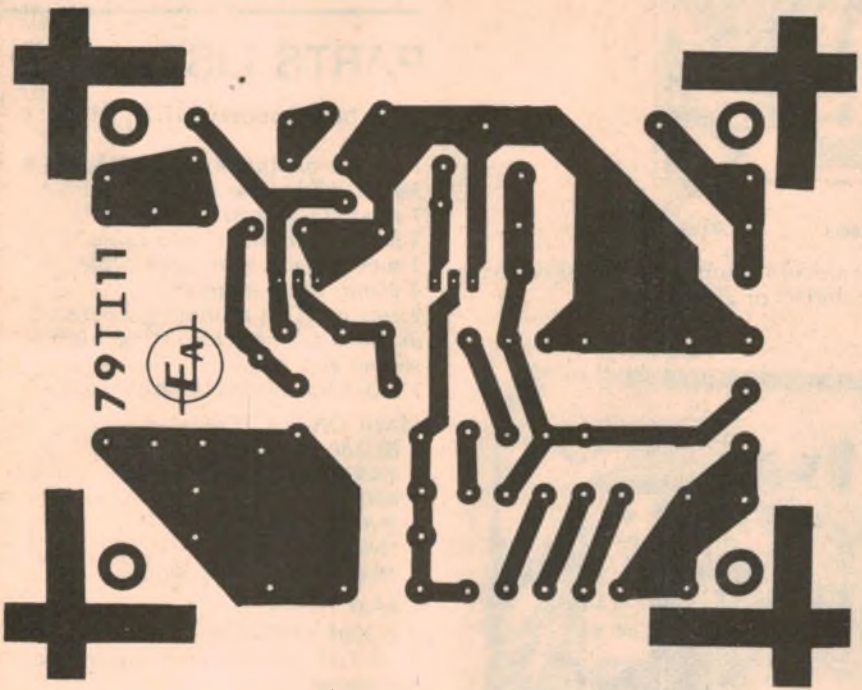
We understand that Watkin Wynne Pty Ltd will be able to make these eyelet assemblies available to parts suppliers. Alternatively, they are available from Dick Smith Electronics.

Apart from the connections to the ignition coil and points it is also necessary to connect the +12 volt lead to the battery via the ignition switch. Some circuit designs actually obtain power via the ballast resistor, which means that the circuit would probably be easier to install but it also has the disadvantage of reducing coil current and so reducing spark energy.

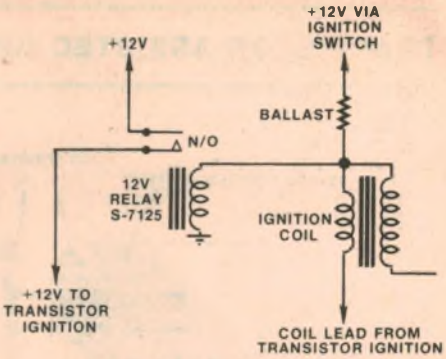
If your car has a separate ballast resistor then it is a simple matter to connect to the ignition switch side of the resistor. Some cars though, use a ballast wire, which complicates the situation because it is then necessary to guide the +12 volt lead from the transistor ignition through an appropriate hold in the firewall to the actual ignition switch itself. Alternatively, if you do not wish to drill through the firewall then you can use the circuit shown elsewhere in this article. It consists simply of a relay connected to the coil side of the ballast resistor which switches the +12 volt from the battery directly. The relay can be installed inside the box.

With installation complete, the system can be tested. The points gap should be set exactly as specified by the car manufacturer. Note that if a "dwell meter" is used to set the points gap, then it is probably best to do this adjustment when the vehicle is running with conventional ignition.

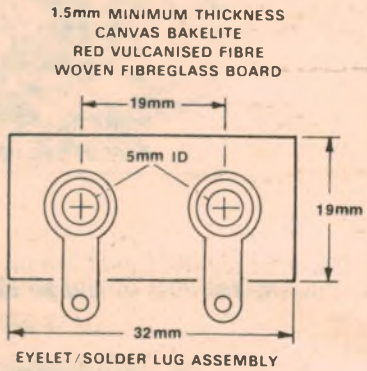
Well, now that all those readers have been disillusioned about CDI, what are they going to do with them? We have thought of that too. The answer is to make use of the inverter in a strobelight for auto tune-ups. Refer to our article on a "Power Timing Light" of February 1976. (File No 7/SC/5).



Actual size artwork for the PCB.



This circuit is suggested as a method of connection in cars with ballast resistor in the wiring harness.



Use two of these lug assemblies to make the connections to the ignition system.

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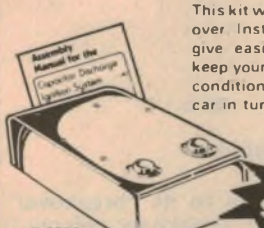

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This kit will pay for itself over and over. Installed in your car, it will give easier starting from cold, keep your points & plugs in better condition thereby keeping your car in tune for a longer time.

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DSE652

Keep your cool on hot summer nights!

Fan Speed Control

slows your electric fan to a gentle breeze

Here is just the thing to help you sleep on these hot, sticky summer nights — a speed control to let you set your electric fan for a gentle breeze which cools and soothes without raising goose-pimples.

by JOHN CLARKE

If adults have a problem sleeping on hot summer nights then young children and babies are even worse off. They really need a fan to avoid heat exhaustion, particularly when trying to sleep during the day. But most fans still blow too hard (and raise the risk of a chill) when set to their lowest speed. And they're often too noisy at this minimum speed so that, even if you can tolerate the draught, the noise of whirring fan blades can keep you awake!

With our speed control you can adjust even the largest domestic fan to give a gentle breeze, at the same time cutting the blade noise to a whisper. Why not get the parts together now so you can start building? You can have it finished in just a few hours.

There is no reason why this speed control needs to be confined to normal domestic oscillating fans though. What about kitchen and bathroom exhaust fans? They could also benefit. Our compact speed control could easily be built into a standard wall box for this application.

For use with domestic fans, you can build the speed control circuit into the base of the fan or make it a separate controller, as we have done.

As it stands, the circuit of our fan speed control looks quite similar to that of a typical light dimmer. But the fan speed control is not really suitable for use as a light dimmer; nor is the typical commercial light dimmer suitable for use as a motor speed control.

Well, how does a phase-controlled circuit such as this control the speed of a shaded-pole induction motor, as used in just about every fan on the market? After all, induction motors are inherently constant-speed motors, aren't they? Or are they really?

Well, induction motors do have a virtually constant speed regardless of load variations and their speed is difficult to control with a simple circuit such as this. But shaded-pole induction motors are in a special class with quite separate characteristics to the normal single-phase induction motor as used in refrigerators and washing machines.

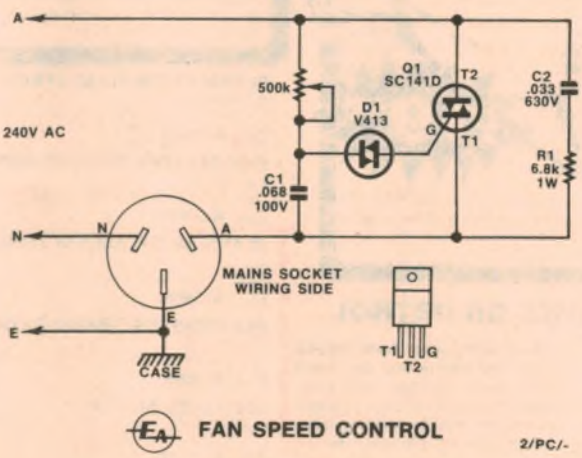
By contrast to the usual induction motor, typical-shaded pole motors, as used in fans, have quite poor load/speed characteristics. In other words, as the load increases the speed reduces. And for a given load, if the input voltage is reduced, the speed is also reduced.

So, by contrast with ordinary induction motors, we can vary the speed of shaded-pole fan motors merely by reducing or increasing the input voltage. This is most simply and efficiently done by a Triac circuit which "chops" the mains AC waveform to reduce the effective voltage.

Fig. 1 illustrates the switching effect of a Triac on the mains waveform. The Triac is connected in series with the load (motor) and is triggered on by pulses from the Diac circuitry. If the Diac pulses arrive late in each mains half-cycle, the Triac feeds a relatively low (effective) voltage to the load. On the other hand, if the Triac is triggered-on earlier in each mains half-cycle, the effective voltage fed to the load is high.

The method altering phase-angle of the Triac firing pulse with respect to the mains waveform is referred to a "phase control". In our circuit, this is achieved with a Diac, V413 (or equivalent) plus an RC circuit consisting of a 500k potentiometer, wired as a variable resistor and the .068uF capacitor, C1.

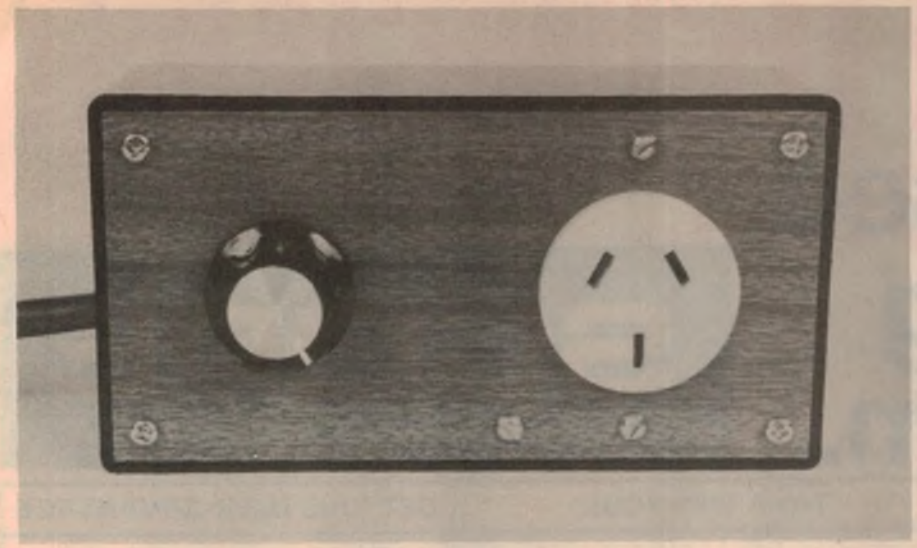
A Diac is a special four-layer device which is designed just to suit this sort of circuit. It is a bidirectional device which is open-circuit up to its "breakover" voltage. When its breakover voltage is exceeded, the Diac breaks down to a low negative resistance.



This simple circuit varies the speed of fan motors.

In our circuit, C1 is charged on each half-cycle from the mains via the 500k pot. When the voltage across C1 exceeds the Diac breakover voltage, D1 delivers a high-current pulse to the gate of the Triac which turns on the Triac and discharges C1.

The Triac remains in the conducting state until the direction of the current through it drops to zero. C1 then begins charging in the opposite direction so that the Triac can be triggered in the next half-cycle. And so the se-



An economical plastic box makes an attractive case for the fan speed control.

quence is repeated. If the pot is set to a low resistance value, C1 is charged quickly and the Triac is fired early in each half-cycle, which thus feeds a relatively high voltage to the load.

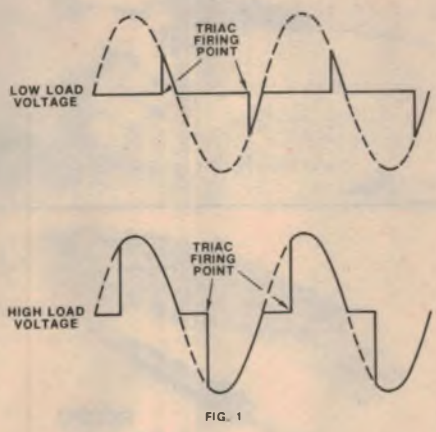
Alternatively, if the pot is set for a higher resistance value, C1 charges slowly and the Triac is fired later in each mains half-cycle, which means a lower voltage is fed to the load.

In practice, there are two limitations on the range of pot settings which can be used with typical domestic fans. The first of these has to do with the starting torque of the motor itself. Because the starting torque of a "shaded pole" motor is quite low even with the full mains voltage applied, a much reduced input voltage may result in the fan not starting at all.

This type of circuit also suffers from the "hysteresis" characteristic which was displayed by early single time-constant light dimmers. In the present circuit, it is possible that this hysteresis may result in the circuit failing to trigger reliably at very low settings. However, the effect is unlikely to be noticed because of the constraint set by the first limitation. In practice, a setting which causes the fan to spin just fast enough to cause a noticeable breeze (by this we mean a gentle breeze rather than a draught) will also be the minimum setting for reliable starting of the motor.

Inductive loads such as fans present a particular problem when controlled by Triac circuitry. Because the current tends to lag the voltage waveform, the Triac turn-off (when the current drops to zero) occurs not at the end of the AC half-cycle but well into the beginning of the next half-cycle. This means that when the Triac turns off, the voltage across it will not be zero but reversed in polarity.

Thus, at turn-off, the voltage across the Triac will rise from near zero at conduction to whatever is the instantaneous value of the mains waveform



These diagrams show how the Triac can vary the speed of the fan.

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

$15

including sales tax.

which may be as high as several hundred volts. This rapid rise in voltage across the Triac may cause it to turn on again in a phenomenon known as "dv/dt switching".

R1 and C2 are incorporated into the circuit to control the rise time of the voltage across the Triac at switch-off and so prevent "dv/dt switching". The values selected for R1 and C2 are adequate for typical fan motors. This RC network is commonly referred to as a "snubber circuit".

We have not included RF suppression components in this circuit. These are necessary in light dimmers because of the very fast rise time of the current waveform at the time of each Triac fir-

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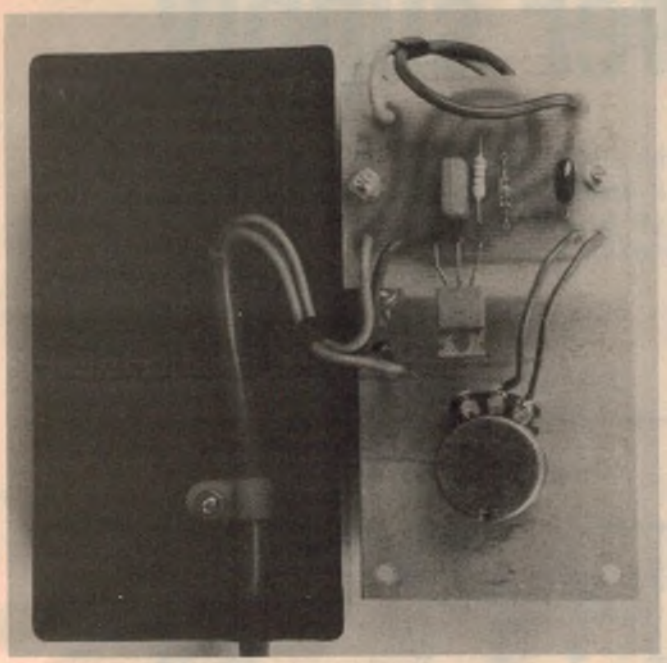
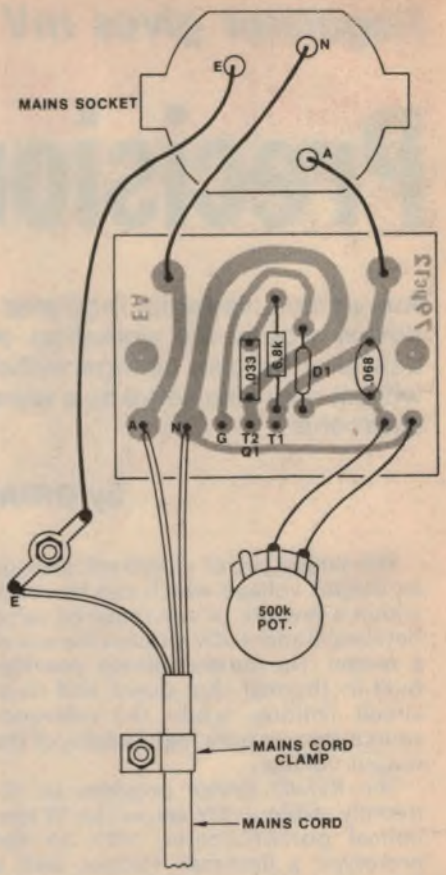
FAN SPEED CONTROL



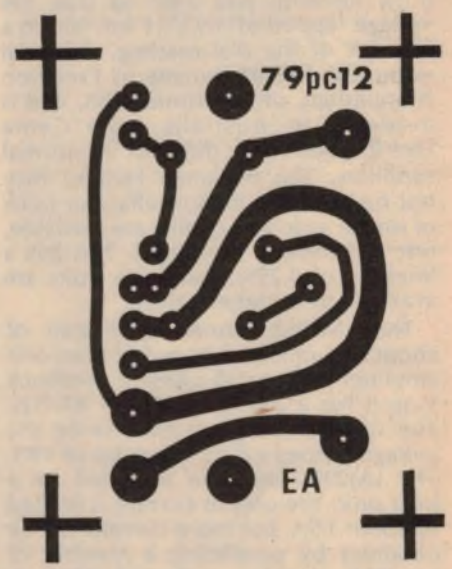
Assembly of this circuit will take only half an hour to have it working. The Triac is wired directly to the PCB. At lower right is the full size artwork of the PCB.



PARTS LIST

1 plastic box 130 x 68 x 41mm
1 three-pin mains plug
1 length 3-core mains cable
1 mains cord clamp
1 grommet
1 panel mount mains socket
1 steel front panel 130 x 68mm
1 PC Board 79pc12
1 knob
1 SC141D Triac
1 V413, BR100 Diac
1 500k (1in) potentiometer
1 6.8k 1W resistor
1 .033uF/630VW or 240VAC polyester capacitor
1 .068uF/100VW polyester capacitor

MISCELLANEOUS:
solder lug, connecting wire, screws and nuts, lockwashers, spacers for PCB, solder.



ing point. However, the inductance of typical fan motors inhibits this fast rise time, making RF suppression components less important.

So the complete circuit comprises just six components, two active and four passive. Which means that it is a simple task to put together.

Our version was made up in a plastic utility box measuring 130 x 68 x 41mm. These boxes are supplied with a light-gauge aluminium lid but this is too flimsy to accommodate a flush-mounting three-pin mains socket. Accordingly, a stiffer lid made of Marviplate steel or thicker aluminium should be made up to replace it.

The circuitry is accommodated on a small PC board measuring 61 x 46mm (coded 79pc12) which is mounted on the back of the mains socket using long mounting screws.

Before mounting this PCB, install the five components on it. The Diac can be installed either way around but make sure the Triac is put in correctly. The Triac does not need a heatsink.

Make sure the capacitors have the voltage ratings specified. No skimping here.

With the components soldered to the PCB, put it aside and work on the plastic box. Drill a hole to take a grommet for the mains cord and a smaller hole for the cord clamp securing screw and nut. Now install the mains cord. The earth wire (green) is connected directly to a solder lug on the control panel and thence to the earth terminal on the AC socket.

Active and neutral wires of the mains cord are terminated directly onto the PCB. Two insulated wires of the same gauge are connected from the PCB to the relevant terminals on the AC socket. Then connect the pot to the PCB and you are finished. Check all your wiring carefully against our circuit and wiring diagram.

Connect a fan to the speed control and apply power. With the pot set fully clockwise the fan should run at normal speed. Now reduce the pot setting and the fan speed should reduce accordingly, allowing for some flywheel effect of the fan blades. You should be able to control the speed over a fairly wide range, subject to the limitations that we mentioned above.

Do not leave the fan in a stalled condition otherwise it may overheat due to the lack of cooling air passing through the motor.

Well there it is. A handy little accessory which will make your fan more useful on these hot summer nights. Sleep well.

Regulator gives mV accuracy without a meter:

Precision power supply

A precision, variable, regulated power supply can be a very useful device around the workshop. As a power supply it can be set to deliver a precise voltage without the need to tie up a voltmeter, while it may also serve as a voltage reference for checking other instruments.

by BRIAN DANCE

The simple circuit shown will provide an output voltage which can be set to within a few mV of any required value between 0 and +20V without the use of a meter. The output device provides built-in thermal shut-down and short circuit limiting, whilst the reference source ensures ultra high stability of the output voltage.

The REF-01 device provides an extremely stable +10V across the 10 turn helical potentiometer, VR1. In the prototype a Beckman Helipot with a 0.1% linearity was used so that the voltage tapped off by VR1 was within a few mV of the dial reading. (Editorial note: The REF-01 is made by Precision Monolithics, of California, USA, and is available in Australia from Cema Distributors, either direct or via normal suppliers. The Beckman Helipot may not be available in Australia, but units of similar style and quality are available, one of which is illustrated. This has a linearity of 0.25%, but 0.1% units are available at a higher price).

The LM295K alone has a gain of about one million but, as fed from one amplifier of the 358 inside a feedback loop it has a gain of two (1 + R1/R2). The output voltage is thus twice the voltage tapped off by the slider of VR1. The LM295K must be mounted on a heat sink; the output current is limited to about 1.5A, but more current can be obtained by paralleling a number of LM295K devices. (The LM295K is available from NS Electronics, either direct or via normal suppliers).

VR2, shown dotted, is an optional trimming device. Even without it, the voltage at pin six of the REF-01 will be within 50mV of 10V (or within 100mV for the REF-01C) and if R1 and R2 are close tolerance resistors, no trimming may be needed. However, VR2 can be included to trim this output voltage at the middle of the range to accurately match the readings of the VR1 dial.

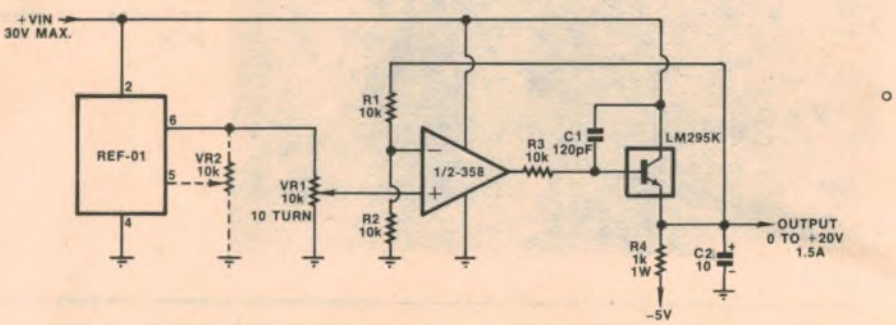
The LM295K will operate correctly only if its quiescent current can pass to the output or to R4. If R4 is omitted and the output current is zero, the output voltage will float upwards to about +9V when VR1 is set for any smaller output than 9V. The use of the -5V supply can be avoided by connecting R4 to ground, but the minimum output voltage will then be approximately equal to the LM295K quiescent current (typically 1mA, maximum 5mA) multiplied by the value of R4.

If a dial calibrated from 0 to 20 cannot be obtained, a dial calibrated from 0 to 10 can be used for VR1 and the reading doubled to give the output voltage. If R1 is shorted out, the output voltage of 0 to +10V can be read directly from a dial calibrated from 0 to 10.

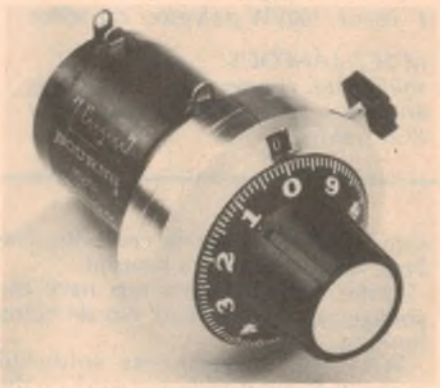
The 358 amplifier maintains its linearity even when the non-inverting input falls to 0V, but if any other type of operational amplifier is employed, its negative supply should be connected to the -5V line. The two capacitors may possibly be required for stability, although the prototype operated satisfactorily without them.

The REF-01 output voltage is independent of the output current taken from the circuit; a current of 1A taken from the output produced an output voltage change of less than 1mV. A change of 10V in the power input line supply resulted in a 10mV change at pin 6; this could be reduced with a series resistor in the pin 2 line and a 15V zener diode from pin 2 to ground.

It was found the output corresponded with the dial readings to within ±5mV. The temperature stability has not been measured, but will be determined by the class of REF-01 device employed — typically three to 20 parts per million per °C. Output noise at very low frequencies was extremely small and difficult to measure.



The precision regulator circuit, which can be added to any power supply delivering up to 30V at 1.5A. Better immunity from line voltage variations can be obtained by pegging the voltage to pin 2 of the REF-01 with a zener diode. Apart from the electronic details, the most important aspect is the mechanical accuracy of the pot and dial used for VR1.



A typical 10-turn pot fitted with a 10-turn dial. Note the small window above main dial, in which is displayed the number of revolutions, and the lever which can lock the dial at any setting. Both pot and dial are made by Bourns of USA. (Photo by courtesy Radio Despatch Service.)

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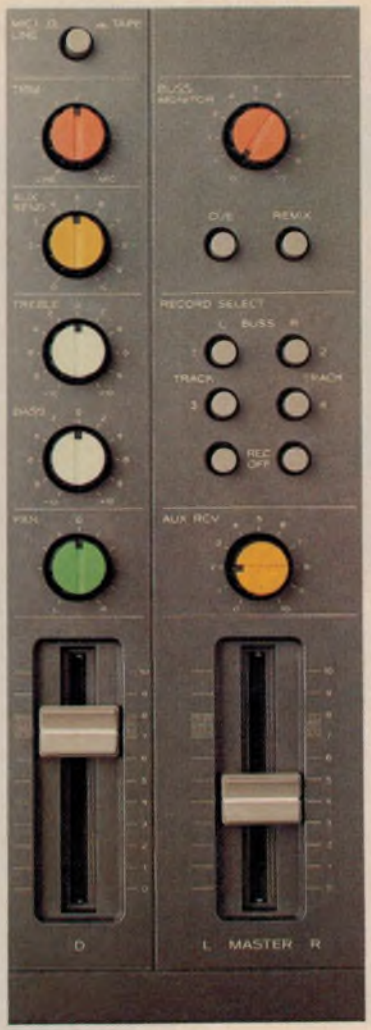

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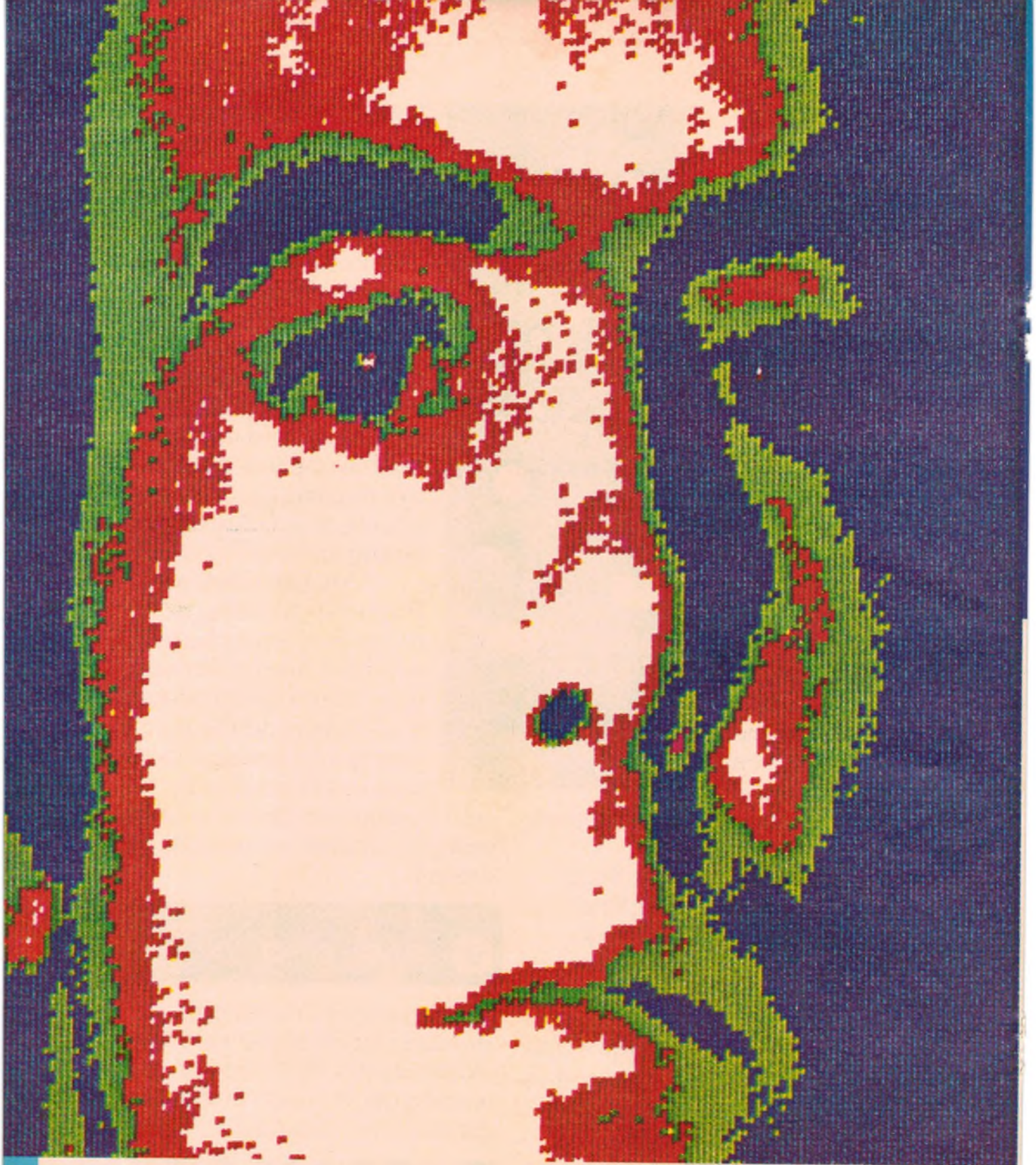


The picture was produced by computer of a video image and plotted on a flat bed plotter by John F Rose Graphics Company Pty Ltd.

The Serviceman

First aid (and last gasp) for an old TV set

By way of a change from my usual run of intermittents, mysteries, and curly ones from the work bench, here is what might best be described as a busman's — or serviceman's — holiday. Or, if you like, how to service a TV set with only the tools from the boot of the family car. (Who needs a soldering iron or multimeter?).

To be honest, this is not a recent story, it has been sitting in my files for well over 12 months now, and it was several months after the incident that I wrote it. I have passed it over on several occasions when more topical stories rated a higher priority. At least it's topical at this time of the year!

It all started when I decided to take Mrs Serviceman and other members of the family for a holiday on the NSW South Coast — to a very small town which boasts some facilities for boating, fishing and swimming, but with no TV serviceman for miles around.

Knowing this, and having a few acquaintances in the area, I quite deliberately omitted to pack even a single item from my own service kit. I have learned from past experience that one can all too easily spend hours on TV service "dogs" for friends instead of spending the holiday in the way it should be spent — "beside the seaside ...".

When I inquired about TV in the holiday cottage, the owner assured me that it contained an old but serviceable black-and-white receiver coupled to an outside aerial. "It takes a while to warm up", he added, "but it goes orright!"

I guess I should have been warned. Sets that "take a while to warm up" are usually sets with a large complement of old, leaky capacitors and off-tolerance resistors — all liberally coated with gunk — which struggle towards some kind of workable state only after the prolonged application of voltage and temperature.

I did consider taking along a portable set of my own but, by the time Mrs Serviceman had packed all the things she regarded as essential, there was barely room for the kitchen sink! When we finally did arrive at our destination and I had time to switch the TV set on, I had every reason to regret the omission.

The set was an ancient STC model, in a (once) handsomely designed and polished console cabinet, very deep, but with a 21-inch tube that still managed to protrude from the back. In its heyday, it had obviously been someone's pride and joy.

When I switched it on, I was greeted a few moments later, by a sharp crack as something "went over" — presumably due to the high warm-up voltage. Since it was not repeated, I left the switch on and waited for the picture to come up. Unfortunately, the old set was barely able to produce a glow from its screen, with a picture that showed very little inclination to lock either vertically or horizontally. The sound wasn't too hot, either!

Thinking of the landlord's warning, I left it on for a quarter-hour but it was still far from "orright": brightness and contrast had improved a trifle but we watched the news only by dint of riding the two hold controls. Even then, the picture seemed to be pulsating in brightness. Clearly, corrective measures would have to be taken if we were going to have something to while away the evening hours. But how do you service a TV set without equipment?

"You want me to fix it once and for all? I'll do that, madam. I'll do just that!" "TV Times")

At that point, I called round to the local general store to ask about the possibility of hiring a TV set for the next couple of weeks but the inquiry was met by a sad shake of the head. I was on my own!

There was just once chance that some of the troubles might be due to fouled valve sockets so, next morning, I looked out the only two tools from the car kit that were likely to be useful — a pair of long nosed pliers and a screwdriver with interchangeable blades.

Taking the back off the set, I peered inside ready to spot the arc-over and switched on. It went over right on cue inside a valve which turned out to be a 6AQ5 — probably the audio output stage. I switched off, pulled the valve out and tapped it smartly pins-down on the table, hoping to dislodge the cause of the flash-over. When I tried again, I was greeted with quite a pyrotechnic display which fortunately didn't last too long. Obviously there would be no more tapping — the valve would be better left alone!

Turning back to the picture circuits, I identified two or three valves that would most likely include the sync separator and the oscillators. One of them, in a sprung socket, seemed to be virtually frozen in and I had to prise it out carefully, in case too large a pull should remove the socket as well!

This done, I pushed the valves back into their sockets and worked them around a bit to clear poor contacts.

When I switched the set on once again, I was delighted to find that I could now lock the picture for a few minutes at a time, so that it was at least watchable. True, it lacked brightness and contrast, and the tuner didn't seem to make much sense, but at least the picture moved and talked!

Suitably encouraged, I visited the local general store and managed to buy a spray can of WD 40, which could be expected to de-louse and lubricate the sockets and expel moisture.

One by one, I removed the valves, sprayed and wiped between the pins, sprayed the sockets and re-inserted the valves. I stress the "one by one", because it is all too easy to get valves mixed up, in the absence of a circuit and, in some cases, the absence of a decipherable type number on the glass envelope.

While doing this, I noticed that the area around the picture tube's EHT connection was completely fouled and, this too, was treated.

TUNER FIRST AID

And the reward for all this? A picture that had reasonable brightness, contrast and stability and that did seem to improve gradually, the longer we watched it. But, alas, the tuner was far from satisfactory and, to obtain a picture at all, one had to wiggle the switch and fine tune, often ending up with rotor deliberately partly out of its detent position. This looked like being a problem indeed because the tuner was inaccessible inside the cabinet and a frozen-on fine tune knob would have prevented the chassis being withdrawn. More immediately, it denied access to the cores through the front. So I sprayed it with WD40 and went for a swim.

That night, I managed to get the fine tune knob off, and, directing the spray through the valve sockets, other holes and now exposed core access holes, I gave the tuner a good drink, meanwhile working the rotor and fine tune controls.

And what a difference it made. Evidence of contact trouble disappeared and, using a screwdriver blade that was fortunately long enough and fine enough, I was able to peak the oscillator cores properly. As I had suspected, they were well out of position and the picture started to look really promising — except that at times it still seemed to oscillate somewhat in brightness. Why?

I woke up to the cause next morning when examination of the aerial showed that the ribbon down-lead had come out of the spacers and was flapping against the steel mast in the prevailing nor-easter. I couldn't climb the mast but a scrap of rope to a nearby nail was sufficient to hold the ribbon clear and steady, and it effectively steadied the picture.

There remained only the sound — somewhat distorted and with an obvious content of frame buzz. Most likely the discriminator core needed touching up — but where was it?

Looking along the valve line-up it seemed likely that a large IF transformer that I could feel but not see, with the chassis in the cabinet, would be the discriminator transformer. I could only hope sincerely that the designer had thought to make the secondary core the accessible one.

And this seemed to be the case. Working by feel rather than sight, I turned the core in and out by repeatable amounts and found that a full turn in gave the result required — clean sound and no frame buzz. And at that point I called it a day.

I think that the set was still well short of optimum because, despite its generous IF line-up, it still had no contrast to spare, irrespective of the AGC adjustments at the back. But as I settled back and watched the sport, I was thankful for whatever the fates that made it possible to achieve an acceptable result with such limited facilities — screwdriver, pliers and a can of WD40!

But there has to be an epilogue to the story affecting this set and thousands of others of like vintage around Australia.

I was lucky in being able to extract temporary advantage from a superficial treatment but in no sense was the set "fixed". If it was to be put into a reasonably reliable state it would have to be given a complete on-the-bench overhaul. I would expect something like the following:

- Remove and dismantle the tuner, cleaning away the gunk that my WD40 treatment had merely loosened. Check all contacts and biscuits, valve sockets etc and reassemble. Either that or fit a replacement tuner.
- Check the video IF chain, almost certainly replacing off-tolerance resistors and leaky capacitors in the supply and AGC systems. Replace valves as necessary and possibly realign.
- Ditto for sound IF system and replace the 6AQ5 output valve.
- Replace all off-tolerance resistors and leaky capacitors in the sync separator and vertical oscillator/output stages to obviate residual vertical rolling tendency.
- Check and clean the entire line output and EHT system and determine why the picture did not come straight up to normal brightness. Perhaps the picture tube itself is reaching the end of its life!
- Check over other components and controls, reinstall in cabinet, set up picture for correct geometry, etc.

Now ask yourself how much all that is going to cost at normal shop rates and you will have some idea of the dilema which faces owners of ageing receivers and servicemen who have to cope with them. They seem too good to discard but the cost of a complete overhaul equally seems prohibitive. The tendency therefore, is to keep patching them up until client or serviceman gives up.

It's bad enough for sets in the suburbs but what about those like the one I describe — 20 or more miles from the nearest service centre? No wonder new portable TV sets are selling so well!

CIRCUIT & DESIGN IDEAS

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. Contributions to this section are always welcome, and will be paid for if used.

Conducted by Ian Pogson

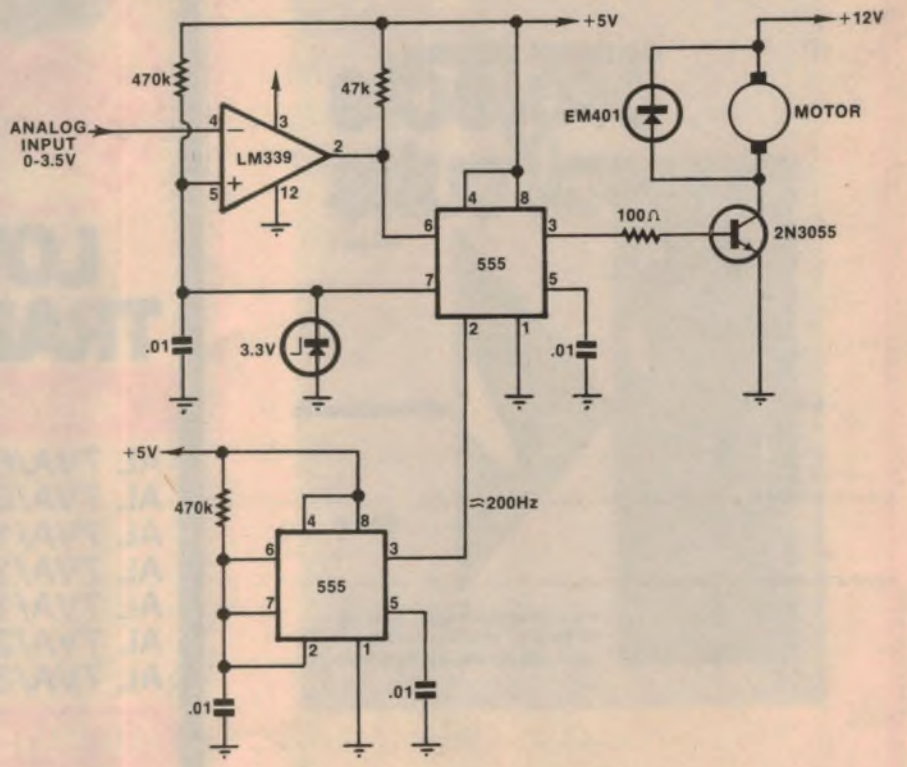
Accurate motor speed control

I recently built a robot using an on-board 2650. Accurate motor control is essential and I designed a circuit to suit. It may be of interest to other readers. The circuit allows a computer I/O port with a DAC (digital to analog converter) to control motor speed. The output voltage can vary the mark-space ratio of the 555 over the widest possible range.

In effect, the 339 comparator replaces the top comparator in the 555. When the capacitor voltage reaches the analog input voltage, the comparator goes high causing the 555 to time out. The maximum analog voltage is Vcc-1.5. The 555 is triggered by a very short pulse from a second 555. To prevent output spikes at full mark, the zener ensures that the capacity never reaches an analog input greater than 3.3V. The motor is turned on and off at 200Hz, the speed being proportional to the mark-space ratio.

A second motor needs only one extra 555 as the astable can be shared and the 339 is a quad comparator. Do not forget the pullup resistor on the comparator as it is open collector. For a linear relation between digital word and mark-space ratio, replace the charging resistor with a constant current source.

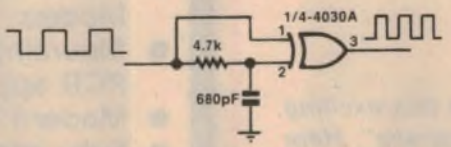
(By Mr A. Peek, 10 Gale Street, Woolwich, NSW 2110.)

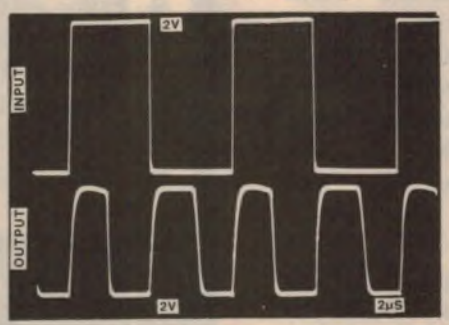


A simple frequency doubler

This very simple circuit generates one pulse for each transition of the input from low to high and from high to low. Since one input of the exclusive OR gate is connected directly to the drive and the other is connected via a delay, it follows that after each transition there will be an interval during which one input is high and the other low — ergo, output high.

The delay network components are selected to suit the particular circumstance, typical values being 4.7k and 0.1uF. The CRO photograph was taken with C = 680pF and R = 4.7k. The input frequency was 125kHz. Although a CMOS device is shown, other logic families could be used equally well if restraints on levels and rise times are observed. Input waveforms other than rectangular could possibly be used.





(By F. J. Maher, CSIRO Division of Chemical Physics, PO Box 160, Clayton, Victoria 3168.)

Adjustable power supply up to + or -12V and 800mA

The circuit shows a power supply which is adjustable up to 12 volts with either positive or negative polarity. The current source is also adjustable up to about 800mA and it is short circuit proof. I have used this circuit successfully for an antenna rotating motor to turn in either direction. I have also used it as a power supply for either polarity as the need has arisen.

The output voltage is set by means of the 500 ohm potentiometer, between the limts of + and -12V, with 0V in the mid position. When the potentiometer is turned towards the negative side, the PNP transistor conducts, while the NPN transistor is blocked. The reverse applies when the potentiometer is turned in the opposite

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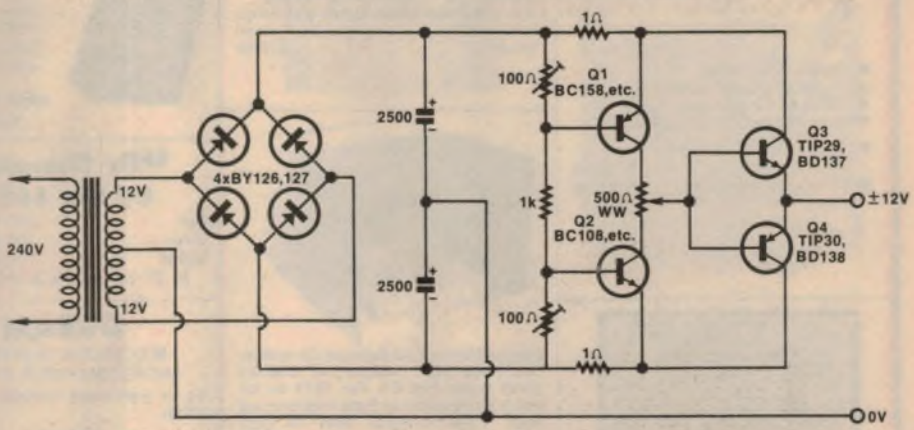
direction.

By means of the respective transistor in the current circuit, with its 100 ohm preset potentiometer, the circuit is protected against overload. The voltage drop across the one ohm resistor will block the transistor when the current exceeds the preset value. The circuit works as a constant current source up to about 800mA.

I made the two one ohm resistors from a piece of heater element but one ohm resistors obtained commercially could be substituted. The two-power transistors must be mounted on a heat-sink of adequate proportions.

(By Mr W. R. Jongeneelen, 463 Hawthorne Road, Bargo, NSW 2574).



A novel vyce to make

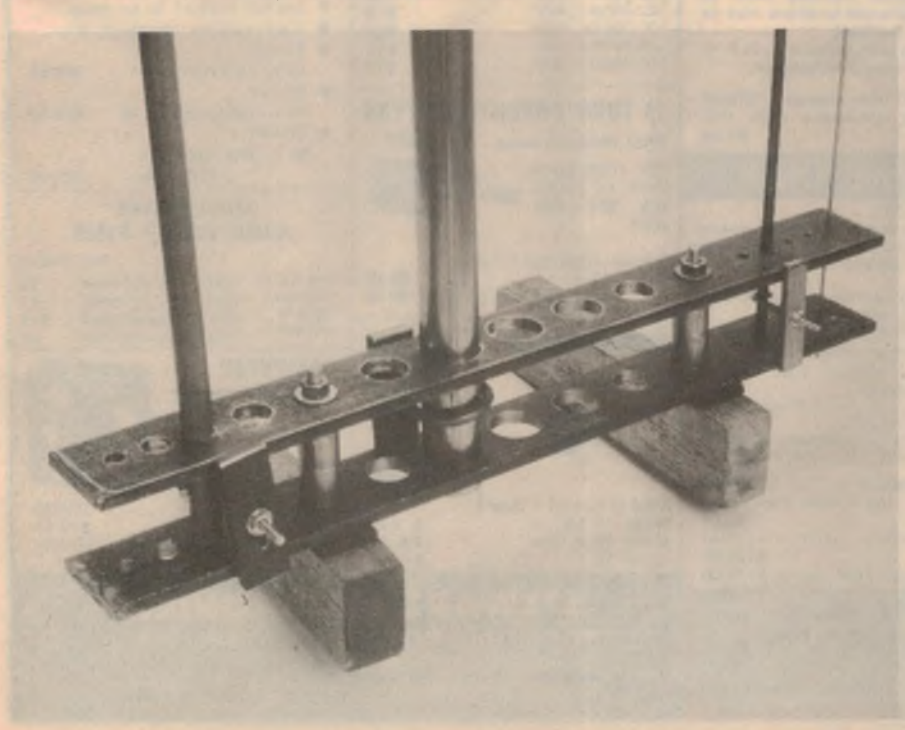
Pictured is a novel type of "vyce" I have developed for holding pipe, tubing and rod stock. It can be built in a variety of sizes, and can firmly hold anything from large-diameter PVC conduit to 3mm welding rod. It can even hold thin-walled stainless steel pipe, without the pipe being deformed.

As you can see the basic idea is two pieces of steel strip, bolted together with spacers between them. The strips have an identical series of holes bored in them, to suit the stock to be clamped, and are then case-hardened.

A number of "J"-shaped hooks are used to perform the actual clamping, as shown. The hooks are made from rod of a suitable diameter, and the hook portion radiused to suit the diameter of the stock to be clamped. They are threaded on the straight end to take a hex nut and flat washer. Each hook is used with a short length of steel strip, to couple it to the sides of the main vyce strips. The nut is simply tightened until the stock is held firmly.

I have made up the vyce in a couple of versions, and they seem to work particularly well. As the stock is clamped in balanced shear mode, even thin-walled tubing may be held firmly without damage. I hope other readers find it as useful as I have.

(By Mr M. Ronell, 14 Griffen Street, Surry Hills, NSW 2010.)



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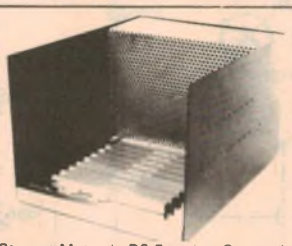
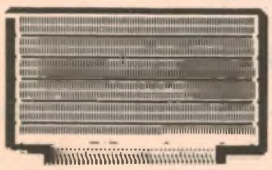


Stewart Motorola D2 Exorciser Compatible Card Cage with provision for shielded power supply. See E.A. Feb 1979 for full details shown with our 9 slot mother board fitted. Cage complete with 18 card guides $39.50



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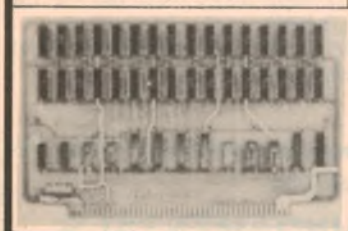

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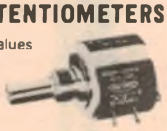

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100 $0.65

Values may be mixed.

20 TURN CERMET TRIM POT

SPECTROL 43P
ACTUAL SIZE

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Give your computer an RS-232C interface

Many printers, video terminals and other peripherals are designed to communicate with the computer via an RS-232C interface. This article gives you a quick rundown on the RS-232C standard, and shows how you can provide your home computer with this sort of interface at low cost.

by JAMIESON ROWE

What do you know about the RS-232C interfacing standard for data communication? Perhaps not too much, although most computer hobbyists and personal computer owners have probably seen references to it in advertisements for high speed printers, video terminals and other fancy peripheral devices. But you won't find much about it in textbooks.

Perhaps you've gained the impression that RS-232C interfacing is fairly complicated, and not suitable for small microcomputers. Or you might think that you can't make use of a printer or terminal designed for RS-232C interfacing, because it would be too hard to connect to your microcomputer. If either is the case, you're in for some good news.

The fact is that in the form you'll normally meet it, RS-232C interfacing is really quite straightforward. Not only that, but you can provide your microcomputer with a basic RS-232C interface very easily and at low cost. In this article we're going to tell you how it's done, so read on.

First of all, just what is an RS-232C interface? Well, it's a set of connections between two pieces of equipment, designed to allow them to "communicate" by exchanging data — numbers, messages and so on. Moreover it's a set of connections which allow the exchange of data according to the specifications set down in Standard RS-232C, published in August 1969 by the Electronic Industries Association (EIA) in the United States.

As a lot of things have happened in electronics since 1969, the RS-232C standard is now regarded as obsolete. The EIA has brought out later standards, like RS-449 (October 1977), which allow better use to be made of modern technology. But a lot of lower-speed data communication still conforms to the basic RS-232C standard, and a lot of modern equipment is made to work at the lower speeds. So from the practical point of view, RS-232C is still quite current.

Basically, RS-232C covers "serial" data communication — where the code bits making up the characters of the message are all sent one-by-one over a single circuit. This is in contrast with "parallel" communication, where each of the bits of the characters is sent on a separate circuit (although the characters themselves are still sent one after the other).

Although the full RS-232C specification covers both synchronous and non-synchronous or "asynchronous" communication, most of the RS-232C interface circuitry you are likely to come across will probably be designed for asynchronous operation.

All this means is that each group of code bits representing a letter, numeral or other character in the message is preceeded by a "start" bit, whose purpose is to tell the receiving end that a new character code is arriving. At the end of each code group there is also one or more "stop" bits, which provide a brief pause between characters to allow for any timing differences between the sending and receiving ends.

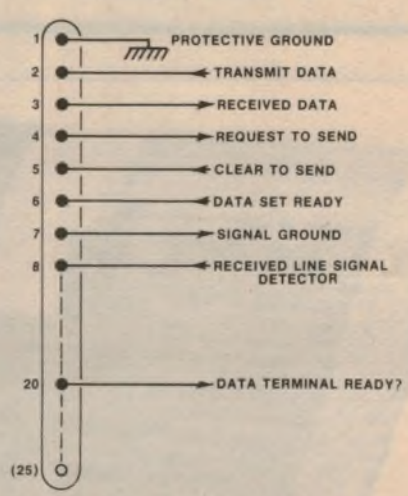

FIG. 1 : BASIC RS-232C CONNECTOR SIGNALS

TABLE 1: The basic RS-232C electrical specification

Communication rate	0 — 20,000 bits per second
Driver output voltage levels, maximum no-load	-25V logic 1 +25V logic 0
Driver output voltage ranges for loads between 3k and 7k ohms	logic 1: -15V (7k) — -5V (3k) logic 0: +15V (7k) — +5V (3k)
Driver output current, short-circuited	500mA maximum
Driver output impedance with power off	300 ohms minimum
Maximum driver output slew rate	30 volts per microsecond
Receiver input resistance	7k ohms maximum, 3k ohms minimum
Effective receiver input capacitance	2500pF maximum
Maximum receiver input voltage range	-25V to +25V

At this stage, those of you with hobby computers may well be wondering how an RS-232C interface compares with the familiar "20mA current loop" interface, which your system probably has at present. What is the difference?

The main difference is that the RS-232C system uses voltage levels to represent the two digital truth values, rather than current levels. The digital 1 or "mark" level is normally represented by a negative voltage level, while digital 0 or "space" is represented by a positive voltage level.

The voltage levels are not given

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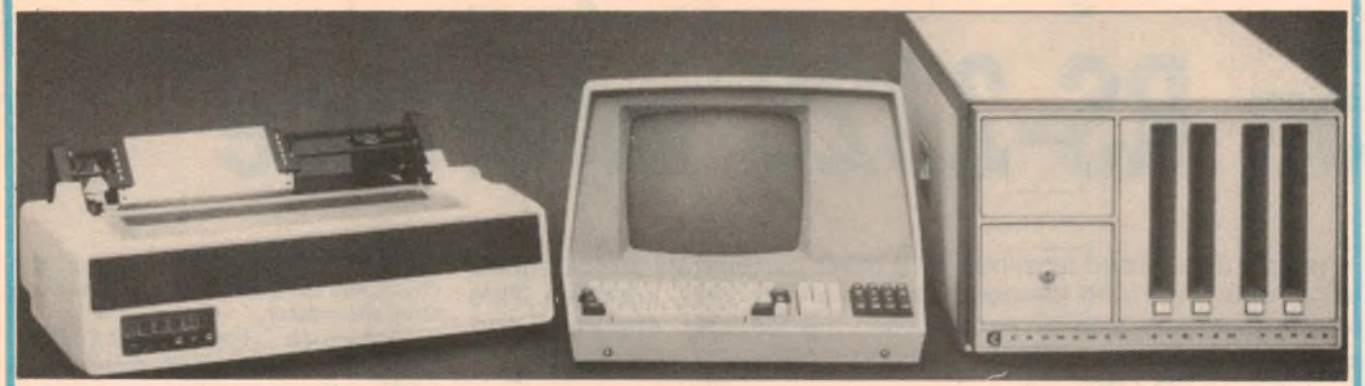

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MODEL 165

SPECIFICATIONS

Features:
- High speed printing: 165 cps full logic bi-directional
- Letter quality printing: 90 cps full logic bi-directional
- Adjustable tractor feed (4" - 15" forms width)
- Paper feeds from front or bottom center
- User adjustable platen
- Forms length from 1 to 99 lines, 15 ips slew rate
- Auto reversing, re-inking ribbon
- LSI Hydra Ball (tm) printhead, 9 wire, 12 x 9 matrix
- Line spacing: 6 lines per inch
- Power save circuitry turns off the fan and motors shortly after printing stops and re-energizes them as new characters are received, reducing noise and power consumption

Controls:
- Lighted "Power On" switch
- FORMS Override allows printing to bottom of last form after the "out of paper" switch has been activated
- ADJUST UP, ADJUST DOWN provides vertical forms positioning
- LINE FEED advances the paper at the slew rate
- FORM FEED advances the paper to next top of form

Functional with optional controller card only:
- ON LINE, OFF LINE
- RESET reinitializes the controller card
- SELECT: De-Select with LED indicator
- TEST causes the printer to go into a self-test mode printing a rotating character pattern

Software Routines:
- Full 96 ASCII character set, lower case with descenders
- Two type fonts, high speed and letter quality, software controlled automatic speed change
- Expanded characters
- Underlining
- Programmable vertical and high speed horizontal tabs
- Selectable left margin
- Complete dot control graphics (60 x 72 dots/inch)
- Easy custom character installation

Physical:
- Selectable primary voltage (110 240 VAC, 50 60 Hz)
- Dimensions: 27.5 x 19 x 9.25 inches (60 x 47 x 23 cms). Weight: 48 lbs. (22 kgs.)

Optional Interfaces:
- RS 232 serial or ASCII parallel controller
- S-100 buss I/O card
- S-100 buss I/O card with memory
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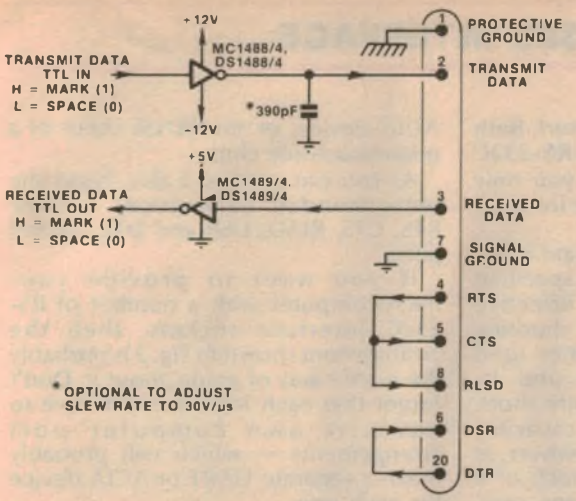


FIG. 2 : TTL/RS-232C INTERFACE USING 1488/1499 ICS

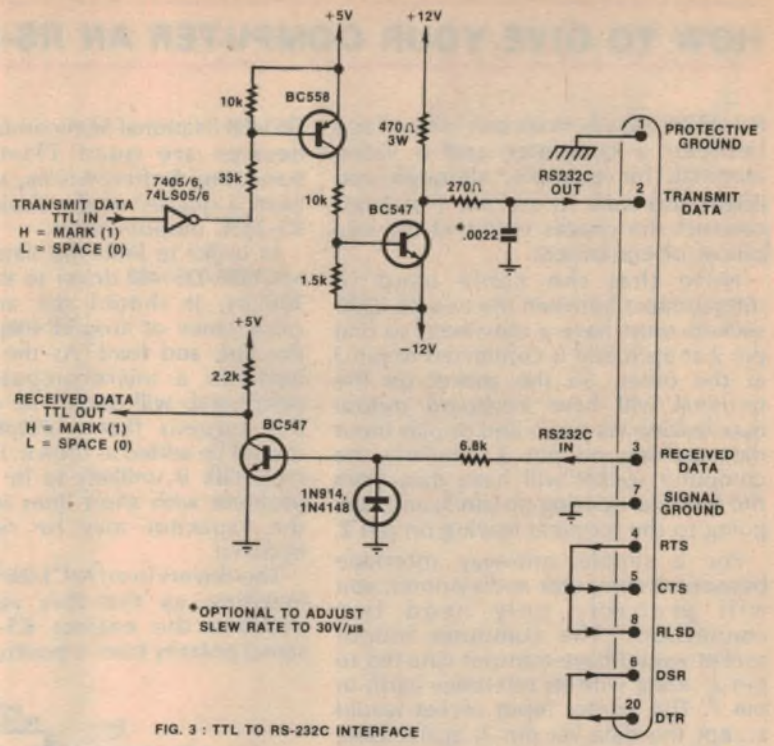


FIG. 3 : TTL TO RS-232C INTERFACE

nominal values, because in practice they will vary somewhat due to component tolerances and line voltage drop. Instead the RS-232C standard simply specifies the limits of the range in which each voltage may vary without causing error. So a digital 1 may be represented by any voltage between -5V and -25V, while a digital 0 may be represented by any voltage between +5V and +25V.

Note that it is not necessary for the voltage levels for 1 and 0 to be symmetrical with respect to signal ground. The only requirement is that each level remains inside its specified range. So a signal swinging between -12V for "mark" and +5V for "space" is quite acceptable, although the +5V level would be regarded as marginal.

A number of other electrical parameters are also specified in the RS-232C standard, as shown in Table 1. An important point is that the RS-232C specification is only intended to cover data communication rates up to 20,000 bits per second, which is loosely equivalent to 20 kilobaud.

Notice that the output impedance of an RS-232C driver circuit is not specified as such, in the active condition. Rather it is given indirectly, by such parameters as the output levels for loads between 3k and 7k, and the maximum short-circuit current.

The maximum effective receiver input capacitance of 2500pF also includes cable capacitance, by the way.

Why does the specification give a maximum slew rate for an RS-232C driver? Simply because it is designed to minimise cross-talk in multiwire cables. The slower the voltage transitions, the lower the potential cross-talk.

Along with the electrical specification given for individual signals, the RS-232C standard also defines some 21 possible connections or "interchange circuits", which may be included in a standard RS-232C interface. It also specifies the corresponding pin numbers for each one, on the accepted connector for RS-232C communication: a 25-way "Cannon"-type connector, type number DB-25 or equivalent.

By definition, any piece of equipment provided with an RS-232C interface is fitted with a DB-25 socket. Any two or more devices fitted with such sockets are interconnected by cables fitted with a matching plug at each end.

Don't let those 21 defined connections worry you. Many of them are quite esoteric, being used mainly for secondary control functions when devices like modems are involved, connected to the switched telephone network. You can generally forget them for simple one-way or two-way asynchronous communication between a computer and its peripherals.

The main RS-232C connections you are likely to come across are shown in Fig. 1, along with their standard DB-25 pin numbers. Even here quite a few of the connections shown are used only when the interface involves "handshaking".

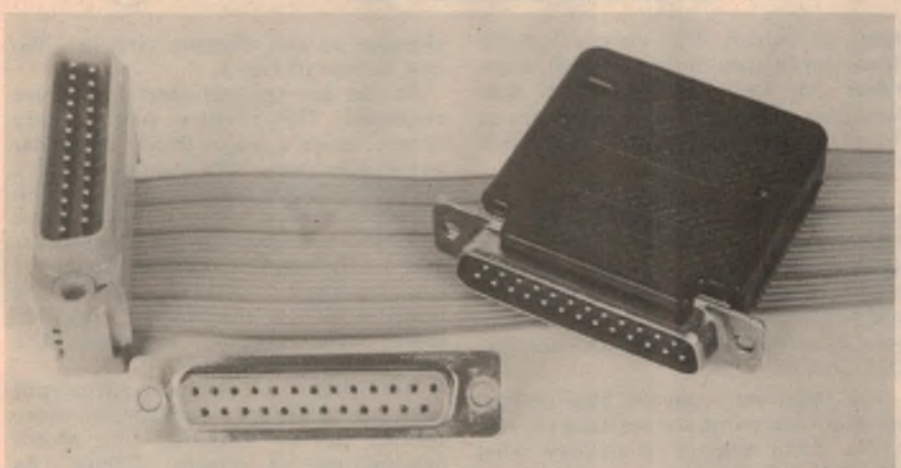
In fact most of the time you will probably only have to worry about three connections: those associated with pins 2, 3 and 7.

Pin 7 carries the signal ground, the reference against which the other signals are compared.

Pin 2 carries transmit data, or data leaving the equipment via the RS-232C socket.

Pin 3 carries received data, or data arriving at the equipment via the RS-232C socket.

These would be the only connections you will normally require for a simple



Typical connectors used for RS-232C interfacing. In front is a standard DB-25S socket, while at right is the matching DB-25P plug for a conventional cable. At left is a compatible plug which crimps onto ribbon cable. (Courtesy Radio Despatch Service)

RS-232C asynchronous interface between a computer and a video terminal, for example, although you might also want to use pin 1 to interconnect the chassis earths of the two pieces of equipment.

Note that the cable used to interconnect between the two RS-232C sockets must have a crossover, so that pin 2 at each end is connected to pin 3 at the other. So the socket on the terminal will have keyboard output data leaving via pin 2, and display input data arriving on pin 3. Similarly the computer socket will have data from the terminal arriving on pin 3, and data going to the terminal leaving on pin 2.

For a simple one-way interface between a computer and a printer, you will probably only need two connections. The computer output socket would have transmit data fed to pin 2, along with its reference earth in pin 7. The printer input socket would accept the data via pin 3, again using pin 7 for the reference earth.

What about the other connections and signals shown in Fig. 1 — can you just ignore them? In many cases, you can. However, if you are ever likely to be connecting to a piece of equipment which makes use of some of the handshaking signals, it is possible to interconnect some of the pins so that the signals are simply fed back to the other end. This "fools" the equipment at the other end into thinking that your equipment is responding normally.

To do this you connect the "Request to send" (RTS) input on pin 4 to the "Clear to Send" (CTS) and "Received Line Signal Detector" (RLSD) outputs, on pins 5 and 8 respectively. You also connect the "Data Terminal Ready?" (DTR) input on pin 20 to the "Data Set Ready" (DSR) output on pin 6.

An alternative scheme is simply to ignore the RTS and DTR inputs on pins 4 and 20, and tie the CTS, DSR and RLSD outputs (pins 5, 6 and 8) to a positive voltage between +5V and +15V, via a 330 ohm resistor. This sets them permanently in the "true" or 1 state, because the logic convention used for RS-232C control signals is the opposite of the convention for data signals.

So much for the basics of RS-232C interfaces in general. Now let's look at how you can provide your microcomputer with a practical interface, so that you can hook it up to an RS-232C terminal, printer or other device.

The approach that is generally taken by commercial designers is to make use of special RS-232C driver and receiver ICs, as shown in Fig. 2. The most commonly used driver IC is the MC1488 (Motorola), or its equivalent DS1488 (National Semiconductor). Both devices are quad TTL-to-RS-232C translating buffer/drivers, so you only need a quarter of the device for each RS-232C output socket.

In order to limit the slew rate of an MC1488/DS1488 driver to the specified 30V/us, it should see an effective capacitance of around 400pF shunting the line and load. As the lines used between a microcomputer and its peripherals will usually be quite short, this suggests that a 390pF capacitor should be added as shown. However, as cross-talk is unlikely to be much of a problem with short lines in any case, the capacitor may be regarded as optional.

The drivers in an MC1488/DS1488 are inverting, so that they automatically produce the correct RS-232C data signal polarity from a positive-logic TTL input, as shown. This means that the driver input can be fed directly from either the TSO (transmit serial out) output of a UART or ACIA device, or the FLAG output of a microprocessor chip itself.

The most commonly used receiver IC is the MC1489 (Motorola) or the DS1489 (National Semiconductor). These are again quad devices, with four Schmitt trigger type RS-232C-to-TTL receivers in one package. So as before you only need a quarter of a device for each RS-232C socket.

The receivers in an MC1489/DS1489 are again inverting, so they take the RS-232C data signal polarity and automatically produce a positive-logic TTL output signal as shown. The signal from the receiver is thus suitable for feeding directly to either the RSI (receive serial input) of a UART or ACIA device, or the SENSE input of a microprocessor chip.

As you can see Fig. 2 also shows the recommended connections for the RTS, CTS, RLSD, DSR and DTR control pins.

If you want to provide your microcomputer with a number of RS-232C interface sockets, then the arrangement shown in Fig. 2 is probably the easiest way of going about it. Don't forget that each interface will have to have its own computer port arrangements — which will probably mean a separate UART or ACIA device for each one.

You don't have to use special ICs like the 1488/1489 combination to produce a practical RS-232C interface, though. In fact if you only want a single interface for a printer or video terminal, it is probably easier and

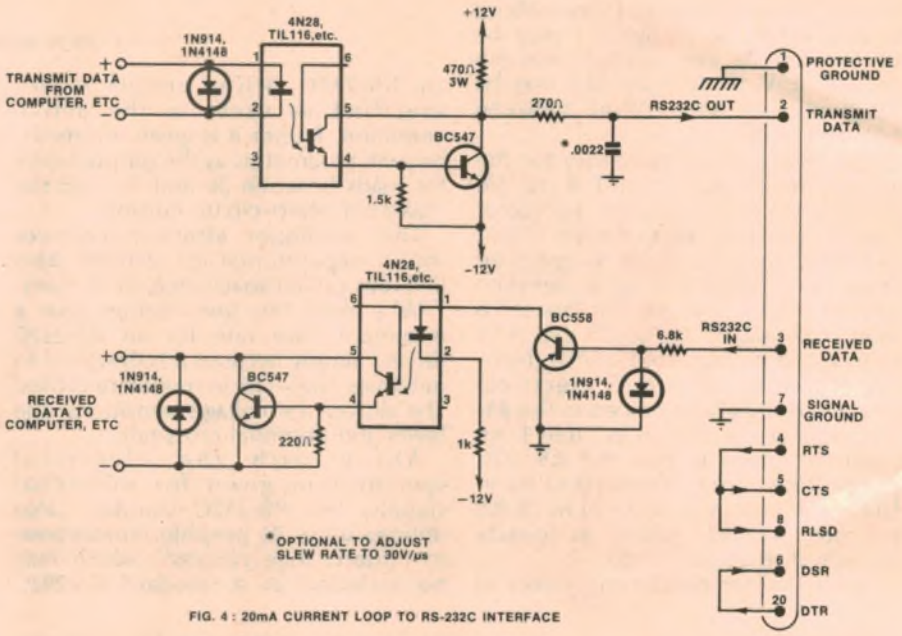


FIG. 4 : 20mA CURRENT LOOP TO RS-232C INTERFACE

cheaper to use discrete circuitry like that shown in Fig. 3.

As you can see, no special parts are required. The receive side is very simple, using a single BC547 or similar general-purpose NPN transistor with a protective diode and two resistors. The transmit side is only a little more complex, with two low-cost transistors and a TTL inverter to allow driving by positive-logic input signals. If the transmit data is available in negative-logic form (L-mark, H-space), the inverter is not required.

Note that to set the transmit output slew rate to the specified 30V/us, there should be an effective line shunt capacitance of around 2200pF. As before this can be regarded as optional.

What if your computer is already provided with a 20mA current loop

Continued on page 139

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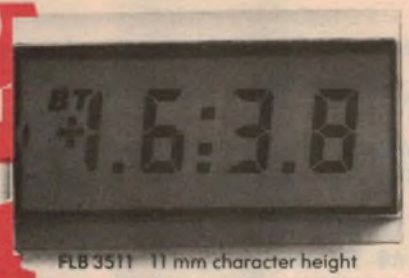

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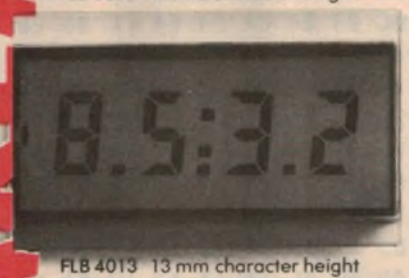

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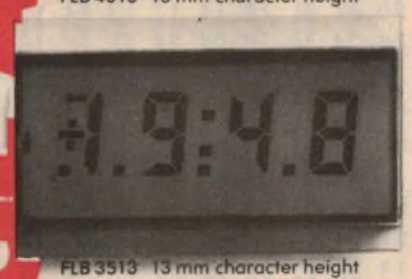

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FAIRCHILD

Use your 2650 system to generate random Morse!

Trying to learn Morse code? The best way is to have an obliging "old timer" send you random groups of letters and numbers, so that you don't anticipate or "journalise". For those lacking an obliging friend here is the next best thing — a program which turns your 2650 Mini Computer into a random Morse generator.

by RICHARD ROGERS, VK7RO
4/439 Huon Road, South Hobart 7000

One of the common errors of beginners in copying Morse code is to "journalise", or write down the end of a word before it has been sent! Random code groups are an excellent practice material to help combat this tendency. Once you are able to copy random groups, plain language will seem easy. Also, with random code there are many more chances to hear the letters which occur infrequently in plain language.

The program described here was originally written for my Central Data 2650 system, but the program as listed has been modified to suit systems using the Pipbug monitor program, like the EA 2650 Mini Computer.

The program generates five-character groups consisting of four letters and one figure, eg ZF90B 8JLUY etc, at speeds ranging from 3 to 25 words per minute. The starting speed is selectable and the speed increases by one WPM every five minutes. The current speed is displayed on the VDU. Below 10WPM, the characters are sent at a 10WPM rate but the spaces between the characters are increased.

As written, the program generates a tone at the 2650 flag output. The tone frequency used is ignored by a 110 baud VDU and nothing is printed on the screen during the morse output. I use a loudspeaker in series with a 1000 ohm resistor, connected between the output of the flag buffer and earth, as a monitor.

The program may be changed to give a voltage suitable for controlling an external oscillator by changing the code at 04A3 from 76 to 74.

Some NOP's are provided within the program to facilitate the use of any other output port. For instance, the use bit Ø of output port D as the tone output, the following code changes are required.

05EB change from CØ CØ CØ CØ to Ø4 ØØ FØ CØ

049D change from 74 40 CØ CØ to Ø4 Ø1 FØ CØ

04A3 change from 76 4Ø CØ CØ to Ø4 ØØ FØ CØ

Ø4AE change from 76 4Ø CØ CØ to Ø4 ØØ FØ CØ

The program may also be modified to generate five character groups of mixed letters, figures and punctuation by changing 04F8 from 18 26 Ø4 1A to CØ CØ Ø4 3Ø.

My thanks to Ron Brown, VK7ZRO, for allowing me to test the program on his system.

At right is the full hex listing of the author's random Morse program. It starts at 0440.

```
0440 1F 05 E7 60 88 A8 90 40 28 D0 08 20 78 B0 48 E0
0450 A0 F0 68 D8 50 10 C0 30 18 70 98 B8 C8 7C 3C 1C
0460 0C 04 84 C4 E4 F4 FC 56 CE E2 32 7A 86 94 B4 B6
0470 4A 8C 54 00 00 E5 00 19 15 1A 0F 3B 2F 3B 2D 3B
0480 2B 3B 29 3B 27 3B 25 3B 23 17 3B 0F 3B 0D 3B 0B
0490 3B 1A D1 45 FE E5 80 18 6C 1B 5A 06 00 74 40 C0
04A0 C0 3B 14 76 40 C0 C0 3B 0E FA 72 17 06 00 76 40
04B0 C0 C0 3B 03 FA 78 17 04 5C F8 7E 17 09 14 0D 64
04C0 D3 85 01 E5 17 1A 02 05 00 C9 07 8D 64 D3 CD 64
04D0 D3 17 00 00 01 02 03 04 05 06 07 08 09 0A 0B 0C
04E0 0D 0E 0F 10 11 12 13 14 15 16 07 05 04 05 C8 29
04F0 0A 24 3B 3C C8 20 08 1E 18 26 04 1A C8 1B 0A 17
0500 3B 2E C8 13 C1 0D 64 43 CF 65 1A A7 01 14 08 06
0510 A4 01 C8 02 1B 62 00 00 00 00 00 00 00 00 00 00
0520 04 0A C8 75 0A 72 3B 08 C8 6E C1 0D 64 5D 1B 58
0530 3F 04 BC 82 1A 03 E8 61 16 A8 5E 1B 77 3F 04 EA
0540 07 06 0F 65 19 C1 3F 04 75 3B 90 3B 8E FB 73 04
0550 01 88 07 E4 00 15 C8 02 1B 63 00 04 00 0E 25 97
0560 14 3F 02 B4 1B 77 01 E0 00 00 00 00 77 0E 08 79
0570 05 00 07 11 75 01 D1 B5 01 18 04 E9 6C 1A 06 77
0580 01 A9 66 77 01 06 02 0E 45 6A D0 CE 65 6A 5A 77
0590 FB 64 09 57 75 FF 17 00 0A 0A 0D 52 41 4E 44 4F
05A0 4D 20 4D 4F 52 53 45 20 44 45 20 56 4B 37 52 4F
05B0 0A 0D 30 33 20 2D 20 32 35 20 57 50 4D 0A 0A 0D
05C0 53 54 41 52 54 49 4E 47 20 53 50 45 45 44 3F 0A
05D0 0D 00 0A 0D 20 20 57 50 4D 00 E7 30 1E 00 1D E7
05E0 39 1D 00 1D 47 0F 17 76 40 75 FF C0 C0 C0 C0 06
05F0 00 3F 05 5D 3F 04 BC 12 1A 7A 3F 02 86 C3 3F 02
0600 B4 3B 57 D3 03 D0 D0 83 CC 05 68 3F 02 86 C3 3F
0610 02 B4 3B 46 8F 05 68 CF 05 68 06 3E 3F 05 5D 0F
0620 05 68 E7 19 1D 00 1D E7 03 1E 00 1D E7 09 19 10
0630 A7 02 04 79 06 02 82 FB 7D CC 05 5C 05 30 1B 1A
0640 CF 05 69 0C 05 66 CC 05 6A 0C 05 67 CC 05 6B 3F
0650 05 6C 04 89 CC 05 5C 0D 05 6B CD 04 9C D1 CD 04
0660 AD 0C 05 68 C1 D1 D1 81 CC 05 54 20 CC 05 5A 3F
0670 05 3D 06 37 3F 05 5D 0D 05 68 E5 19 18 02 85 01
0680 CD 05 68 E5 0A 1A 0A E5 14 1A 04 85 0C 1B 02 85
0690 06 3F 02 69 1F 06 1A
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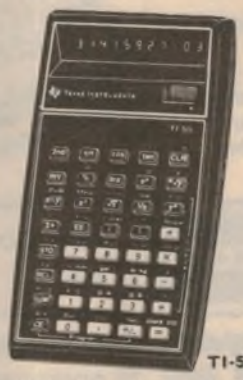
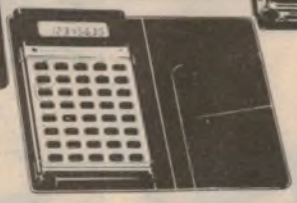


TI-55

TI-50

TI-25



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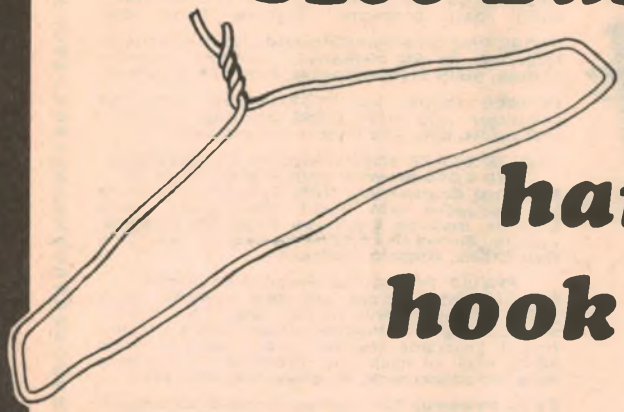

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DSE653

Adapt your D2 kit to run CHIP-8 programs

How would you like to run CHIP-8 programs on your Motorola MEK6800D2 evaluation kit system? Here is a memory/video interface circuit which lets you do just that. Build it and you can run just about any program written for the Dream 6800 or the RCA "VIP" systems.

by GRAHAM LEADBEATER*

Michael Bauer's excellent "Dream 6800" computer project as described in the May-August 1979 issues has captured the imagination of many people, enabling them to experiment with a simple high level language like CHIP-8 at low cost. However, there must be many people like myself who did not wish to build up a complete new computer, as they already have a Motorola 6800 D2 kit. If you're in this position, you may be interested in how I modified my D2 kit to run CHIP-8.

When we look at the problem of adapting Michael's interpreter program to the D2, everything drops into place. We already have a Monitor Program (J-Bug). We have the cassette interface and we have the keypad. Once we remove the software associated with these things from the CHIPOS PROM we will have plenty of space for program changes. We also have a PROM socket located at C000 to take our new program.

We will need a 50Hz interrupt input for the timer and an audio "bleeper". These are easily connected to the D2 kit's "User" PIA located at 8004-5.

What we don't have is a block of memory at 0200 for storing CHIP-8 programs, and a video interface. These are best built on a separate board designed to plug into the 86-pin "Exorcisor" bus as is the kit itself.

The prototype was hand-wired on a piece of matrix board for development, but to make a good job of it, an Exorcisor-compatible, wire-wrap board, available from Pennywise Peripherals, is recommended. Fig 1 shows the connections. Whether you use a card cage or just two sockets wired together is up to you.

The D2 kit comes with 256 bytes of memory in two 6810s with sockets provided for another 256 bytes. The last address used is 01FF but images extend to 1FFF because of incomplete address decoding. It would be possible to make our new memory start at 0200 but since 2114's are the cheapest way to make memory and since they come in 1K blocks, the decoding becomes a bit fiddly if they are not located on the 1K boundaries. It was decided to make a board which would allow for memory expansion and occupy the address range 0000-1FFF, containing up to 7K of 2114s for general purpose memory and 256 bytes in 6810s dedicated to the video display.

The idea is to remove the 6810s from the D2 Kit and open up the bottom 8K of memory for off-board expansion as described in the kit handbook. The 6810s can now be used in the new board.

It is suggested that you build a board with 1K of memory (two 2114s) for a start but leave space for another 12 ICs which can be added later if you have the inclination and the money. Note that CHIP-8 is limited to the first 4K anyway. The Video RAM can be used as ordinary memory when not running CHIP-8 (just switch off your TV set).

Fig 2 shows the circuit. This looks a bit of a monster at first glance, but it is really fairly straightforward. Note that the Video RAM is permanently enabled and is connected to the data bus via tri-state transceivers (ICs 19 and 20). The signals to separately enable their sending and receiving sections are derived from the $\overline{VRAM}$ decoder output and the R/$\overline{W}$ and $\phi 2$ lines.

The video circuitry calls for some comment. It was decided not to halt the processor while the picture is scanned, as the D2 Kit has a slow clock to start with (614.4kHz). Instead, the address lines to the Video RAM are normally driven by the scanning counters but are switched over to the processor address bus whenever this part of memory is accessed. This is done with the 74LS157 devices. The 74LS157 is a quad 1-of-2 data selector and can be likened to a relay with four sets of changeover contacts (but a bit faster). Two of them switch the eight low-order address lines. (ICs 11 and 12). The Video RAM looks just like ordinary memory to the processor. The picture is blanked whenever this RAM is accessed.

Since we don't have to compromise between picture size and processor thru-put, the picture has been enlarged to better fill the screen. Each dot is now 0.667us wide and six lines high.

The theory of operation remains the same, only the figures have been changed to protect the innocent!

We start with a 3 MHz oscillator, the output of which is divided by two to

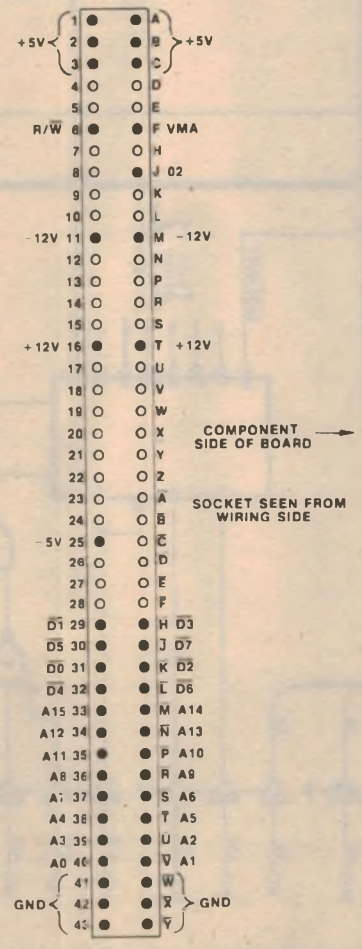
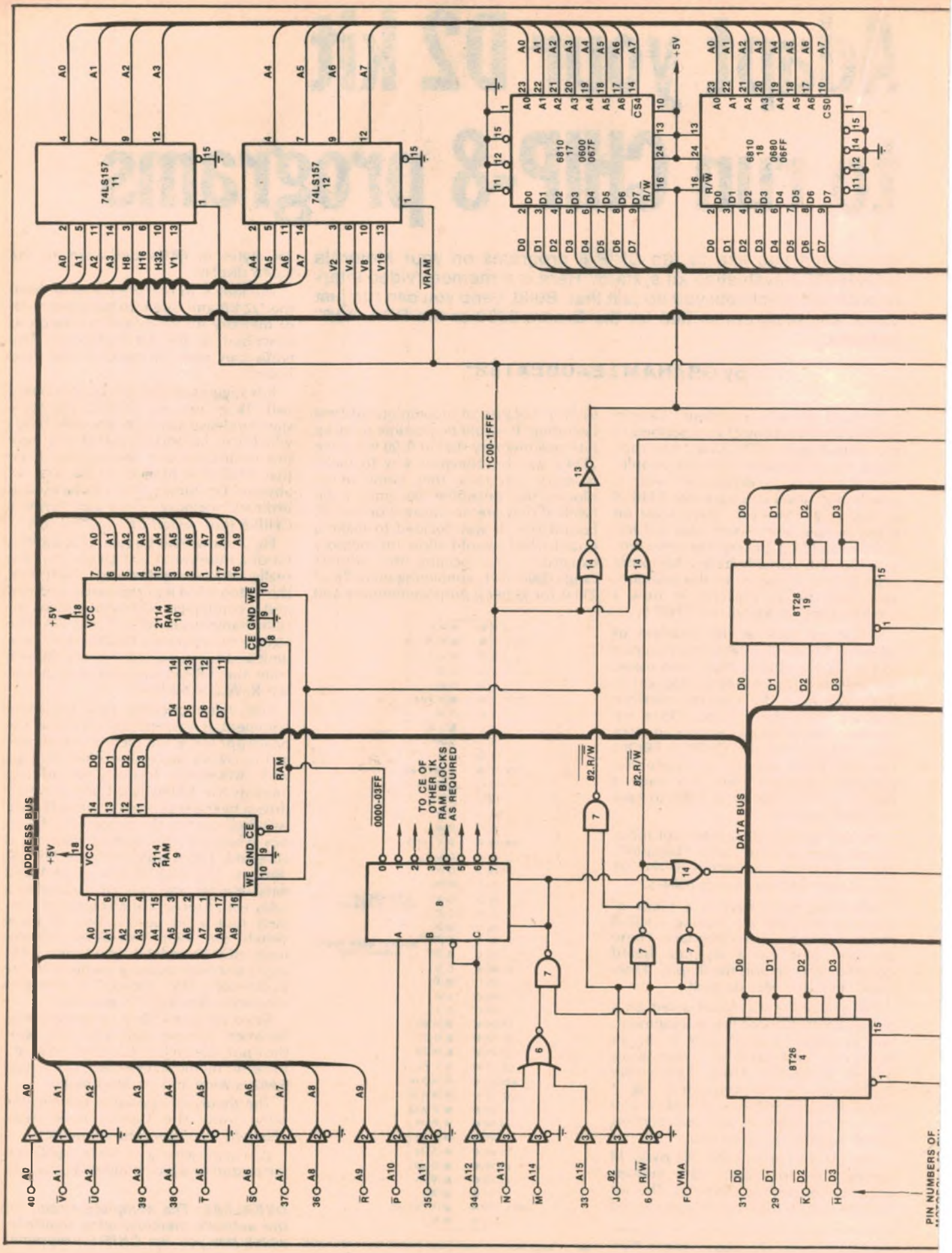
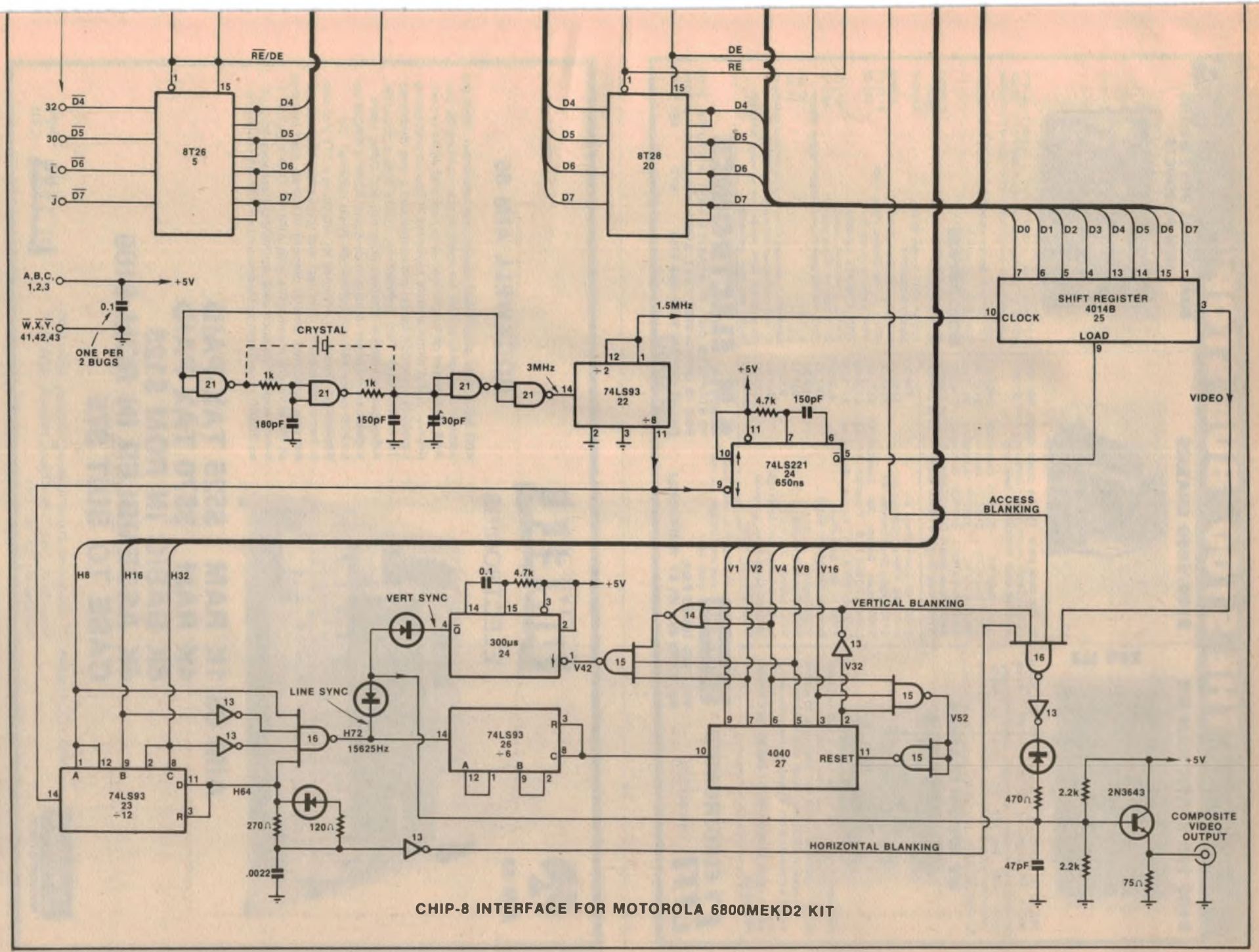


FIG. 1 : RELEVANT CONNECTIONS TO THE MOTOROLA BUS

OVERLEAF: The complete circuit for the author's memory/video interface, which lets you run CHIP-8 programs.

*16 Ellison Street, Ringwood, Victoria 3134


74LS157
11
74LS157
12
6810
17
0600
067F
6810
18
0680
06FF
2114
RAM
10
2114
RAM
9
8T28
19
8T26
4
8
VRAM
1C00-1FFF
RAM
0000-03FF
TO CE OF
OTHER 1K
RAM BLOCKS
AS REQUIRED
ADDRESS BUS
DATA BUS
+5V
VCC
GND
CE
WE
R/W
CS4
CS0
VMA



CHIP-8 INTERFACE FOR MOTOROLA 6800MEKD2 KIT

CHIP-8 FOR THE D2

produce the dot clock. This is divided by eight to give the load pulse to the shift register. These divisions are performed by IC22. IC23 now divides by 12 to produce the line sync frequency of 15625Hz. The pulses from the first stage of this counter are 5.3us wide which is near enough to the required 5us line sync pulse. The 64us per TV line is equivalent to 96 dots, but we only want 64, the remaining 32 represent the horizontal blanking period. Gating is arranged to put the line sync pulse in the middle of this period to centre the display in the screen.

To give square dots we would need 5.3 lines per dot, which is a bit hard to do; so we will settle for six. Line sync pulses are counted by IC26, which divides by six. Unfortunately we can't use the first stages of the 4040 (IC27) as we could if dividing by four or eight. The outputs from the first five stages of the 4040 provide the addresses for the 32 rows of dots. The 312 lines per TV field represent 52 rows of dots so IC27 is reset on the count of 52. We only want 32 rows so the sixth stage is used to provide vertical blanking for the remaining 20. The vertical sync pulse is positioned in the middle of this blanking period, ie at 42.

The 3 MHz oscillator features reliable starting and adequate stability. Keep all leads as short as possible. If you have a 3 MHz crystal it can be connected as shown dotted, omit the trimmer and change the 180pF to 150pF. IC21 must be a 74LS00.

I estimate the cost of the ICs to be around $60 ($75 if you include the 2708).

The 8T28s could be replaced by three 74LS367s or any other non-inverting tri-state buffers.

The buffers on the address bus (ICs 1, 2 & 3) could possibly be omitted but I consider the few dollars that they represent to be a good investment to reduce bus loading in big systems and to keep MOS inputs off the edge connector.

Changes to the software are relatively

IC IDENTIFICATION

IC 1	74LS367	IC15	74LS10
IC 2	74LS367	IC16	74LS20
IC 3	74LS367	IC17	6810
IC 4	8T26	IC18	6810
IC 5	8T26	IC19	8T28
IC 6	74LS27	IC20	8T28
IC 7	74LS00	IC21	74LS00
IC 8	74LS155	IC22	74LS93
IC 9	2114	IC23	74LS93
IC10	2114	IC24	74LS221
IC11	74LS157	IC25	4014B
IC12	74LS157	IC26	74LS93
IC13	74LS04	IC27	4040B
IC14	74LS02		

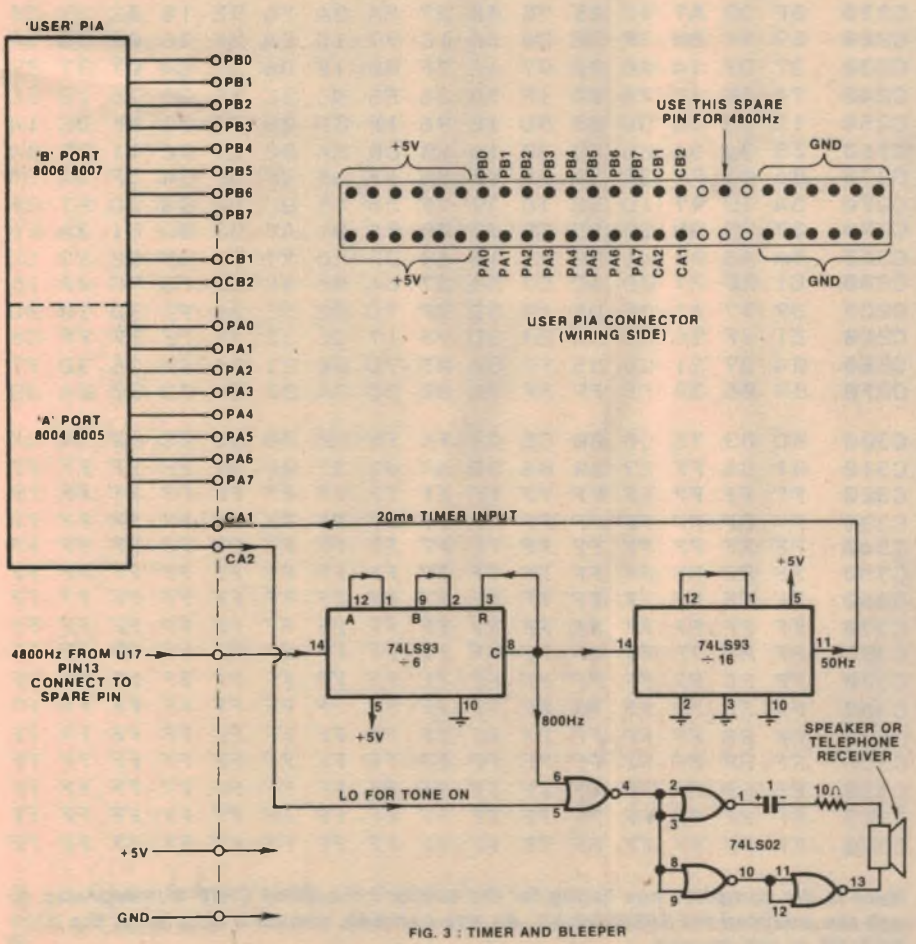


FIG. 3 : TIMER AND BLEEPER

CHIP-8 FOR THE D2

minor until we get to the keypad routines. The D2 keypad cannot just be read like the DREAM, it must be scanned and decoded. Unfortunately there are few subroutines accessible in J-Bug for this purpose, so we must provide our own.

The PIA initialisation subroutine at C287 is no longer needed. A new Keypad Input Subroutine (KEYINP) is now located at C287. It makes use of some minor subroutines and the look-up table of key values in J-Bug. A new GETKEY subroutine follows at C2C4 (the same address as the old one). It is a bit simpler since we don't need the function key. Tone generating subroutines follow at C2DA and the new interrupt service routine is located at C2F6.

To run CHIP-8 we use the monitor to enter at C300. A set-up routine is located here which writes the start address of the interrupt service routine into the J-Bug pseudo IRQ vector at A000-1. Then it initialises the timer/tone PIA at 8004-5, clears the interrupt mask and jumps to the start of the CHIP-8 mainline at C000.

Nearly a quarter of the 2708 PROM is left over and could be used for extensions to CHIP-8.

The only requirement for the timer is a 50Hz signal into the CA1 lead to the PIA but it must be an accurate 50Hz if the computer is to be used for serious timing applications or even if you just want to "write" a digital clock. The 50Hz could simply come from the mains and the bleeper need only be something that make a noise while CA2 is low.

One approach is shown in Fig 3 which uses the D2's crystal as the timebase and also provides the source of tone.

There is scope for ingenuity here. You could for example, pick other frequencies out of the divider chain and use the PIA outputs to select them. Resistors could also be switched in or out by transistors driven by the PIA to make a crude programmable attenuator.

With program control over frequency, amplitude and duration of tones, you could just about make your computer talk to you. Machine code subroutines for this purpose could be stored in the empty space in the PROM and called via jumps in the accessable area.

In fact, a program to convert ASCII to speech could be the subject of an article for the April issue of EA!

So there you are, D2 owners, the world of CHIP-8 is open to you. Happy programming!

In conclusion, the author would like to thank Michael Bauer for his patience on the telephone, explaining software.

```
C000  8D 77 CE 02 00 DF 22 CE 00 7F DF 24 DE 22 EE 00
C010  DF 28 DF 14 BD C0 D0 96 14 84 0F 97 14 8D 21 97
C020  2E DF 2A 96 29 44 44 44 44 8D 15 97 2F CE C0 48
C030  96 28 84 F0 08 08 80 10 24 FA EE 00 AD 00 20 CC
C040  CE 00 2F 08 4A 2A FC A6 00 39 C0 6A C0 A2 C0 AC
C050  C0 BA C0 C1 C0 C8 C0 EE C0 F2 C0 FE C0 CC C0 A7
C060  C0 97 C0 F8 C2 1F C0 D7 C1 5F D6 23 26 25 96 29
C070  81 E0 27 05 81 EE 27 0E 39 4F CE 1C 00 A7 00 03
C080  8C 1D 00 26 F8 39 30 9E 24 32 97 22 32 97 23 9F
C090  24 35 39 DE 14 6E 00 96 30 5F 9B 15 97 15 D9 14
C0A0  D7 14 DE 14 DF 22 39 DE 14 DF 26 39 30 9E 24 96
C0B0  23 36 96 22 36 9F 24 35 20 E8 96 29 91 2E 27 10
C0C0  39 96 29 91 2E 26 09 39 96 2F 20 F0 96 2F 20 F3
C0D0  DE 22 08 08 DF 22 39 BD C2 87 7D 00 18 27 07 C6
C0E0  A1 D1 29 27 EB 39 C6 9E D1 29 27 D0 20 D5 96 29
C0F0  20 3B 96 29 9B 2E 20 35 8D 38 94 29 20 2F 96 2E

C100  D6 29 C4 0F 26 02 96 2F 5A 26 02 9A 2F 5A 26 02
C110  94 2F 5A 5A 26 0A 7F 00 3F 9B 2F 24 03 7C 00 3F
C120  5A 26 0A 7F 00 3F 90 2F 25 03 7C 00 3F DE 2A A7
C130  00 39 86 E0 97 2C 7C 00 2D DE 2C 96 0D AB 00 A8
C140  FF 97 0D 39 07 C1 79 0A C1 7D 15 C1 82 18 C1 85
C150  1E C1 89 29 C1 93 33 C1 DE 55 C1 FA 65 C2 04 CE
C160  C1 44 C6 09 A6 00 91 29 27 09 08 08 08 5A 26 F4
C170  7E E0 8D EE 01 96 2E 6E 00 96 20 20 B0 BD C2 C4
C180  20 AB 97 20 39 16 7E C2 E1 5F 9B 27 97 27 D9 26
C190  D7 26 39 CE C1 BC 84 0F 08 08 4A 2A FB EE 00 DF
C1A0  1E CE 00 08 DF 26 C6 05 96 1E 84 E0 A7 04 09 86
C1B0  03 79 00 1F 79 00 1E 4A 26 F7 5A 26 EB 39 F6 DF
C1C0  49 25 F3 9F E7 9F 3E D9 E7 CF F7 CF 24 9F F7 DF
C1D0  E7 DF B7 DF D7 5D F2 4F D6 DD F3 CF 93 4F DE 26
C1E0  C6 64 8D 06 C6 0A 8D 02 C6 01 D7 0E 5F 91 0E 25
C1F0  05 5C 90 0E 20 F7 E7 00 08 39 0F 9F 12 8E 00 2F

C200  DE 26 20 09 0F 9F 12 9E 26 34 CE 00 30 D6 2B C4
C210  0F 32 A7 00 08 7C 00 27 5A 2A F6 9E 12 0E 39 D6
C220  29 7F 00 3F DE 26 86 1C 97 1C C4 0F 26 02 C6 10
C230  37 DF 14 A6 00 97 1E 7F 00 1F D6 2E C4 07 27 09
C240  74 00 1E 76 00 1F 5A 26 F5 D6 2E 8D 28 96 1E 8D
C250  15 D6 2E CB 08 8D 1E 96 1F 8D 0B 7C 00 2F DE 14
C260  08 33 5A 26 CB 39 16 E8 00 AA 00 E7 00 11 27 04
C270  86 01 97 3F 39 96 2F 84 1F 48 48 48 C4 3F 54 54
C280  54 1B 97 1D DE 1C 39 7F 00 18 BD E0 84 BD E1 2F
C290  27 2B BD E0 DD CE 80 20 86 01 A7 02 BD E1 3A 26
C2A0  0A A6 02 81 20 27 16 68 02 20 F1 16 4F CE E3 DC
C2B0  E1 00 27 0D 8C E3 EB 27 04 08 4C 20 F3 7C 00 18
C2C0  39 97 17 39 DF 12 8D BF 7D 00 18 26 F9 8D 10 BD
C2D0  E1 2F 26 FB BD E0 DD 96 17 DE 12 39 FF FF FF C6
C2E0  04 D7 21 C6 35 F7 80 05 7D 00 21 26 FB C6 3D F7
C2F0  80 05 39 FF FF FF 7A 00 20 7A 00 21 7D 80 04 3B

C300  8D 03 7E C0 00 CE C2 F6 FF A0 00 0E CE 80 04 6F
C310  01 C6 FF E7 00 86 3D A7 01 E7 00 39 FF FF FF FF
C320  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C330  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C340  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C350  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C360  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C370  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C380  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C390  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C3A0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C3B0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C3C0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C3D0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C3E0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
C3F0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Here is the complete hex listing for the author's modified CHIP-8 interpreter, to suit the adapted mEK6800D2 kit. As you can see, almost a quarter of the 2708 EPROM is left unused.

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Microcomputer News & Products

Melbourne's Home Computer Show a roaring success

Peter Alpar from Futuretronics puts the Bridge Challenger through its paces at the recent Melbourne Home Computer Show.

The Home and Small Business Computer Show held in Melbourne in September continued the impressive growth seen at earlier shows. Total attendance over the four days was 17,400, well up on the 14,000 who attended the May show in Sydney and the 6000 who visited last year's Melbourne show.

Some 2000 of those who visited the show were secondary school students, in official school excursion groups. This indicates the degree of interest being generated by computers at secondary school level.

Some 59 exhibitors had stands at the show, displaying the latest personal and small business systems as well as microprocessor based products for the mass consumer market. A program of seminars was also held on the second day, and these were well attended.

In the second round of the Australian Computer Chess Championships, the Fidelity Electronics Chess Challenger (marketed by Futuretronics) again proved itself superior to all competition. A door prize of a Dick Smith System 80 computer was won by Mr Disseldorp, Pascoe Vale, Victoria.

NEXT SHOW

The next Home and Small Business Computer Show is planned for Adelaide, in March. After that there will be the next Sydney show, to be held in the Westco pavilion at the Showgrounds, from May 22 to 25. Further details regarding both shows are available from the organisers, Australian Seminar Services, 190 Albert Road, South Melbourne 3205. Telephone (03) 690 3833.

ONYX C8000

Computerland has announced the availability of the Onyx C8000, claimed to be one of the new generation of microcomputer systems and probably the most powerful microcomputer currently available. It sports many of the features normally considered by the EDP industry to be essential in a business system: Memory parity, a full 64K memory, run time monitor with start-up diagnostics, an "orderly shut-down" routine, fully integrated 10 megabyte hard disk (20cm Winchester technology), an integrated backup system with 12 megabyte cassette storage, and a comprehensive and powerful operating system (OASIS or PASCAL) with full complement of languages — BASIC, FORTRAN, COBOL and a full line of business and commercial applications packages.

The C8000 has three serial ports and one bidirectional parallel port. One serial port is programmable to support data communications and will interface with most synchronous and asynchronous modems. The 8-bit parallel port has six general-purpose control lines and can be programmed as either an industry standard (Centronics) printer interface or as a DMA controlled bidirectional port for connecting the C8000 to another computer.

UPGRADES TO Z8000

The basic C8000 uses a Zilog Z80A microcomputer. However it can be upgraded at any time by the addition of a 16-bit Z8000 processor, a two-hour field conversion. This gives a system with either 256K or 512K bytes of RAM and the ability to support up to eight user terminals. The original Z80 board is not made obsolete by this upgrading — it becomes an intelligent file management system for the Z8000 host processor.

Further information on the Onyx C8000 system is available from Computerland, 55 Clarence Street, Sydney.

MICRONEWS CONTINUED ➡

Microcomputer News & Products

S100 SLAVE PROCESSOR

Microprocessor Applications Pty Ltd, a small Melbourne-based firm, have released a new S100 slave interface board. The board may be used for a variety of tasks as it features its own 8085 microprocessor with 4k of usable RAM and 2k of EPROM. An RS232 port is also provided with software-selectable Baud rate.

Initial applications include allowing the board to emulate Burroughs' "polling and select" protocol without affecting the main S100 processor. A "direct connect" adaptor (TDI) is also available.

For further information, contact Microprocessor Applications on (03) 754 5108.

APPLE CORVUS

Corvus Systems has announced an interface which allows Apple II microcomputers to be connected to a 20cm Winchester-technology hard disk drive, for memory expansion to 11 megabytes. The new Corvus 11A system consists of an IMI 7710 disk drive with Corvus intelligent controller and power supply, together with an intelligent module for the Apple. The latter consists of an interface card and associated software.

The system software interfaces with the Apple Disk II operating system to provide complete compatibility with DOS commands and existing DOS applications. This is accomplished by maintaining 82 physical volumes on disk, that are sector by sector compatible with Apple memory volumes. All 82 volumes are effectively "on line" concurrently, such that any application program can utilise the entire data base by simple use of DOS syntax.

The Corvus system supports standard Apple II DOS as well as the recently announced UCSD PASCAL language system.

Interfaces for Tandy TRS80 and S-100 systems are being developed.

Electronic Concepts Pty Ltd has been appointed Australian distributor for Corvus. The 11A disk system will be available through Computerland outlets throughout Australia; also from selected agents.

LOGIC SHOP

Situated in Melbourne at 212 High St, The Logic Shop Pty Ltd has just opened with a range of microcomputer terminals and peripherals from Compucolor, Decwriter, Texas Instruments, QUME and others. Take a look, they are well worth investigating.

BRIGHTON TECHNICAL COLLEGE CHOOSES TEKTRONIX

Victoria's Brighton Technical College has ordered five Tektronix 8002A Microprocessor Development Systems. Valued at $140,000, the equipment is to be used in support of the government's Microprocessor Aid Program (MAP) which is aimed at increasing the industrial and commercial applications of microprocessor technology.

Initially, the Department of Electrical Engineering at the College will employ the system to train engineers in the use of assembler language and the development of systems covering a wide range of microprocessors. However, the scheme will be kept flexible in order to accommodate the needs of local industry and other users.

The Tektronix 8000 Series Micro Development Labs offer support for a wide range of micros allowing the user flexibility in selection of the right chip for each purpose. The range of micros supported by the 8000 Series is being rapidly increased in line with the continued advances in microprocessor design.

Shown is the Tektronix 8002 Microprocessor Development System, of which five have been ordered by Brighton Technical College.

IMS DIRECT MAIL

A software package for the management of mailing lists on small microcomputer systems has been released by IMS Computer Systems, a division of Integrity Management Services Pty Ltd. The package is called the IMS Direct Mail System.

The package caters for any business with a names and address file of clients, prospective clients, users, etc. In addition to having 12 fields covering surname, title, company, position held, address, etc, it contains the date the entry went on to the file plus a 30 digit KEY field. This KEY field allows the user to assign KEY words and place user defined values to each of 20 fields. These fields can then be used, in any combination, to select individuals who satisfy specific selection criteria.

The system can produce reports, write letters and/or prepare labels for those selected. Word processing facilities are included in the package, which comes complete with a comprehensive operating manual for $500.

The package is written in CBASIC2 and runs under CP/M, the most popular of the operating systems for microcomputers. Hardware which is suitable includes the EDC1, ALTOS, CROMEMCO, VERSATILE 4, SBC1, SUPERBRAIN, etc. IMS can supply the software, the hardware and software system or bureau facilities.

For further information, contact IMS Computer Systems on (03) 51 9156 or (02) 922 6319.

MICRONEWS CONTINUED ➔

Microcomputer News & Products

Anaclex Printer

Bell and Howell has announced an addressable printer interface for connecting the Anadex DP-8000 printer with the Commodore PET microcomputer. The interface is supplied in OEM form and attaches directly to the back of the Pet IEEE port. A hard wired cable connects to the DP-8000 input port. The interface also provides an IEEE port for connection of other peripherals.

A new pricing schedule has also been announced for the DP-8000 printer, to encourage the growing OEM market. The new schedule offers attractive OEM discounts starting at $850 plus tax for quantities of 1-15.

Further details from the Electronics and Instrumentation Division of Bell & Howell Australia Pty Ltd, 55-69 Murray Street, Pyrmont NSW.

New DREAM 6802

J. R. Components, PO Box 128, Eastwood, NSW, have produced a new version of the very successful DREAM 6800 microcomputer published earlier this year in this magazine. Using a new PCB and the new 6802 microprocessor which has its own internal clock, the new design neatly solves the problem of non-availability of the 6875 clock chip. J. R. Components have also produced a 2.5 amp version of the power supply to cope with any likely expansion.

SWTP Distributor for Victoria

G.F.S. Electronic Imports, of 15 McKeon Road, Mitcham, Victoria, have been recently appointed Victorian distributor for South West Technical Products Corporation.

In Brief

● There is a rumour circulating that pioneering US microcompute firm Imsai has been declared bankrupt. Also that Processor Technology has ceased manufacturing, for unspecified reasons.

● Cromemco has released a hard disk system using a 20cm Winchester drive to provide 11 megabytes of storage. As an upgrade facility the HDD-11 system comes in the same case as the System 11, and costs $6750. Further details from Melbourne's Byte Shop, 17 Arawatta Street, Carnegie, Victoria 3163.

● Patents have apparently been granted to Apple Computer Co in the USA for the switching-mode power supply and video display designs in their Apple II microcomputer. As it is unusual for patents to be either sought or granted for such "run of the mill" circuit subsystems, Apple is particularly proud of the new patents. Both subsystems were designed by Apple's vice-president, Rod Holt, in 1976.

From the clubs . . .

Computerland of Adelaide, 131 Pirie Street, has been selected as the venue for the Apple Computer User's club. First meeting was scheduled for October 23. Membership is open to anyone interested in Apple Computers, not just existing users. There are now over 600 Apple computers in use in Australia. Further information may be obtained from Computerland of Adelaide.

A new microprocessor club has been formed in Manly, NSW. They meet on the second Monday of each month at the Manly Youth Centre, Kangaroo St, Manly (behind the War Memorial Club). They extend an invitation to all people interested in both hardware and software aspects of microcomputers. All age groups are catered for. More information is available from Lionel Hirning on (02) 98 7338 or Ron Bloom on (02) 938 1476.

● The new secretary of the Tasmanian Amateur Computer Society is Richard King, replacing Clive Myers who has resigned. Mail address of TACS is PO Box 474, Sandy Bay, Tasmania 7005.

The COMMODORE PET is a completely self contained personal computer. Just plug in, and within a few short hours even the complete novice will be amazed at what can be done. The 8K model is shown. The 16K and 32K models have full size typewriter keyboard and numeric pad. External Cassette, Dual Drive Intelligent Minifloppy and Printers are also available. All models are expandable to 40K and have a built in real time clock. PET FOOD A large range of programs including games, business applications and even a program to teach yourself Basic are available. $200 WORTH OF PROGRAMS FREE WITH EVERY 8K PET.

We handle the complete TRIO test equipment range. The CS-1352 Dual Trace C R O. pictured above features 15MHz bandwidth, 2mV/div, 0 5S to 0 5uS/cm, and AC-DC-Battery operation. $740 includes rechargeable batteries. PC-29 probes to suit CS-1352 $32 ea.

The B & K range of Test Equipment includes quality laboratory standard units such as the Model 283 Digital Multimeter shown above — $211. Other gear includes Signal & Function Generators, Power Supplies, Capacitance meter, Frequency Counters and Semiconductor Testers.

L12 P/03 RCF manufacture a large range of PA, Hi-Fi and Disco sound equipment including speakers (system & components), amplifiers, pre-amps, mixers, microphones, crossovers, and all accessories. For example the L12P/03 (pictured) is a 320mm professional 8OHM loud speaker rated at 35 Watts RMS (50 Watts Peak) and with a 75 to 7000Hz response. Cost is only $57.00 ea.

H025H02

The range of Plessey Foster speakers include Wide Range, Guitar, Woofers, Mid Range, tweeters and Crossovers. For example the HO25HO2 pictured, is a Mid Range Horn 8 ohm speaker with 12W RMS (30W Peak) power handling and a response from 1500 to 14,000Hz. Cost is only $17.00 ea.

KSN1001

KSN1025

In our range are the Motorola Piezo-Ceramic tweeters. For example, take the two pictured. The KSN1001 A will handle 100W with a response from 4K to 30KHz. The KSN1025 A will handle 150W with a 2K to 30KHz Response. These tweeters feature excellent transient response, low distortion, high impedance, high reliability and light weight. The KSN1001 A is only $11.00 and the KSN1025 A is only $21.00 (no crossover is required).

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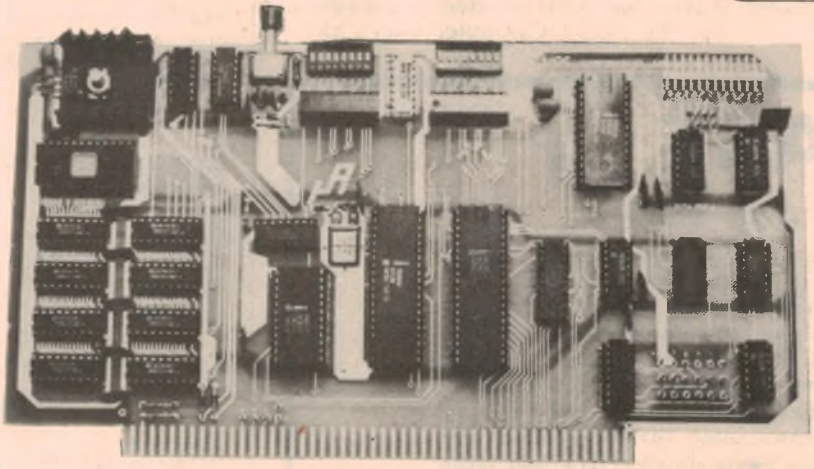

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Electronic bongo drums

Basic Electronics

by GERALD COHN

Did you know that a simple circuit can give a remarkably realistic simulation of a set of bongo drums? In this article we show how to make your own electronic bongos for a fraction of the price of the real thing. And you can play them in exactly the same way as with real bongos.

With the advent of synthesizers, it has become possible to simulate just about all musical instruments. Even the magnificent pipe organ has been challenged by its electronic counterparts. But while many instruments are quite difficult to simulate, percussion instruments such as bongo drums are a "piece of cake". You don't need anything as complicated as a synthesizer.

The reason why it is easy to simulate the sound of bongos and other percussion instruments is that their physical behavior is relatively easy to analyse and understand. And having been analysed, it turns out that the electrical analogue is a simple and familiar circuit.

Percussion instruments may be broadly defined as those which are struck, whether by hand, drumsticks or other implements. Rigid objects which are struck forcibly tend to vibrate with the frequency, waveform and duration of the vibration dependent on the type of material and its shape.

For example, if the object to be struck is a tuning fork it will vibrate at a single frequency and the waveform will closely approximate a sinusoid, or in more familiar terms, a sine wave. The vibration will be sustained for a relatively long time.

At the other extreme, if the object to be struck was a large block of concrete, the resulting vibration would be small and of short duration. In describing the vibration we would say it was heavily "damped". By contrast, the tuning fork has a vibration which is lightly damped.

In between these two extremes fall most percussive instruments. To similate these, we create an electrical analog: a circuit which resonates in a controlled manner when an electrical impulse is applied to it. This circuit will have a means for setting the frequency of oscillation (or vibration) and a means for controlling the damping of the oscillation.

One possible form of this electrical analog is the twin-T oscillator. For a set of bongos, two of these oscillators are required. Our circuit uses two twin-T oscillators and very little else.

The name "twin-T" is a reference to the configuration of the two RC phase shift networks in each oscillator. Sometimes this oscillator circuit is also referred to as a "parallel T" oscillator.

Each oscillator can be considered to be a common-emitter amplifier with a feedback network connected between collector and base. In this case, the feedback network is the "twin-T". In our circuit, one "T" is comprised of two 56k resistors in series, together with a capacitor from their junction to the negative rail. The other "T" comprises two .01uF capacitors in series with a 50k pot connected from their junction to the negative rail.

The "twin-T" is actually a nulling network which produces a maximum attenuation at its centre frequency together with a phase shift of 180 degrees. Now if we use this network as the feedback path of a common-emitter amplifier we find that the inherent 180 degree phase shift in the C-E amplifier plus the phase-shift of the twin-T adds up to 360 degrees at the centre frequency.

This means that positive feedback is being applied to the amplifier at the centre-frequency of the twin-T network. Thus we have an oscillator.

The twin-T oscillator may be made to oscillate continuously or it may be adjusted so that it oscillates for a short period, with controlled decay, when fed with an electrical impulse. In our circuit, each oscillator will produce a continuous sinewave output when the 50k potentiometer is set to a minimum.

Increasing the resistance of the 50k pot will cause the amplitude to decrease to the point where the oscillator stops altogether. At this point the oscillator is said to be "quiescent". An electrical impulse applied to either of the two T-networks or to the base of the transistor will then shock the circuit into brief oscillation, and the degree to which the oscillation is sustained will depend upon the setting of the pot. If it is set for maximum resistance, the oscillation will decay very quickly.

Two potentiometers allow the Bongos to be individually tuned.

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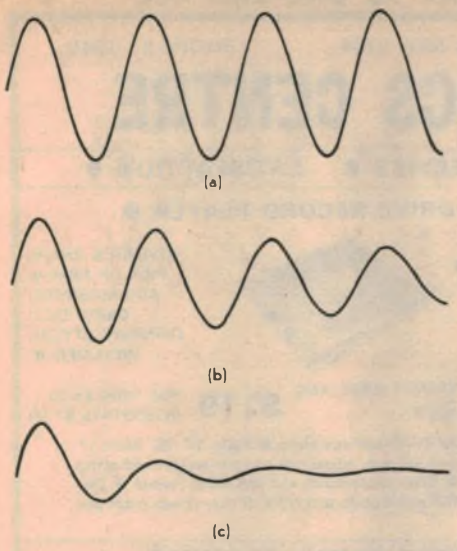
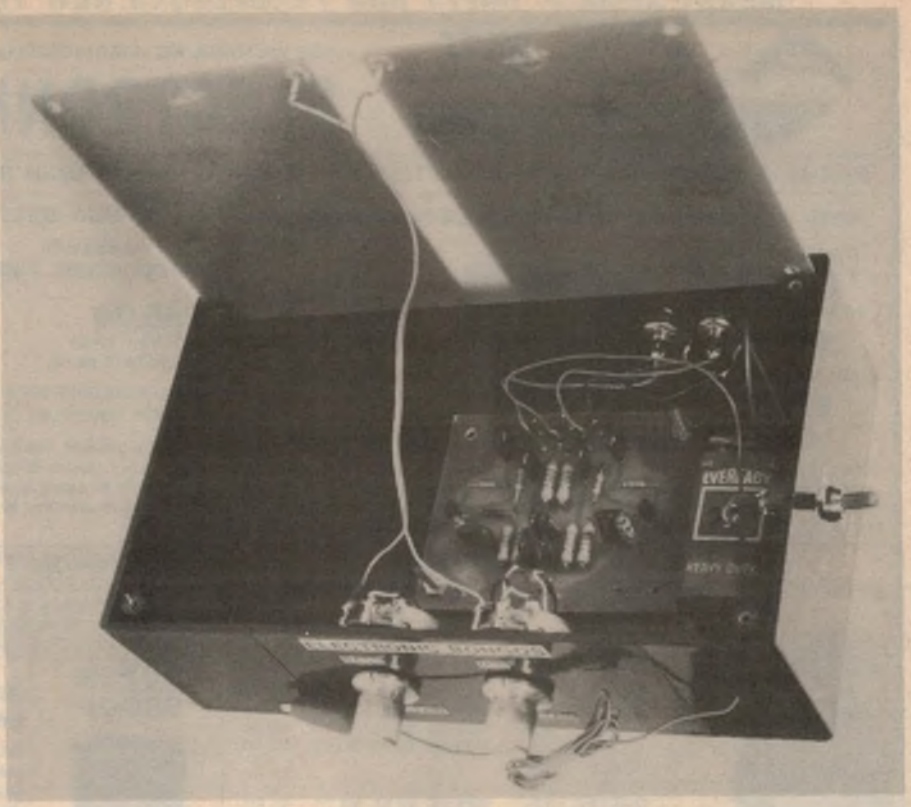


FIG. 1

The above waveforms show the three modes of oscillation possible with a twin-T oscillator: (a) continuous; (b) lightly damped; and (c) heavily damped.



This photograph shows the internal construction of the unit. The two 47k resistors in series with the touch plates can be seen mounted underneath the touchplate PCB.

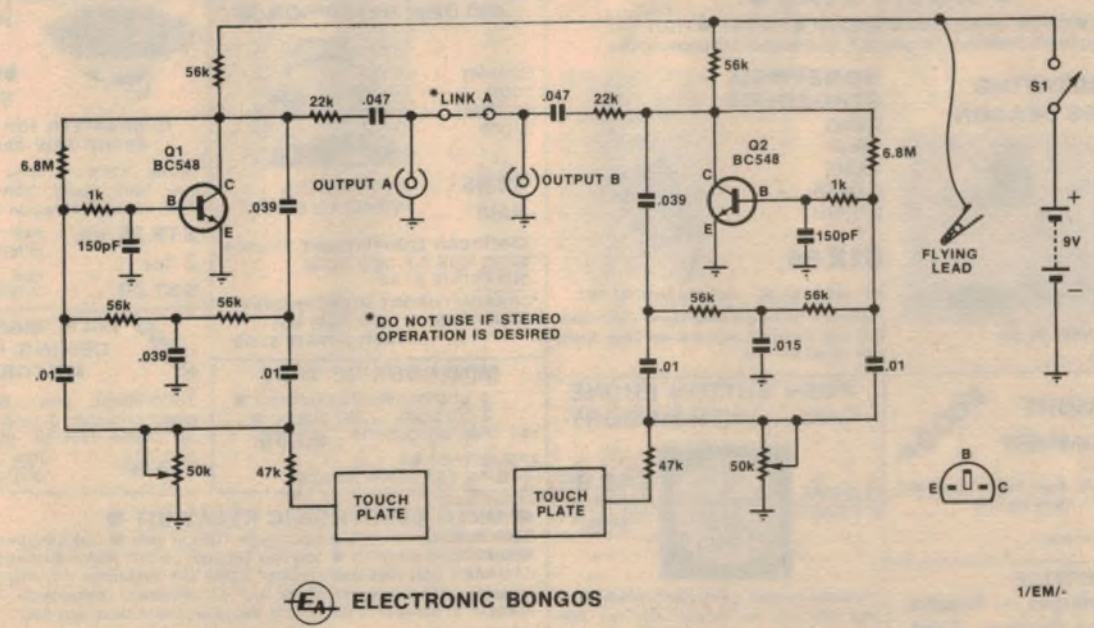
On the other hand, if the 50k potentiometer is set so that the circuit is just on the point of oscillation, the result of an electrical impulse will be oscillation which decays very slowly.

Fig 1 shows the modes of operation that are possible. 1(a) shows a continuous oscillation at a constant amplitude, 1(b) shows a lightly damped oscillation and 1(c) shows a heavily damped oscillation.

The electrical impulse to shock the oscillator into the ringing mode is obtained by touching the plates connected to the junction of the T-networks containing the pots. In some cases the "stray" hum fields will be strong enough for the oscillators to be triggered when the plates are touched, (ie, the hands are used to momentarily inject hum into the circuit).

In most situations, there is not enough stray hum field, so a lead connected to the positive supply rail has been provided. This is held in the hand or connected to the player's metallic watchband if this proves more convenient. In this case, a DC pulse is injected into the circuit via the player's skin resistance when the respective plates are touched.

47k resistors connect the touch plates to the respective oscillators. These resistors, together with the 1k resistors and 150pF capacitors at the base of each



The circuit consists of two twin-T oscillators. The link allows the unit to be used in the mono mode.

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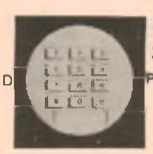

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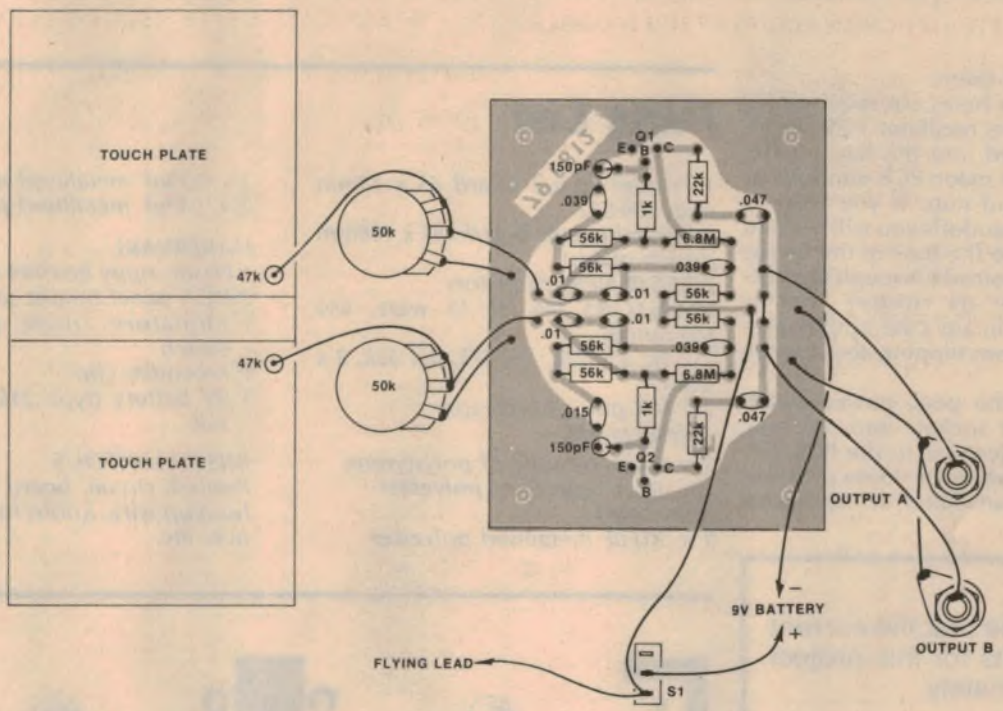
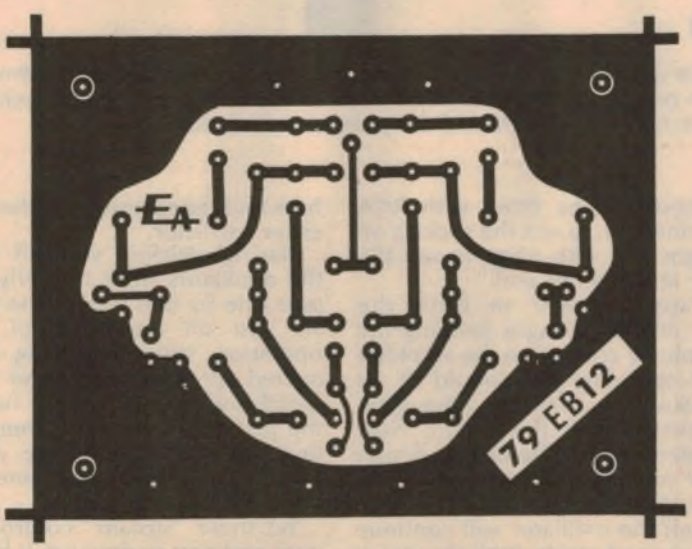


Use this wiring diagram, together with the circuit, as a guide to construction.

transistor are for RF suppression. Without these components, the circuit tends to pick up and detect strong RF signals, usually from the local radio station.

Output from the circuit is in the form of two independent channels, one for each oscillator. There is also a provision on the board for the insertion of a link so that the output can be made mono. When used as a stereo unit you will find that the results can be quite interesting with, say, the bass drum in the right hand channel and the other drum in the left channel.

So much for the working of the circuitry. Now let's take a look at the construction of the unit. Two printed circuit boards and a plastic utility box make up the unit and the assembly of these should only take a couple of hours at the most. The first of the two boards is a replacement for the lid of the box and forms the touch plates, but more about this later. The other PCB contains all the electronics.



A full size reproduction of the printed circuit board artwork.

This latter board measures 65 x 83mm (coded 79EB12) and accommodates all the circuitry for the oscillators, with the exception of the pots.

Assembly of the printed circuit board is a simple process and should only take half an hour or so. A component overlay diagram has been provided to assist you in the placement of the components. Take care to insert the two transistors correctly.

We recommend the use of PCB pins for external connections as they make the final assembly task easier and neater.

Once the board assembly is complete, go back and check that all the components are correctly installed and also inspect the solder joints, as a dry joint can be a most frustrating thing when a circuit refuses to work.

Having checked the board put it aside and start on the preparation of the box that is to house the unit. The box that we used for the prototype measures 114 x 197 x 60mm. The aluminium lid that is supplied with the box is replaced by a second printed circuit board that forms the touch plates for the drums, as mentioned earlier.

Six holes need to be drilled into three sides of the box, two for the pots, another two for the output connectors, another for the power switch and the final hole for the flying lead. The positions of these holes is not critical, and a look at the photographs will show

how we placed them.

A further two holes are required for mounting of the oscillator PCB which can be mounted into the base of the box using either nylon PCB standoffs or using screws and nuts. If you elect to use the nylon standoffs you will need to fit rubber feet to the base of the box as the standoffs protrude through the bottom. The use of rubber feet is recommended in any case as they prevent the unit from slipping about while being played.

Now install the pots, power switch and the output sockets into the box, and make connections to the PCB. For those readers that live in close proximity to a radio transmitter, it may prove necessary to use shielded cable for the connections from the PCB to the pots and output sockets.

The two 47k resistors (shown on the circuit diagram to be in series with the touch plates) are mounted on the underside of the touch plate PCB (see photograph). The wires to the touch plates connect from the free ends of the 47k resistors to the pots and should be approximately 16cm long.

The battery was mounted on the base of the box using double sided adhesive tape. This is available from most hardware stores and is always a handy thing to have around the home.

The negative side of the battery is connected directly to the PCB while the positive side is connected via the power switch. The flying lead is connected to the switched 9V and is terminated with a small crocodile clip.

The flying lead is passed through a small hole drilled in the front of the box and has a knot tied in it to prevent the solder joint being strained.

When all the wiring has been completed check it over to satisfy yourself that there are no errors.

To connect the Bongos to your amplifier you will need a set of shielded leads. These will be fitted with RCA plugs at one end, to suit the sockets on the Bongos and with plugs to suit the amplifier at the other end.

Now apply power to both the amplifier and the Bongos keeping the master volume control on the amplifier to a low level. The pots should be set fully clockwise so that they have maximum resistance in the circuit. Now slowly rotate one of the pots and note that after some degree of rotation the oscillator starts up. If the pot is turned far enough the oscillator will continue in the sustained mode until the pot is turned back again. Now turn the pot back and repeat the procedure with the other oscillator.

Having satisfied yourself that both the oscillators work properly, turn the pots one by one so that the oscillators are just on the verge of sustained operation. With the flying lead connected to your watchband (if it is a metal one) or held in the hand touch the plates and note that there is a distinct "bong" sound. The degree to which this sound is sustained can be controlled by the pots.

Set these "sustain" controls to your taste and start to practice. It sounds just like the real thing! Happy drumming!

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

$20

This includes sales tax.

Parts List

1 Printed circuit board 65 x 83mm code 79EB12
1 Printed circuit board 191 x 108mm (touch plates)
2 BC548 NPN transistors
RESISTORS (¼ or ½ watt, 5% tolerance)
2 x 1k, 2 x 22k, 2 x 47k, 6 x 56k, 2 x 6.8M
2 x 50k pots, linear taper
CAPACITORS
2 x 150pF ceramic of polystyrene
4 x .01uF metallised polyester (greencap)
1 x .015uF metallised polyester
3 x 0.39uF metallised polyester
2 x .047uF metallised polyester
HARDWARE
1 Plastic zippy box 114 x 197 x 60mm
2 RCA panel mount sockets
1 miniature single pole toggle switch
1 crocodile clip
1 9V battery (type 216) and clip to suit
MISCELLANEOUS
Printed circuit board pins, solder, hookup wire, knobs for pots, screws nuts etc.

This is the artwork for the touch plates that replace the lid (191 x 108mm) on the box. The reproduction is not shown full size but owing to the simplicity of the board we feel that this should not present a problem.

Experiment with digital counters

Basic Electronics

by GERALD COHN

Like to learn more about digital counters and how they work? The best way to do this is to experiment with a low-cost counter IC, the 7490. You can run it through its paces with the simple square wave oscillator we described in the August issue.

by GERALD COHN

The counter that we are going to build is of the decade type, the name decade being derived from the Latin word "decem" which means ten. This means that the counter is capable of counting to 10 before the whole cycle is repeated.

All that we need for the experiment is an easy-to-get 7490 digital counter IC and a handful of other components. The actual "workings" inside the IC consist of four master-slave flip-flops and some additional gating, providing the reset and count control functions. A brief description of flipflop and basic counter operation is provided in the box.

The 7490 is a decade counter device, which counts in a modified binary fashion known as "BCD". There are several ways in which binary numbers can be used in digital counting, one of which is known as BCD or "binary coded decimal". Broadly speaking a code of this sort must use four binary digits or "bits" to represent each decimal digit. This is because this many bits must be used to provide 10 different value combinations. Four bits actually provide 16 different combinations, but the remaining six combinations are unused.

For those readers that are not so familiar with the binary numbering system, we will go over some of the basic rules of the system. You will find that these are going to prove quite important later on, in particular when you have completed the construction of the project and are ready to use it.

To handle decimal numbers in digital circuits is rather cumbersome, and also demands greater circuit complexity. An alternative is to change the format of the numbers into what is known as "binary". Binary notation uses 2 as its base, in place of the 10 that is used in the decimal system. Binary notation is very well suited to digital circuits, as it involves only two numeral values: 0 and 1. These replace the 10 numeral values (0, 1, 2, . . . 9) used in decimal notation.

This means that many more digits must be used to represent a given number, because each numeral digit position represents a certain power of 2 rather than a power of 10. In place of the units-tens-hundreds-thousands progression of the decimal system, the numeral positions represent units-twos-fours-eights and so on.

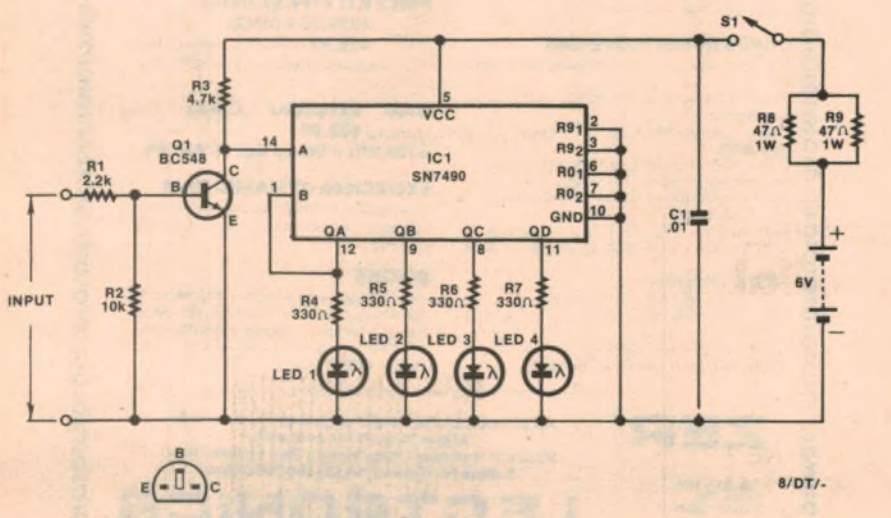
In this sense the binary system is clumsier. But each numeral position has only two values, so that it may be represented very simply by a circuit voltage or current switching between two levels — high and low.

Hooking up the 7490 as an experimental counter is a simple task, and if performed with care should only take about two hours. You will probably find that apart from the IC and the LEDs, all the other components will be in your junk box.

The components are all mounted on a small piece of Vero-board, keeping the cost to a minimum. The input stage to the counter consists of an NPN transistor inverter that performs the function of level translation. The reason that level translation is required is that the oscillator used to provide the input pulses uses a 9V supply, whereas the counter circuit operates from a 5V supply.

The 7490 IC that is used in this counter is of the TTL type, and this type of logic is designed to operate from a 5V supply rail. The level translator at the input to the counter will prove to be quite useful, since it will enable the counter to be used with all sorts of equipment operating at various different supply voltages.

The output of the transistor inverter is fed to the input of the counter IC, which is at pin 14. The counter IC features two inputs because it is internally made up of two separate counters, the first of which is a divide by 2 counter and the second being a divide by 5 counter. The output of the



The circuit diagram of the counter. Note the inverting level translator (Q1) at the A input to the IC.

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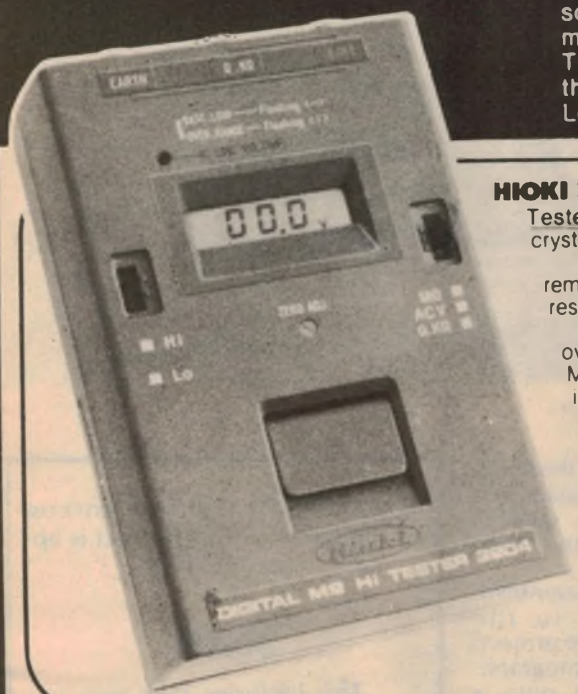

HIOKI 3204 B Believed to be the world's first production Digital Insulation Tester, the Hioki 3204B offers wide test ranges, high accuracy and a FE liquid crystal display.

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The model 3204B is Semi-Auto Ranging and includes display hold, overreading indication, battery check and overload protection facilities. Measurements facility for AC voltage to 500 Volts included. The instrument is supplied with one lead with probe and one red lead with clip.

Specifications

Reading Ranges and Tolerances

Function	Range Lo	Hi	Tolerance
MΩ	1.999MΩ 19.99MΩ	199.9MΩ 1999MΩ	±2%rdg. ±3dgt. 500MΩ under: ±4%rdg. ±2dgt. 501MΩ over: ±5%rdg. ±2dgt.
Ω-kΩ	199.9Ω 1999Ω	19.99kΩ 199.9kΩ	±1%rdg. ±0.5%f.s. ±1dgt.
ACV	199.9V (Hi or Lo)	500 V	±1%rdg. ±1%f.s. ±1dgt. (40Hz-70Hz)

HIOKI 3205 Digital Multi Tester
Compact multimeter featuring Semi-Auto Ranging, electronic and fuse protection and approximately 40 hours continuous operation with alkaline batteries. Among the many advantages are overrange indication, auto polarity and automatic battery condition indicator.

Specifications

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

HIOKI 3206 Digital Clamp Tester has FE liquid crystal display, reading hold facility and surge hold for motor start readings. A special 0-20A range provides 0.01A resolution. This Auto Ranging instrument enables current measurements to be made without breaking the circuit. In addition, voltage and resistance measurements can also be made.

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Specifications

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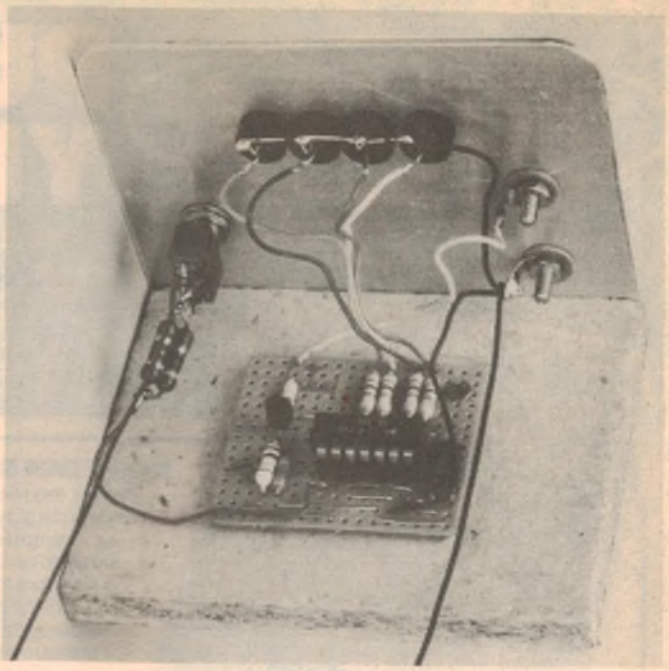


Photographs showing the construction of the unit. The front panel layout appears above, while the rear view of the unit is shown to the right.

divide by 2 counter is fed to the input of the divide by five counter, this being done via a link between pins 1 and 12 of the 7490 IC.

The counter IC also has four other inputs that perform the functions of resetting the counter to either 0 or 9. Since we are not interested in using these reset functions, we ground the inputs. The output of the counter takes the form of four LEDS (light emitting diodes), arranged in such a way that they provide a binary readout. The output can be easily read if you consider a lighted LED to indicate a logic 1, and an unlit LED to indicate a logic 0.

As you can see from the circuit diagram, each of the LEDs has a resistor in series with it. The reason for the series resistor is to limit the amount of current that passes through the LED to approximately 10 miliamps. This is plenty of current to ensure that the LEDS have adequate levels of light output.

Before you start placing components onto the strip board, cut the appropriate tracks as shown in the component overlay diagram. To cut the tracks is a simple matter requiring the use of a small twist drill. The tip of the drill is placed in the hole where the copper track is to be cut and then rotated until the drill has cut away the copper that is not required. The finished result will be a small countersink in the board, with the copper strip milled away.

Once you have cut the tracks that are indicated on the overlay, start to mount the components, again following the layout shown by the component overlay. The first components that should be mounted onto the board are the resistors and the capacitor. These can then be followed up by the transistor. The IC is the last component that is to be mounted, and we suggest that an IC socket be used for this, therefore enabling the IC to be used again in a future project without any damage resulting from soldering and then removing.

Once the board has been assembled, we turn our attention to the mechanical construction of the project. As can be seen from the photograph, we mounted the prototype onto a piece of particle board, and mounted the LEDs in a front panel that was made from a small piece of aluminium sheet. Also mounted on the front panel are the terminals for the input to the counter, and the power switch. The two 47ohm 1W resistors are mounted on the rear of the power switch, and their purpose is to drop the battery voltage from 6V to approximately 5V, and at the same time limit the amount of current that the circuit can draw. The maximum current drain on the battery will occur when the counter reaches the count of 7, since three of the four LEDs will be lit up. Since this is a BCD counter, this will be the maximum number of LEDs that will be lit up at any one time.

All the holes in the front panel were drilled to a size of 6.5mm, and these are for the mounting of the LEDs, the power switch and the terminal posts. The wiring to the LEDs should be done carefully to ensure that the order of the outputs is correct. The cathodes of the LEDs are wired up to a common bus and then taken to ground, together with the black terminal post. The input of the counter is taken to the red terminal post.

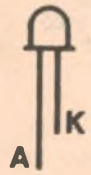
We used a 6V lantern battery for the prototype. It is not essential that this type of battery be used, but we found it to be the best since it is a heavy duty battery. You could also use a battery clip that contains four type AA batteries to obtain a six volt source.

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

$6.00

This includes sales tax.

Led lead identification



The cathode is the shorter of the two leads or can be identified by a flat edge on the plastic body.

THE PARTS LIST

1 7490 TTL IC
1 BC548 NPN transistor
2 47 ohm ½W resistors
4 330 ohm resistors
1 2.2k ohm resistor
1 4.7k ohm resistor
1 10k ohm resistor
1 .01uF polyester capacitor
4 Red LEDs and bezels to suit
1 Piece Vero board, 44 x 40mm

MISCELLANEOUS

Piece of aluminium sheet 7cm x 9cm, piece of particle board 7cm x 9cm, miniature single pole toggle switch, terminal posts (1 red and 1 black), IC socket (14 pin), solder tags, solder, hookup wire etc.

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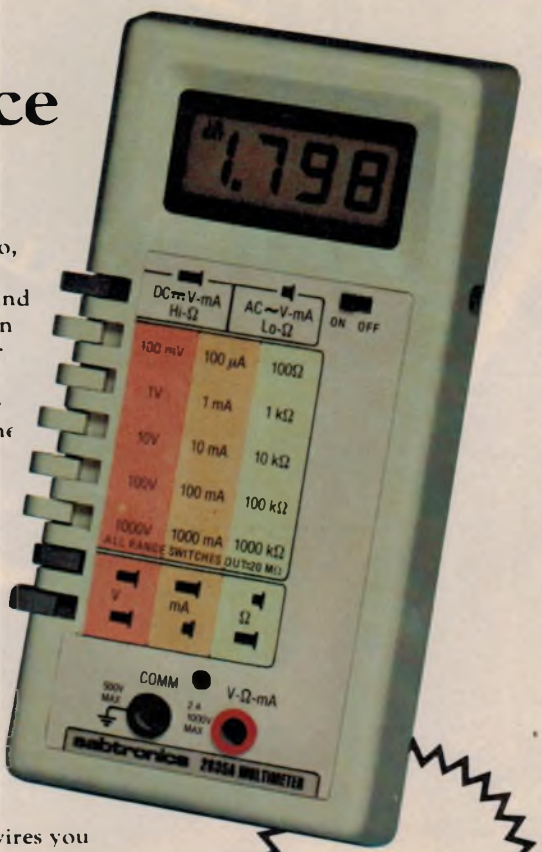

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FLIPFLOPS: what they are & how they work.

Apart from logic gates, probably the most basic elements in digital circuits are flipflops. As the name suggests, a flipflop is a bistable device. It has two stable operating conditions, and can be made to switch from one to the other.

A very basic flipflop can be formed by connecting two 2-input NAND gates, as shown in Fig. 1. As you can see, the two gates are "cross coupled", with the output of each being connected to one of the inputs of the other. This forms a regenerative feedback loop, with the result that if the two uncommitted inputs are taken to true (1) logic level, only one of the gates can have a true output; the other must have a false (0) output.

This happens because the output that is true causes both inputs of the other gate to be true, driving the second gate's output false by virtue of the inherent inversion in a NAND element.

Only one output of the flipflop (or "FF") is normally true, and the other is false. The two outputs are logically complementary, in other words — each is the logical complement of the other. By convention one output is usually labelled "Q" and the other "Q-bar".

The FF has two stable states then: one with Q true and Q-bar false, and the other with Q false and Q-bar true. Just which of the two states the FF is in depends upon its previous history.

The main factor that determines the state of the flipflop is any signals which may be applied to the inputs A and B. There are various possibilities here: the FF may have either Q or Q-bar true initially, while either A or B may be taken true or false independently. With three variables, this gives eight different situations, each of which can be analysed using basic gate principles.

The results are shown in concise form in the "truth table" of Fig. 1. Each pair of lines covers one of the four possible true-value combinations for the two inputs, with the other two lines in each pair covering the two possible initial states of the flipflop.

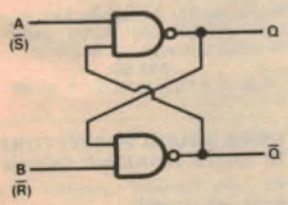
A simple flipflop of the type in Fig. 1 is known as a "Reset-Set" or R-S flipflop. While an RS flipflop has its uses, there are many applications in digital systems that require a FF to respond only at certain fixed times, as determined by general timing or "clock" signals that are fed throughout the system. To provide for this sort of operation, a number of variations on the basic flipflop have been evolved.

One of these is the so-called T-type or "toggle" flipflop, shown in Fig. 2. This has two inputs, like the RS type, but here the inputs perform entirely different functions. One input is called the toggle or "T" input and the other the "clock" input.

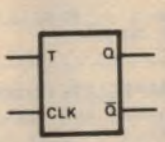
Referring to the truth table of Fig. 2, you can see that if the T input is held false (0 logic level) during the clock pulse, this has the effect of "freezing" the FF in its initial state; ie, no change occurs at the outputs. However if the T input is held true (logic 1) during the clock pulse, the clock pulse forces the FF to "toggle" or change states — regardless of its initial state. If it was set, it will reset; and vice-versa.

The T-type FF is thus capable of only two responses to a clock pulse. It can either remain unchanged, or toggle, depending upon the logic level applied to the T input.

Probably the most important type of clocked flipflop is the JK type, which is shown in Fig. 3. This is a very flexible element (and also the type that is used in the counter IC around which this project is built), in that it can be arranged to perform all of the functions performed by the other types.

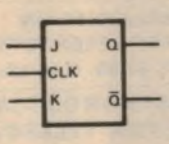


A	B	BEFORE Q	BEFORE $\overline{Q}$	AFTER Q	AFTER $\overline{Q}$
1	1	0	1	0	1
1	1	1	0	1	0
0	1	0	1	1	0
0	1	1	0	1	0
1	0	0	1	0	1
1	0	1	0	0	1
0	0	0	1	?	?
0	0	1	0	?	?



T	BEFORE CLK PULSE Q	BEFORE CLK PULSE $\overline{Q}$	AFTER CLK PULSE Q	AFTER CLK PULSE $\overline{Q}$
0	0	1	0	1
0	1	0	1	0
1	0	1	1	0
1	1	0	0	1

Fig. 1 to the left shows the SR flipflop, while Fig. 2 above shows the T-type flipflop and its truth table.



J	K	Q (BEFORE)	Q (AFTER)
0	0	0	0
0	0	1	1
1	0	0	1
1	0	1	1
0	1	0	0
0	1	1	0
1	1	0	1
1	1	1	0

Fig. 3 The most widely used of the flipflop family, the JK type, shown here with its truth table.

The counter could also be powered from a power supply that runs from the mains, and we will consider publishing a power supply project of this type sometime in the not too distant future.

Now that you have completed the assembly of the project, go through and check all the wiring once more, and don't forget the board assembly. If you are satisfied that all is in order, hook up the square wave oscillator that was featured in the August issue, and turn on the power to the counter. Now turn the switch on the oscillator into the 1Hz position and note that the LEDs of the counter's display should start to follow the binary counting sequence. To check that the sequence does in fact follow the binary notation, refer back to table 1 and check that the sequence of the LEDs corresponds to that shown in the table.

The counter does have some other more practical applications other than flashing a row of lights in a binary sequence. You could for example use it as a frequency divider. If you feed a frequency into the input, you can obtain two different output frequencies; one corresponding to the input divided by two, and the other to the input divided by 10. So if we feed a frequency of 1000Hz into the input, the resulting output frequencies will be 500Hz (1000/z) at output A and 100Hz (1000/10) at output D.

As you can see from the above information, the input frequency is divided down by a factor of 2 each time, and the different output frequencies appear at the outputs of the counter IC.

If you did build the oscillator project, you will soon discover that you can obtain 25 different frequencies, if you use the oscillator together with this counter project.

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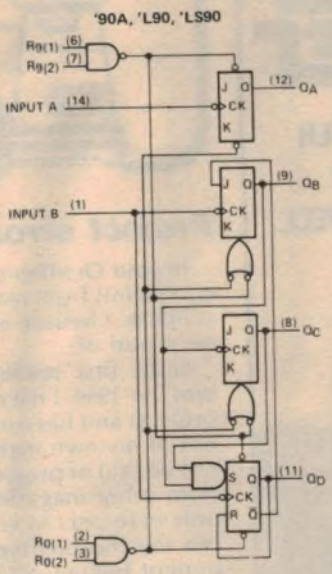
Flipflops in counters

The JK flipflop has two main inputs in addition to the clock input, and as you can see these are labelled "J" and "K". If the J input alone is held true, the FF will set; if the K input alone is held true, the FF will reset; if both the J and the K inputs are held true together, the flipflop will toggle with the applied clock; and if both are held false, the flipflop will "freeze".

If you now refer to the diagram of Fig. 4, you will see that we have reproduced the circuit of the 7490 IC. Note that it uses JK type flipflops.

Closer examination of the schematic will reveal that the first FF in the counter chain is in fact not connected to the other FFs. The device is actually a dual counter in that the first stage is a divide-by-2 stage, while the other three FFs form a divide-by-5 stage. To use this device as a divide-by-10 stage, we must connect the two internal stages in cascade. This is done by connecting the output of the first stage to the input of the second stage (ie pins 12 and 1 are connected together).

The device also features some special reset inputs, but we shall leave these from the discussion as they are not used in this project. The pulse train that is to be counted is fed to the input of the first stage, ie. pin 14. The output from the device is in a four bit binary pattern, actually not pure binary, rather BCD or "binary coded decimal". The outputs are labelled QA to QD, with QA being the least significant bit (LSB), and QD being the most significant bit (MSB).



COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

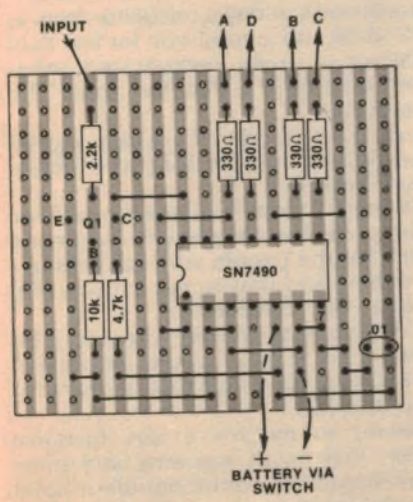
Fig. 4 to the right shows the circuit of the 7490 IC. Two separate counters exist in the package, the first a divide by two, and the second a divide by five. Fig. 5 above shows the truth table for the outputs of the 7490 counter.

The resulting output from the counter will appear as shown in Fig. 5. Here you can see the BCD code that is output, and also the decimal equivalent of the BCD number.

For those readers that wish to learn a little more about flip-flops and electronic counters we refer you to the Electronics Australia handbook "An Introduction To Digital Electronics".

build up several of these counters and interconnect them to obtain counts that are increasing in decade steps. In other words, if you use two of these counters, you can count up to 100, and with three you can count up to 1000, and so on. To connect one counter to another, all that has to be done is to take the output of the first counter (output labelled QD), and feed this to the input of the next, and so on.

By cascading counters in this way you can obtain count lengths that are as long as you could want them. All that is required is to build several of these, one for each decade. If for example you want to be able to count to one million, you will need to build six of these counter modules and then interconnect them the way that was described in the last paragraph. The number of applications for a counter of this type is almost enedless. All that you need to do is come up with some more ideas, other than those that have already been described here.



The component overlay diagram. Note the cuts in the copper tracks.

In an early issue we hope to show you how to hook up a digital display to your counter, so you can read the count in both binary and decimal form. Apart from being an extremely practical and fun project, it also goes a long way in teaching you some of the basics that are involved in electronic counting.

Incidentally, a little message to all you beginners out there. This is your section of the magazine, and we would welcome suggestions for projects and ideas that you would like to see designed and published. You are the people that know what you want, and you could greatly simplify our task in project selection if you let us know.

In the meantime, we hope that you have lots of fun with the counter, and if you have any novel ideas for the use of the counter, let us know so that we can pass some of these along to other readers.

Letters to the editor

Project errors?

In your October editorial you refer to complaints from readers about errors in projects. I believe you have a record to be proud of.

Since first reading "Radio & Hobbies" in 1954, I have built many of your projects and have never had a problem not of my own making. The same cannot be said of projects I have attempted from other magazines. This is true not only in respect to errors and omissions, but the thoroughness of design (component tolerances, for example).

Keep up the good work!
G. Derrett,
Beacon Hill, NSW.

COMMENT: Thanks for the bouquet, G.D. However, we must admit that despite a fairly elaborate checking procedure, occasional errors do slip by.

NZ attitude to FM

In researching an article, I came across an "Electronic Australia" series on FM radio, written just after approval was given to restart FM transmissions in Australia. The first of the article talked of the FM "hiatus" in Australia and described how, for many, FM broadcasting had become "a pipe dream, which they would (eventually) be too old to enjoy!"

That is still the situation in New Zealand and I, too, am beginning to despair of ever having FM broadcasting in this country. The history of attempts to introduce FM broadcasting to NZ is a sorry one of indifference and procrastination, which has not been helped by frequent political interference in broadcasting.

The first event to impede the introduction of FM radio was the short-sighted decision of the NZ Post Office to allocate most of the international FM band to two-way radio use. Although the Post Office was to have the band cleared by 1980, they have now relaxed this to 1982! Subsequent events which have delayed FM radio include the introduction of colour TV, and the establishment and networking of a second Government run TV channel throughout the country.

A 1973 report which recommended the fragmentation of the one Government broadcasting organisation into four corporations contained an interesting reference to FM Radio, which admitted its technical advantages, but dismissed it with the statement: "but the submissions to the committee did not reveal the existence as yet of any large body of opinion pressing for the change (from AM to FM)". Thus the public not only has to know about FM without having any transmissions to judge it by, it also has to show the administrators of broadcasting the advantage of high quality transmission methods!

The original "Electronics Australia" article wound up with the words "and what of NZ? There has been consistent minority pressure in that country for a VHF FM service — and no less consistent rejection of the idea by successive governments."

At a public hearing in 1969 there were 33 submissions, nine of which were presented in person. Most favoured the introduction of FM, with the exception of the government broadcasting organisation! Hardly minority pressure!

Your article went on to suggest that on the basis of the Australian decision, this might strengthen the case for FM radio in NZ. I have to tell you no such luck!

Keith Macdonald ZL2AWM,
Silverstream, NZ.

Hearing aids

Four hundred dollars seems a lot to have to pay for a small battery operated mono amplifier.

The price ICs are today, it's not surprising one can buy a calculator from as little as $6 and a good one for less than $100; or a pretty complicated solid-state electronic watch for about the same price.

Yet, if one is deaf, it's usually a good deal more than $100 for just a simple mono amplifier.

It doesn't seem fair since they use the same parts. The people who most need them are the people who can least afford them and they're not a luxury like watches and calculators.

I'm sure if they were cheaper a lot more deaf people would be buying them and making life more pleasant for their relatives.

Seems to me it's a very lucrative racket that needs exposing and since your magazine is quite popular I hope it does just that.

P. Truscott,
Mosman, NSW.

Oldest reader?

Thinking back through the past, I reckon that I may now be the oldest reader of "Electronics Australia" and the journals from which it emerged.

I bought the first edition of "Wireless Weekly" in 1912 or 1913, as published from the old Bulletin office in George St. I've been building radio sets ever since.

The only station on the air at the time was the ship's station that came on at 1:00pm. I thought it wonderful to pick it up on my first crystal set.

Down through the years I've enjoyed reading "Wireless Weekly" through to "Electronics Australia". I'm now 82 and my eyesight is failing but I still make some of your projects to while away the time. My last project was the digital clock with the National module 1002B. I made the aluminium cabinet and finished it in gold and brown.

R. Barton,
Caringbah, NSW.

Computer contest

I think that it is not good that you make a big thing on your cover about "Win a Computer" when you have to own one already to be able to enter. The rules say you have to write the program so it will go into "Level 1 Basic", and they want it on a cassette which only a computer can make. How do I get to know "Level 1 Basic"?

Your cover should also have said "competition for TRS-80 owners only". Joke's a joke, but either the ad or the competition is not fair.

P. Brown,
North Adelaide, SA.

COMMENT: We agree that entrants would have to understand Basic (see article in the same issue) but there are lots of readers who do — students, hobbyists, teachers, professionals — and who have access to a computer using Basic. Being on display in Tandy stores, the TRS-80 is fairly readily accessible for reference. The cassette was not a pre-requisite for success, merely "desirable to assist the judges".

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

Liona Boyd: "fine Spanish music"

LIONA BOYD plays music by Albeniz, Barrios, Sor, Satie, Debussy, Tarrega, Payet, Barnes. Liona Boyd, classical guitar. CBS Stereo Disc SBR 235975.

The record sleeve refers to the artist on this disc as "The First Lady of the Guitar"; however sexist the argument, it seems to be justified as I cannot recall any other serious guitarist on the distaff side — not among the true professionals, anyhow. Miss Boyd (who would seem to be most toothsome as well), is a young Canadian, whose teachers include Julian Bream, Narciso Yepes and Alirio Diaz — a formidable team indeed. Her playing is so sure, clean and competent that I find it difficult to believe her teachers had a hard task.

About the music: Augustine Pio Barrios, a Paraguayan Indian guitarist, who died in 1944, wrote 19th century music of beauty and charm; Carlos Payet is a composer-guitarist-physician in El Salvador and his music, also, is of straight-forward appeal. Miss Boyd's transcriptions of Debussy ("The Little Shepherd") and Satie (Gymnopedie No. 1) are sensitive, delicate and work exceedingly well as plucked by her. A Fantasy by Canadian Milton Barnes, written for Miss Boyd and based on an Amerindian folk song is of limited interest. Musically, the best (and not unexpectedly) are the three Waltzes by Fernando Sor, Tarregas' "Recuerdos de la Alhambra" and Albeniz' "Granada" and "Asturias".

It is in fine Spanish music written for the instrument that the classical guitar comes into its own; it is in such music that Miss Boyd gives of her best — and her best is pretty good! My only reservation about this record is in the sound which appears to have been recorded with some bass-bias. Apart from this — and it may well be that others' ears will react differently — all of it is in good taste, the Albeniz is played with agreeable restraint and the Tarrega is as gorgeous as I've yet heard. (P.F.)

Brahms: four hands, two pianos

BRAHMS: Sonata F minor; op 34b, after the Quintet op 34, for two pianos; Variations on a Theme by Joseph Haydn, op 56b, for two pianos. Alfons & Aloys Kontarsky, pianos. DG Stereo Disc 2531 100.

This release was actually timed to coincide with the current Australian concert tour, their second, by the Kontarsky brothers. The playing is quite brilliant and, as one has come to expect from them, always musicianly and very stylish. The quality of their playing is matched by the recorded sound; the two pianos blend and balance so well that one might almost suspect the duo to be performed on one instrument, at four hands (the record cover somewhat oddly, refers to "two pianos, four hands" — how many hands would you expect?)

It was not at all uncommon in the 19th century to arrange major chamber works or even full orchestral ones for two pianos or, more usually, one piano at four hands; at first, I expected these works to be such arrangements and I would not have been surprised had they been made, with or without Brahms' approval, by someone else. The surprising thing is that these two-piano works are undoubtedly by Brahms; op 34b in fact precedes the Quintet op 34 and op 56b may or may not have been written before the orchestral version. In any event, we are here faced by two major compositions, authentically Brahms' and both of them as good as unknown in recent times.

The Piano Quintet op 34 is very well known and a justly admired work. The work for two pianos is, in all essentials, identical; all the same, the divergencies are sufficient to be worthy of notice and there are passages in which the piano sound is preferable; others in which the strings seem much more convincing. The contrapuntal final Presto impresses me much more powerfully in this version; on the other hand, the Poco Sostenuto is diminished by percussiveness. As for the Variations, I find the sonority and tone colours of the pianos to be quite definitely preferable to the over-rich orchestral sound that Brahms so often favoured.

Preferences will, needs, be personal ones and dictated by one's taste; one thing stands out: these are important works of considerable beauty, quite apart from their historical curiosity. I can recommend this recording on every count. (P.F.)

☆ ☆ ☆

BRAHMS: Hungarian Dances Complete. Michel Beroff and Jean-Phillipe Collard, piano duet. World Record Quadraphonic Disc QR 05890.

Twenty-one Nocturnes from Chopin . . . 21 Hungarian Dances from Brahms, and they are all here, on one disc, delightfully played on two pianos. This is really much more fun than hearing the more usual orchestral arrangements, let alone all the other arrangements for various palm-court ensembles. The authenticity of "Hungarian" is, of course, irrelevant; Brahms was not an ethno-musicologist and he wrote these dances to entertain — did not even allot them an opus number!

The Beroff-Collard duo lack the Kon-

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.).

tarskys' relentless accuracy and earnestness, which is rather fortunate for this music; they score with greater liveliness and temperament and communicate their joy in happy music-making to the listener. The recording (HMV, originating in the Salle Wagram, Paris) combines agreeable acoustics and good piano tone for any occasion of twenty-one times total pleasure. (P.F.)

Avant-garde sound

REVERBERATIONS TWO. Ron Nagorcka: Sanctus. James Penberthy: Hymn for the Death of Jesus. Scherzo ("Devils up there"). Felix Werder: Holy Thursday. Douglas Lawrence, organ. Move Stereo disc MS 3025 (Move Records, PO Box 266, Carlton South, Vic 3053).

Recorded in St Patrick's Cathedral, Melbourne, this record has remarkably fine sound and contents that are as avant-garde as one could wish for. Side 1, Nagorcka's piece for organ, didjeridu (their spelling and it seems more sensible than the traditional one), voices and electronics is described by the composer as ". . . the coming together of an organist, a didjeridu player, an electronic technician and a group of untrained singers to produce a sonic object according to the general specifications of a simple score."

I do like "sonic object" — a novel term, but one which is quite descriptive of a near-monodic event. At over 20 minutes, the experience may seem a bit long; all the same, there is interest here, there is tension (though without resolution) and some sections of the sound produced are deeply satisfying. Felix Werder's brief piece for organ shows this composer from a new angle; it is nervously charged music and the sleeve notes fairly refer to ". . . scatter techniques and constant nuance of tempo and colour". As always, Werder makes few concessions to the lazy listener and I regard this as one of his most successful essays in terse self-expression.

The two pieces by James Penberthy are for organ solo and combine strict notation and aleatoric sections. The adaptation of these recent compositional techniques to organ music are, to my ear, very successful and I found some of the eventuating tone clusters both interesting and beautiful. Penberthy, in these works, seems to have progressed considerably from earlier organ pieces of his. Nagorcka, 30 years his junior, had also written for organ before and it might be noted that Move Records recorded a piece of his, and one of Werder's, on a previous occasion, with similarly spectacular results. (P.F.)

(Still to be reviewed: "Full Spectrum"; works of Percy Grainger and others performed by Barry Coningham using digitally controlled sound sources).

Christmas with Move Records

THE MESSAGE OF CHRISTMAS in Song and Story. Stereo, Avant Garde AVS-117.

An unusual record, this, appropriate for those who have the time to relax and ponder the Christian implications of Christmas.

A female voice is used for the narration and the first impression is one of affectation, even tension. But the impression gives way to acceptance and the realisation that it is probably a deliberate part of the presentation.

All through, the story is punctuated by snippets of Christmas songs from many lands, often in the appropriate language and backed by national instrumental sounds. Israel is represented, along with Mexico, Germany, Spain, India, Ireland, the Ukraine, Norway, the Cameroons, Switzerland, Greece and Chile. There are Gregorian chants and a negro spiritual.

Diction is excellent but, on the rear of the album is a sheet containing both narration and lyrics. The recording quality is clean and the record should be enjoyed, as I said, by those who have the time and inclination to listen. (WNW).

☆ ☆ ☆

15 FAVOURITE CHRISTMAS CAROLS. Organ, Brass and Tubular Bells. Move MS-3019.

This one is also different from the usual run of Christmas albums but for another reason — one that will appeal to some and alienate others. Normally simple carols have been selected and arranged to use the resources available to arranger and conductor Christopher Willcock: Douglas Lawrence playing the organ of St Patrick's Cathedral, Melbourne; Dal Barbare, tubular bells and glockenspiel; the Festival Brass Ensemble.

Carols presented are: While Shepherds Watched — Unto Us Is Born A Son — Sussex Carol — We Three Kings — Hark The Herald Angels — Sing Aloud On This Day — It Came Upon The Midnight Clear — Es Ist Ein Ros Entsprungen — Once In Royal David's City — First Noel — Coventry Carol — Silent Night — O Come All Ye Faithful — Angles From The Realms — God Rest You Merry Gentlemen.

Recording organ, bells, brass and glockenspiel is not an easy assignment and I could not classify the sound quality as anything more than average. Best you sample it for yourself. (WNW).

☆ ☆ ☆

COME TO BETHLEHEM. Johnny Pearson, his Chorale and Orchestra. Stereo, Avant Garde AVS-118.

Different again is this English recording, which substitutes contemporary carols for the traditional, with some of them, not surprisingly, employing a mild up-tempo beat:

Hallelujah, Hallelujah — Lord Give Us Lasting Faith — Lord of Lords, King of Kings — Star Of The East — Mary, Mary, Pray For Us — Come To Bethlehem — Cantate Domino — How Could There Be A Fairer One — Christmas Prayer — Jesus Christ The Holy Infant — Christmas Prayer — Asleep To The World — Glory To The Lord In Heaven.

The sound quality is a trifle "edgy" in complex passages but, otherwise, the tracks are a pleasant mix of instrumental, solo voice and chorale, and of Christmas/devotional themes which will be new to most. (WNW).

☆ ☆ ☆

All three albums are distributed in Australia by Move Records, Box 266, Carlton South, Vic 3053.

SCHOENBERG: Pierrot Lunaire, op. 21. Yvonne Minton, mezzo-soprano; Pinchas Zukerman, violin & viola; Lynn Harrell, cello; Michel Debost, flute & piccolo; Antony Pay, clarinets; Daniel Barenboim, piano; conducted by Pierre Boulez. CBS Masterworks Stereo disc 76720 (with full texts).

Written in 1912, this music remains as revolutionary and prickly as ever it was — the compiler of the English-language notes rightly states that this is a work one never "gets used to". On this occasion, we have a recording made in

"timbre, clarity, presence"

APPALACHIAN SPRING, Aaron Copland. THREE PLACES IN NEW ENGLAND, Charles Ives. Played by the St Paul Chamber Orchestra, conducted by Dennis Russel Davies. Stereo from Digital Master, Sound 80, S80-DLR-101. (From P. C. Stereo, PO Box 272, Mt Gravatt, Qld 4122.)

The notes explain that Appalachian Spring is the current title for a composition "Ballet For Martha", composed circa 1944 for Martha Graham. Although more commonly heard as a ballet suite for full orchestra, it is played here in its sparse original scoring — but a happy episode by way of a quaker wedding in the hills of Pennsylvania.

"Three Places In New England" (or "New England Symphony" or "Orchestral Set No. 1") composed between 1903-1914 involves an enlarged chamber orchestra. It opens with a gentle nocturne ("The St Gaudens in Boston Common"), which is followed by "Putnam's Camp, Redding, Connecticut" — a fantasy on a Revolutionary Army camp, with Stravinsky-like clashes of harmony and rhythm.

"From the Housatonic at Stockbridge" retains the mood, but in a different setting.

The two sides, 25 minutes and 18 minutes respectively, were non-interrupted performances, as for direct cut, but captured instead on a 3M digital mastering system. The quality is very clean, with soft passages that are likely to be compromised, not by the recording itself, but by ambient noise on the home — from a fan, a ticking clock, or distant traffic.

Indeed, Norman Eisenberg of "High Fidelity" magazine has nominated this as a disc especially suitable for judging instrumental timbre, clarity and presence.

The music, if you don't know it? Copland: instant, simple appeal; Ives: takes longer. (WNW).

SCHOENBERG — cont.

a Paris church two years ago as one of the "manifestations" connected with the inauguration of the acoustic research centre at the Centre Georges Pompidou — a cause closely connected with Boulez.

Comparisons are neither easy nor, perhaps, very relevant; I've only heard this work twice before on disc, once "spoken" by Alice Howell and once sung by Mary Thomas. In live performance, I know Marilyn Richardson's splendid readings; what Yvonne Minton gives us, presumably at Boulez' direction, is very different. In this performance, there seems to be a determination (shared by all the participants, except perhaps Barenboim) to avoid emotional excesses, to play down the romantic and expressionist elements and to present the work as starkly and uncompromisingly as possible.

Miss Minton's singing is much further removed from the usually accepted "speech" sounds than I've heard before and I'll confess to a preference for Mary Thomas' methods which, I think, are closer to the composer's intentions. However, the quality of Minton's vocal effort is quite splendid and possibly easier on many listeners' ears; equally, all the instrumental playing is of a wonderful clarity and precision and Boulez direction is certainly firm and consistent. Although the lavishly produced album includes full texts, in three languages, it is worth noting that other recorded versions of this work had space left for additional music. However, the quality of the recording is what matters more and that is certainly excellent. (P.F.)

☆ ☆ ☆

TCHAIKOVSKY: Piano Trio in A minor, op. 50. Yuval Trio. CBS Masterworks Stereo disc 76698.

In some five decades of concert-going, I've heard this work just once and on record, also, I'd encountered it but once before. It is rather a mystery that this should be so: the music is delightful, characteristically Slavonic and among Tchaikovsky's happiest creations. It was written in 1882, to commemorate the death of Nicolai Rubinstein, founder of the Moscow Conservatory, a supporter of the composer's and an outstanding pianist of his day; therefore one need not cavil if the piano is a little more prominent than in some other trios — it is never oppressively dominant.

If the music is very lovely — in three movements: elegiac and allegro; tema con variazioni, andane co moto; and allegro risoluto — the performance and recording are worthy of it. The Yuval Trio brings three outstanding Israeli musicians together in a remarkably fine reading; the only legitimate objection might be their omission of the eighth variation (a fugue) because it is, in the words of pianist Jonathan Zak

"somewhat weak". The recording is yet another of the 1977 series made on the occasions of the Israeli Music Centre's opening in Jerusalem; it is distinguished by good sound from both piano and strings and Tchaikovsky, who doubted the validity of this combination, would be duly gratified to hear the result, I believe. (P.F.)

☆ ☆ ☆

VIVALDI: Four Solemn Concertos for Violins. Chamber orchestra conducted by Claudio Scimone. World Record Club stereo, R 03505.

A record for anyone who enjoys the characteristic music of Antonio Vivaldi, the famous "red monk". The four concerti played are all of ecclesiastic origin: that in C major (RV581) for the feast of La Santissima Assontione di Maria Vergine, in D major (RV212) for the feast of the Tongue of St Anthony of Padua, in B-flat major (RV579) known as the Concerto Funebre, and in F major (RV286) for the Solennita di San Lorenzo. All are rather more contemplative than secular works like the well-known Four Seasons, but still very satisfying and enjoyable.

The performance here is sensitive and warm, and the recording is also excellent.

If you're at all partial to Vivaldi, well worth a hearing. (JR).

☆ ☆ ☆

SONGS AND POEMS OF AUSTRALIA. Stereo, Harbour MLF-281. Distributed by 7 Records.

I would guess that this album has been designed primarily as a keepsake for tourists, overseas relatives, etc. It is packaged in a colourful double-fold jacket, with typical colour pictures of Australia, an outline map, a flag and a few relevant facts.

The album itself contains songs sung by the Hawking Brothers: Waltzing Matilda — The Wild Colonial Boy — Eumerella Shore — The Lime Juice Tub — Click Go The Shears — Botany Bay — The Queensland Drover — South Australia.

Interspersed with the songs are poems read by Ken Sparks and Terry

Devotional or sentimental?

EVERLASTING KIND OF LOVE. Lynn. Stereo, Day Spring DST-4010. (From Word Records Australia, 18-26 Canterbury Rd, Heathmont, Vic 3135)

Lynn is introduced in the jacket notes as "a very special kind of person . . . a striking, lovely young christian" — a statement which is certainly supported by her portrait. Although an obviously capable vocalist, she nevertheless stays well inside the dynamics of the backing — ranging from full orchestral strings to soft rock. For much of the time, the words are submerged by the instrumental but, fortunately, the lyrics appear in full on the inner sleeve.

The title song is "Everlasting Kind Of Love" and the other tracks carry on the same general theme: More Of You — Make Me Smile — It's A New Day — I've Never Been Loved Like This Before — Heed The Call — No Greater Love — Satisfaction Guaranteed — I Love You — Break Out.

One must accept the sincerity of the artist and the fact that younger people in particular will like the sound but, to many others, the lyrics will be seen as sentimental imitations of secular love songs. Maybe it's me, but I had much the same reaction, a few months back, to Jamie Owens-Collins' "Love Eyes" (July, 1979).

You'd better hear this one for yourself. (WNW).

Another side of Burt Bacharach

WOMAN. Burt Bacharach and the Houston Symphony Orchestra. Stereo, AM (Festival) L-36843.

A difficult album to classify, this. The music was composed, arranged and conducted by Burt Bacharach and there are nine tracks in all: Summer of '77 — Woman — Riverboat — Magdalena — New York Lady — There Is Time — The Dancing Fool — I Live In The Woods.

Although the title majors on the Houston Symphony, 11 guest musicians have been added, plus five vocalists. As a result, the sound ranges from traditional orchestral, through touches of jazz and blues, to rock. And therein lies my difficulty in trying to visualise who will like or dislike the end result. Really, I think that it's an album that will appeal most to Bacharach fans who may tend to respond and analyse, rather than merely listen. Certainly the album is being hailed overseas as a response to the danger of his becoming musically "type cast".

The sound quality and production is excellent but you had still better judge for yourself. (W.N.W.)

McDermott: Kimberleys — Cattle Camps — Clancy Of The Overflow — Long Time I Remember — Retired Territory Drover — Ruby's Pie — Northern Plains — The Camp Cook, Southern Home.

The sound is clean and full and the general style a compromise between "City and the bush" — not too rough, not too much polish. As I said, a keepsake, in the same general class as mulga wood ashtrays (WNW).

REGINALD DIXON Recalls The Hits of World War II. Stereo. World Record Club WRC — R 04454.

As I remember it, the first record I every bought was a 2/6d Regal Zonophone featuring Reginal Dixon playing "Teddy Bear's Picnic" and "Blaze Away". He's been "blazing away" ever since, the very epitome of the old-time Wurlitzer organist, with their endless array of popular tunes, and their ability to embellish, improvise, bridge and modulate with seemingly effortless ease.

That is well illustrated here with 12 tracks containing three melodies in each, strung together in traditional style. Please don't ask me to list them but you'll know them. And listen to the way he pulls every trick of the console to summon and blend voices without the least suspicion of a pause.

Technically, my pressing had an irregularity on the outer edge which upset the playing of the first few grooves but, hopefully, it was an isolated fault. And the sound is rather zizzy on the high pitched pipes; you can ease that back with the tone control, if you want to be reminded of one of the big-name artists of the thirties. (W.N.W.)

☆ ☆ ☆

THE MINSTREL SHOW. Stereo, 7 Records MLR-277.

The jacket names Eddie Foy Jr, Harold Adamson and David Burns, but gives no other information about the when and where of this recording. However, it follows the traditional minstrel show format with Mr "Locutator" and Mr Bones and their traditional jokes, a couple of featured instrumentalists and, of course, old-time songs. As a recording and as a minstrel show, I could only rate it as "average". (W.N.W.)

☆ ☆ ☆

THE WIND IN THE WILLOWS, by Kenneth Graham. Adapted and produced by Tony Robertson. Stereo, two-record set. World Record Club WRC R-05547, R-05548.

First published in 1908, "The Wind In The Willows" was not received very warmly at the time. However, the highly fanciful stories, built around such animal characters as Ratty, Mole, Badger, Mr Toad and Otter, gradually built up a following, to become something of a classic.

In this two-record set, the stories have been re-scripted for sound recording, with Patricia Wymark as the narrator and other experienced people in the character roles. The seven episodes are: The River Bank — The Open Road — The Wild Wood — Dulce Domum — Toad's Adventures — Like Summer Tempests Came His Tears — The Return Of Ulysses. All these are presented in stereo with sound effects (cars, trains etc) as nearly as possible reminiscent of the era.

I guess that their major appeal will be partly nostalgic and partly to teachers and others involved with primary school-age children.

Technically, the sound quality is average only, adequate for the purpose but not without some suggestion of "crushing", probably in the original tape master. But don't let this put you off if you're partial to goings-on in the wild wood yonder! (WNW).

The Australian CB SCENE

FIRST US-STYLE REACT TEAM SET UP IN SYDNEY

According to a letter from its newly elected President, the first REACT team has been formed in Australia and has established a liason with the International organisation in the United States.

REACT is an acronyn for Radio Emergency Associated Citizens Teams and, as such, is probably the best known — if somewhat controversial — CB volunteer aid group in the Americas. Figures published a few years back credit REACT with about 1400 24-hour stations monitoring and active on the U.S. emergency channel 9. They are manned by more than 40,000 "hard core" members, with at least as many again licensed CBers having had some kind of REACT training.

REACT is primarily concerned with assisting motorists in need of routing information, or faced with mechanical problems, or in need of emergency help from ambulance, fire or the police. They operate from vehicles and/or fixed locations and handle about 50,000 calls per month, nationwide.

Unlike many other CB groups, REACT is not particularly concerned with the social aspects of CB-ing, DX-ing, card-swapping, etc. They are a fairly loose organisation of "teams" averaging about 25 members involved primarily in community service activities.

Unfortunately, some such teams have attracted a good deal of criticism for excessive zeal and the assumption of a right to order their fellow citizens around. In extreme cases, according to reports, this has gone as far as marked cars, uniforms and acting out the role of highway police.

It will not be surprising if moves to set up REACT teams in Australia are not met with opposition based on this image.

The first such group in Australia is the Waratah State REACT Team (NSW) 4380, with Peter W. Herman NBR 695 as President. Their postal address is P.O. Box M447, Sydney Mail Exchange, 2012.

Enclosed with the announcement is a letter from REACT International, which reads as follows:

Dear Peter:

We are delighted to acknowledge the establishment of your REACT team as the first official REACT Team in Australia!

We are enclosing all necessary information for immediate activation of your team. Your membership cards and other materials for each of your members has been shipped separately and should be arriving very soon.

Your official REACT Team charter is being made up and will be received some time later.

I think that you should be aware of the fact that we have already received correspondence from CREST concerning your Team operation. They are very concerned about REACT developing in Australia when it is not under their auspices. We should point out to you that you are established as a local team and have no authority to represent REACT except in your local team area. Of course, when new people want to start REACT in Australia we will refer them to you for counsultation and co-ordination.

Very frankly, we are still hopeful that CREST will choose to affiliate as National REACT organisation, and in that case all existing REACT Teams will be part of that body. We don't know when or if that will ever happen.

In any case, you are now the only official REACT team in Australia. We will keep you informed as to when and if additional teams are established. We of course expect that you will want to assist in that effort and we are enclosing additional team applications for that purpose.

If we can help you in any way unique to your team's needs, please let us know. Your interest and cooperation will help to build REACT in Australia in the months ahead.

Best wishes for the success of your team. You know we stand behind you.

REACTively,
Gerald H. Reese
(Managing Director)

NCRA: National Citizens Radio Association

I would like to thank "Electronics Australia" for the support being shown for the NCRA and for CB operators generally, in providing this space in your magazine. It is much appreciated.

For those readers who are not quite sure what NCRA is, the following brief details may be of interest.:

The NCRA is a National Organisation made up of the constituted Divisions of the ACT, NSW, Victoria, Western Australia, Queensland and Tasmania. Each Division is made up of and represents the clubs within the State which are affiliated with it. To affiliate, a club pays the State Division a once only $10.00 registration fee, and $2.00 per financial member per year. Of this, 50% is forwarded to the National body, and this, except for donations, etc, is the only income of the organisation. Clubs are represented on the State Council by sending along two delegates to each Council meeting, where State policy is formulated. In turn, each State sends along two delegates to the National Council.

The Government has officially recognised the NCRA as the spokesman for the CB operators of Australia and, as such, the NCRA was a member of the WARC '79 Preparatory Group. Many NCRA submissions were accepted in the re-write of the RB 14. The 1982 proposed cut-off of 27MHz is still a priority issue with the NCRA, and the time is coming when the CB operators will be faced with an issue which, to a great many of them, will be as important as legalisation itself was.

At the Annual General Meeting of the NCRA, held in Canberra last September, the first "CB Merit Award" was presented. It is a National award which will be presented each year to the person considered by NCRA as having contributed most to CB in that year. There was only one nomination for the inaugural Award, and who else could it have been than Mike Hurst-Meyers, past National Director of the NCRA and past National Director of CREST.

(Mrs) Jan Christensen,
National Liaison Officer, NCRA.

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Cat D-2888 **$358.00**

Price includes NiCad battery pack

The Yaesu FT-207R 2 metre hand held

This is the transceiver you've dreamed of. Gone are the horse-and-buggy days of crystal controlled hand-helds. This new Yaesu uses a four-bit microprocessor to give you more features, more control than you'd imagine possible. If you really want to get into 21st century amateur radio, the Yaesu FT-207R is the transceiver to to take you there.
Expensive? no, not when you remember you're holding a computer in the palm of your hand. A computer ready to go to service for YOU.
The Yaesu FT-207R. 21st century amateur radio.

We welcome bankcard or offer easy terms with BFC FINANCE LIMITED

Some other fine **Yaesu** products from Dick Smith. . .

FT-901D: all HF bands, all modes, 180W input.
For the discerning amateur who wants the best technology available today. Vox, FM unit, RF speech processor, digital frequency display, RF negative feedback, crystal filter . . . you name it, the 901 D has it! Outstanding value. Cat D-2854 **$1266.00**

FT901D Options:
FC-901 Antenna tuner Cat D-2855 **$265.00**
DC-DC Converter Cat D-2856 **$75.00**
Memory Unit Cat D-2858 **$149.50**

FT-101Z all HF band transceiver. 180W DC input.
A worthy successor to the FT-101E. All the features of the previous model, but with 6146B finals, selectable AGC, front panel VOX control, Rx/Tx clarifier, and fully compatible with the FT-901 series of accessories. Superb! Cat D-2862 **$849.00**
(For accessories refer above to FT901)

FT-7B: Up-rated mobile HF transceiver. 100 W.
Now a massive 100 watts with AM, USB & LSB, the FT-7B is a force to be reckoned with. Designed for mobile use (single knob tuning makes it a breeze) but makes a great base station, too. 13.5V operation, a superb performer. Cat D-2868. **$649.00**

FT-625R: 6 metre, all mode transceiver.
The sunspot cycle is nearing its peak. Don't miss the chance of some rare DX! The 625R will get it for you. ALL modes, so you aren't going to miss any of the action. Cat D-2886. **$795.00**

FT-227RB: 2 metre mobile transceiver.
Here's a chance to go 2m mobile and save. We've reduced the price of this unit by $46.00! Simplex, repeaters, etc etc. all easily accomplished! 1W or 10W output. Cat D-2891 **$399.00**

CPU2500RK: The ultimate 2 metre transceiver!
Central processing unit (CPU) controls the action. And there's plenty of that. 800 channels from 144-148MHz, LED readout, dual gate front FET front end, 25 watts output . . . it really is a brilliant piece of gear. Call in for a test drool! Cat D-2889 **$549.00**

FRG-7: listen to the world! 0.5 – 30MHz coverage.
This extremely sensitive communications receiver is used by monitoring services throughout the world. It runs from mains or 12 volt, is a delight to use. Cat D-2850 **$395.00**

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The greatest mobile system you'll find: Buy the gutter mount base and 2 metre stub and you're on the air immediately on 2m. Then, as you need them, buy the whips for the HF bands you want to operate on. It's as simple as that. Now there's no excuse not to go mobile — with Yaesu mobile antennas from Dick Smith Electronics.

RSE-2-M	RSE-2A	RSL-145	RSL-3.5	RSL-7	RSL-14	RSL-21	RSL-28
Gutter mount	2 metre stub	6 & 2 metre antenna	80 metre antenna	40 metre antenna	20 metre antenna	15 metre antenna	10 metre antenna
Cat D-4100	Cat D-4102	Cat D-4104	Cat D-4110	Cat D-4112	Cat D-4114	Cat D-4116	Cat D-4118
$32.50	**$10.95**	**$23.95**	**$19.95**	**$19.95**	**$20.95**	**$20.95**	**$20.95**

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Amateur radio clubs — their aims and activities

On a worldwide basis amateur radio can be likened to a club with ever increasing membership; a club whose keynote is to foster the widest possible communication between all members at all levels, technical, social, educational and the goodwill which comes from sharing a common interest.

The fraternity of amateur radio is made up of individuals and large and small groups throughout the world, meeting under various names which can be embraced by the term "club" — an association of people united in pursuance of a common interest. It is through the aims and activities of such individuals and clubs that continuing progress is made at the grassroots level in the fields of technical and social discourse.

Australia has the oldest national amateur radio society in the world — the Wireless Institute of Australia — founded in 1910. Throughout the country there are clubs fostering local needs by providing a venue for meeting others with the same basic interest. A warm welcome is extended to visitors dropping in on such gatherings.

To promote such aims and activities, and as a service to all interested in amateur radio, here is a brief summary of those clubs who accepted the invitation to be included in these notes.

The details given are: club name, call sign and postal address. Contact may be made on air as most clubs hold nets on which inquiries may be made, or from the address given. The repeater (R) call signs given are for the two metre band and licensed through the respective clubs. Regular meetings provide lectures and classes for those wishing to obtain their amateur licence.

AUSTRALIAN CAPITAL TERRITORY

ACT Division WIA, Inc: VK1WI, VK1RAC, VK1RGI. Secretary, PO Box 46, Canberra, ACT 2600.

NEW SOUTH WALES

Australian National Amateur Radio Teleprinter Society: VK2TTY. Secretary, PO Box 860, Crows Nest 2065.

Blue Mountains Amateur Radio Club: VK2AUX, VK2NCM. Secretary, PO Box 54, Springwood 2777.

Central Coast Amateur Radio Club: VK2AUX, VK2RAG. Secretary, PO Box 238, Gosford 2250.

Crestwood Amateur Radio Club: VK2BFZ. Secretary, 16 Turon Avenue, Baulkham Hills 2135. Telephone 639 0267 or 638 6970.

Hunter Branch WIA, NSW: VK2AWX, VK2RAN. Secretary, 49 Valaud Crescent, Highfields 2289.

Illawarra Amateur Radio Society: VK2AMW, VK2RAW. Secretary, PO Box 1838, Wollongong 2500.

Jesmond & Districts Electronic and Communication Club: VK2BHZ. Secretary, John Murphy, at clubrooms rear of Regal Theatre, Moore Street, Birmingham Gardens, Saturday 1pm to 5pm.

Liverpool and District Amateur Radio Club: VK2AZD. Secretary, 42 Waratah Cres, Macquarie Fields 2564.

Mid South Coast Amateur Radio Club: VK2RMU. Secretary, PO Box Milton, 2538. Telephone (044) 55 1077.

Museum of Applied Arts and Sciences Amateur Radio Club: VK2BQK. Secretary-general, MAASARC, 659-695 Harris Street, Broadway, Sydney 2007.

North West Amateur Radio Group: VK2RMI (Moree). Publicity Officer, David Grant, 19 Delander Cres, Moree 2400.

St George Amateur Radio Society: VK2LE, VK2RLE. Secretary, PO Box 77, Penshurst 2222. Telephone 531 3295 (Bus), 521 7303 (AH).

University of New South Wales Amateur Radio Society: VK2BUV. Secretary, UNSWARS, PO Box 1, Kensington 2033.

Westlakes Radio Club: VK2ATZ, VK2RWR. Secretary, Box 1 PO, Teralba 2284. Telephone (049) 59 1588.

Wagga Amateur Radio Club: VK2WG, VK2RWG. Secretary, PO Box 71, Kooringal 2650.

VICTORIA

Eastern and Mountain District Radio Club: VK3ER, VK3BNW. Secretary, PO Box 87, Mitcham 3132.

Geelong Amateur Radio Club: VK3ATL, VK3RGL. Secretary, PO Box 520, Geelong 3220.

Geelong Radio and Electronics Society: VK3ANR. Secretary, PO Box 962, Geelong 3220. Telephone (052) 21 3658.

Gippsland Gate Radio Club: VK3BJA. Secretary, PO Box 98, Dandenong 3175. Telephone (03) 772 7985.

Moorabbin and District Radio Club: VK3APC. Secretary, PO Box 88, East Bentleigh 3165.

RAAF Laverton Amateur Radio Club: VK3ARC. Secretary, PO Box 326, Laverton 3028.

Shepparton and District Amateur Radio Club: Secretary, PO Box 692, Shepparton 3630.

Southern Peninsula Amateur Radio Club: VK3BSP, VK3VKR. Secretary, 7 Spensley Street, Rosebud 3939.

Swan Hill and District Radio Club: VK3BSH, VK3RSH. Secretary, PO Box 682, Swan Hill 3585. Telephone (050) 37 2591.

QUEENSLAND

Brisbane VHF Group: VK4IF, VK4RBC, VK4RBN. Secretary, PO Box 911, Fortitude Valley 4006.

Dalby and District Amateur Radio Club: Secretary, 19 Twine Street, Dalby 4405. Telephone (074) 62 2596.

AMATEUR RADIO

Gold Coast Amateur Radio Society: VK4WIG, VK4RGC. Secretary, PO Box 588, Southport 4215.

Townsville Amateur Radio Club: VK4WIT, VK4RAT. Secretary, PO Box 964, Townsville 4810.

SOUTH AUSTRALIA

Wireless Institute SA Division: VK5WI, VK5RAD, VK5RHO, VK5RMN. Secretary, PO Box 1234, GPO, Adelaide 5001.

South Coast Amateur Radio Club: VK5ARC. Secretary, PO Box 333, Morphett Vale 5162.

WESTERN AUSTRALIA

The West Australian VHF Group Inc: VK6WH. Secretary, PO Box 189, Applecross 6153.

Perth Radio League of Western Australia: Secretary, PO Box N1102, GPO, Perth 6001.

TASMANIA

North West Branch Tasmanian Division WIA: VK7NW, VK7RNW. Secretary, PO Box 194, Penquin 7316. Telephone (004) 25 3770.

NORTHERN TERRITORY

Alice Springs Community College Radio Club: VK8AR, VK8RCA. Secretary, PO Box 2935, Alice Springs 5750.

Darwin Amateur Radio Club: VK8DA. Secretary, PO Box 37317, Winnellie 5798.

INTERNATIONAL NEWS

Amateur radio teletype offers a definite advantage by providing hard copy of interesting events relating to amateur radio. Several ART groups transmit regular news sessions for local and overseas information.

From the Australian National Amateur Radio Teleprinter Society here is an extract from a broadcast by the British Amateur Radio Teleprinter Group of the Radio Society of Great Britain made on September 23, 1979.

"Russian amateurs may use top band: An announcement in the newspaper 'Sovetskiy Patriot' on May 16 last has been translated by HB9BRQ as follows:

'Amateur radio stations and novice radio stations are permitted to operate on CW in the band 1850 — 1950kHz, on SSB between 1875-1950kHz and with AM on 1900-1950kHz. The highest power that can be used is 10 watts, with five watts maximum for novices.

"Novice stations may only establish communication with another novice station. For these stations the prefix 'EZ' will be used. The number of the prefix will be composed in the usual system.

"It is hoped that the use of this band will encourage the development of radio sport as well as a wide attraction of youth into amateur radio."

"RAYNET — is the abbreviation given to the Radio Amateurs' Emergency Network in the United Kingdom set up to handle emergency traffic for police and a number of other organisations in times of emergency and disaster where normal communications have failed."

"RAYNET has over 2000 members who it is stated are highly skilled in the art of communication, and is, outside the USA, the largest such organisation in the rest of the world."

"The national RAYNET committee wants to obtain information about similiar organisations in other countries to ensure that complete information

AMATEUR RADIO

can be given of public service given freely by amateurs at international IARU and other conferences. Such information should be sent to E. W. Yeomanson, G3IIR, 32 Gaynesford Road, Forest Hill, London, SE 23 2UQ, England as soon as possible."

(Comment: It would be no surprise if, on a population basis, national or amateur, the area covered and the scope of emergency and community service work done by WICEN — the Wireless Institute Civil Emergency Network — surpasses the claims made for Raynet. — VK2APQ).

GOSFORD FIELD DAY

The 23rd annual field day of the Central Coast Amateur Radio Club will be held at the Showground, Showground Road, Gosford, NSW, Sunday February 17, 1980.

A full program of radio and non-radio events and attractions have been arranged for the enjoyment of amateurs, their families, and friends.

See January and February issues of these notes for further details.

WARC 79

At the time of compiling these notes (mid October) a few details of the World Administrative Radio Conference, which commenced on September 27, had been received. These were preliminary decisions and may yet be amended.

The conference (organised by the ITU) will deliberate for 10 weeks. In addition to the 147 delegations, 38 international organisations have sent observers, including the International Amateur Radio Union. The delegates and observers number over 1900.

The first plenary meeting was addressed by Mr M. Milli, Secretary-General of the ITU. Mr Milli referred to the expansion of the ITU since the previous conference in 1959 and the vast technical achievements made since then. He drew attention to the need to use the radio spectrum in the most efficient and economic way.

In regard to the conference he made these points.

"With its 1800 participants, its 14,000 proposals amounting to nearly 5000 pages, and co-ordinated documentation in several volumes totalling nearly 3000 pages, no term seems adequate to designate the largest conference ever organised under the auspices of the ITU".

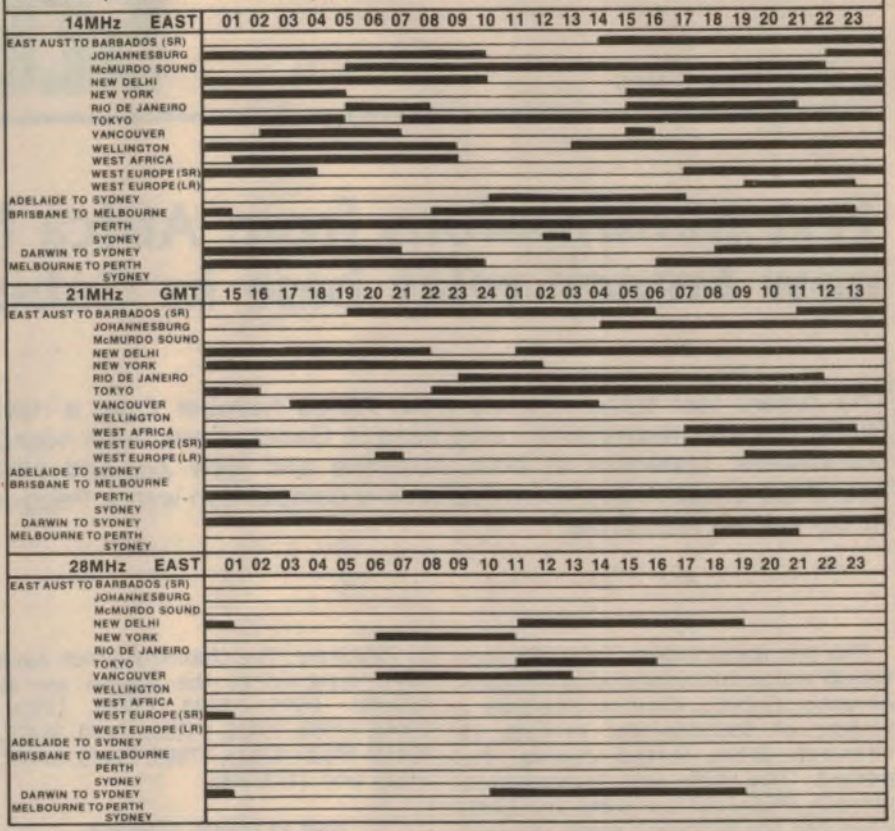
The conference elected Mr Roberto J. P. Severini from Argentina as chairman. Delegates from the USSR, Cameroon, Switzerland, China, Italy and USA were elected vice-chairman.

Mr E. J. Wilkinson of Australia was elected vice-chairman of Committee 6 — Regulatory Allocations Committee.

Taking a very active role at the conference is another Australian, Mr Richard Butler, deputy-secretary general of ITU.

IONOSPHERIC PREDICTIONS FOR DECEMBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 12.79



AMATEUR RADIO COURSE

The University of New South Wales Amateur Radio Society's vacation study course for the full and novice examinations, to be held by the P & T Department early in 1980, will commence on Friday December 14, 1979 at 7.00pm, at the Wireless Institute Centre, 14 Atchison Street, Crows Nest, Sydney, NSW.

This will be the society's seventh annual course and will cover Morse code, theory, and regulations for the three types of amateur licence.

The course is to be held on Tuesday, Thursday, Friday and Saturday evenings from 6.00pm to 9.00pm for six weeks.

The cost, which includes all text books, is $22 for the AOCP and NAOCP and $5 for the Morse code only section.

Those wishing to enroll should attend the WIC at 7.00pm Friday December 14.

Additional information may be obtained from Michael Katzmann, VK2BEA, telephone (02) 665 8014 after 6.00pm.

This is an excellent opportunity for beginners or those wishing to uprgrade their knowledge in the field of amateur radio.

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.

SHORTWAVE SCENE

by Arthur Cushen, MBE

Test transmissions from Africa Number One: new French relay base in Gabon

The recent test transmissions from Africa Number One, a new Radio France International relay base in Gabon, have been heard world-wide. Listeners in both Australia and New Zealand also heard the broadcasts, which featured a competition with a Peugot motor car as first prize!

The test transmissions from the four 500kW transmitters located at Moyabi-Moanda, Gabon, were received on a variety of frequencies; in fact 18 channels were tested during the period. The two test transmission periods, 0400-1200 one week and 1300-2100GMT the following week, resulted in many listeners in Australia and New Zealand hearing these broadcasts.

The station offered prizes including a Peugot car to the winners of a lottery which would be drawn after the series of tests were completed. Listeners were asked to send details of their reception on a postcard, including name, address, frequency of reception, interference and details on the particular broadcast being heard. The transmissions were in Arabic, French and English, but later other European languages were added to the schedule.

The address of the station was given as Africa One, Mail Box Number One, Libreville, Gabon.

Africa Number One is the name of the holding company which owns the transmitters at Gabon and is leasing them to Radio France International for their world-wide services. The test transmissions were beamed to South America, Europe, North Africa and East Africa and reception in New Zealand covered frequencies from 9595kHz up to 21525kHz. The channels which have been assigned to the station are as follows: 9595, 11720, 11755, 11910, 11945, 11950, 15125, 15200, 15270, 15325, 15415, 17820, 17835, 17895, 21475, 21495, 21525 and 21635kHz.

NSB EXTENDS SERVICE

The Nippon Shortwave Broadcasting Company has, for many years, broadcast on short-wave with a commercial program. The first program is mainly Japanese, but the second program includes English.

An extension of the schedule has been noted on 6115kHz when JOZ6 is received with an English broadcast from 0900-0930GMT. The program then continues in Japanese. The English program consists of commercial announcements and talks, as well as popular English recordings.

The broadcasts on NSB are regularly received in 3925, 3945, 6055 and 9595kHz. These four channels have been in use for many years and provide fair reception during our evening listening period.

The Nippon Shortwave Broadcasting commenced operation in the early 1950s and one of our early verifications was from JJ2KY operating on 3925kHz with the power of 500W.

RADIO NEW HEBRIDES

The recent change in status of broadcasting in the New Hebrides has resulted in a new verification being printed, and this will be issued shortly. Many reports are being held by the station pending the printing of the new card. The station is also installing new transmission equipment, which should give better reception of the signals in Australia and New Zealand.

Formerly known as the New Hebrides Broadcasting Service and Radio Vila, the organisation is now known as Radio New Hebrides. The address is PO Box 49, Port Vila, New Hebrides. Broadcasts are well received on 3945kHz to closing at 1100GMT daily except Sunday, when close down is 1000GMT.

A new medium-wave transmitter has already been noted on 1125kHz and this frequency seems to replace 1422kHz. French has been noted to 1000GMT, and the local Bislama program follows to closedown.

ENGLISH FROM ALGIERS

Radio Algiers has been observed by Stewart Forsyth of Christchurch, NZ, with a new program in English 2000-2030GMT on 11810kHz. According to "DX Post" in Adelaide the station also broadcasts on 7145, 9610 and 11740kHz. According to the WRH Newsletter the transmissions in French from Algiers are erratic and have been observed on 7195, 9509, 11633, 11810 and 15160kHz.

Further observations show that as well as the unannounced 11810kHz carrying the English broadcast at 2100GMT, another frequency, 11615kHz, is also heard with the same program. News is broadcast up to 2015 when disco music is featured up to 2030GMT. The out-of-band frequency of 11615kHz has suffered some side band interference from All India Radio on 11620kHz.

TRANS WORLD RADIO

Trans World Radio at Monte Carlo has been looking for a new outlet in the 31-metre band. The latest channel is 9495kHz, which is in use with English up to 0800GMT. Broadcasts are well received on this frequency and requests for reports have been noted in the transmission with the address of the London office being given. This address is 175 Tower Bridge Road, London SE12AS, England.

Another new frequency for Trans World Radio is 11795kHz, which is still

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add eight hous for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing Daylight Saving Time add a further hour.

GET VICOM'S INTERNATIONAL LINE-UP

AIRCRAFT RECEIVER
Model 747

* 16 Channels
* AC/DC Operation
* 4 crystals supplied

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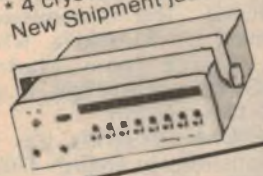

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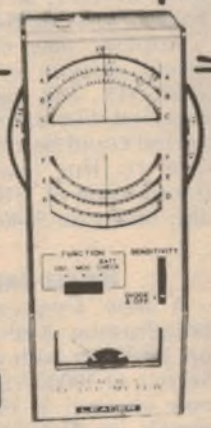

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SHORTWAVE SCENE

being used with transmissions to South East Europe and the Middle East. An Armenian program has been observed on this channel at 1845GMT.

ETHNIC RADIO

Ethnic radio in Australia has been extended with the opening of repeater stations in Newcastle and Wollongong which relay the 2EA Sydney program. Both of these stations operate with a power of 100W on medium-wave. Wollongong, on 1485kHz, and Newcastle, on 1584kHz, have both been verified by the writer, with reception in New Zealand best just before sign-off at 1400GMT. 2EA's schedule shows that it operates from 2000-1400GMT and broadcast in 41 languages. The address of the station is Radio 2EA, GPO Box 21, Sydney 2001.

The two present stations which have operated for some months are to increase power. 2EA Sydney is to move from 801 to 1386kHz early in the New Year with an increase of power to 5kW, while 3EA, the Melbourne station, will move from 1116 to 1224kHz with the power increased to 5kW.

A further ethnic station is projected for Brisbane. 4EB will be operated by Ethnic Broadcasting Association of Queensland with 250W power and should come into service this month.

NEW GREEK FREQUENCIES

Broadcasts of the Voice of Greece to North America have been heard on the new frequency of 9650kHz from 0200GMT. This channel replaces 9655, which suffered interference from Radio Moscow and from Radio Kiev during the transmission period 0200-0355GMT. The signals from Athens are also observed on 9515 and 11730kHz. The transmission is all in Greek, except for English news 0215-0225GMT.

Another new channel is 7205kHz, broadcasting to Australia in Greek from 2100GMT. This signal has been well received, but during our mid-summer period could be a little difficult to hear, due to the low frequency. The transmission is 2100-2150GMT and is also heard on 9640 and 9760kHz.

ISRAEL FREQUENCIES

A new frequency for the Israel Broadcasting Authority has appeared on 21600kHz with a relay of the Home Service of 1900GMT. Another relatively new channel is 15615kHz. Consistent signals on 21600kHz are received on Saturdays and Sundays from 0535-0600GMT, but a program in Russian relayed on 25620kHz at the same time is subjected to severe jamming. The higher frequency of 29705kHz seems to be free of any jamming and provides fair reception.

LISTENING BRIEFS
EUROPE

FINLAND: Helsinki is broadcasting to North America with English 0330-0400GMT. Two frequencies are used, 9675 and 11755kHz, with the latter channel giving the best reception.

SPAIN: The broadcast in Spanish to Australia and the Philippines, which for some months has been using 9790kHz, is now heard on 11920kHz 0730-1000GMT. The transmission is best received on 11730kHz, which carries the service from Madrid up to 1100GMT, while 9520kHz carries the same transmission.

BELGIUM: Brussels has two daily transmissions in English 1705-1750GMT on 6010 and 17740kHz to Africa. English to the Americas is 0015-0100GMT on 6080 and 9685kHz. There is a DX program on the second and fourth Sunday of each month at 1735GMT to Africa, and on Monday at 0045GMT to North America.

ANDORRA: Adventist World Radio has been carrying out test transmissions over Radio Andorra on 6215kHz 2000-2100GMT. This daily transmission has English for the first 30 minutes and then at 2030GMT on Monday French, Wednesday Arabic, Thursday Greek, Friday Dutch and German and Sunday Swedish. According to the BBC Monitoring Service, the transmissions on Tuesday and Saturday are in English for the full hour.

EAST GERMANY: Radio Berlin International has made a frequency change for its English transmission at 0330GMT. The new channel is 11975kHz which replaces 11970kHz. English broadcasts to Europe are: 1915-2000GMT on 6080, 6115 and 7185kHz; 2030-2115 on 7260; and 2130-2215 on 6080 and 6115kHz.

AMERICAS

COLOMBIA: Ecos del Combeima in Ibague, which was using 4785kHz, has been noted on the new frequency of 6025kHz by Ray Crawford of Invercargill, NZ. The station operates 24 hours a day, and has been heard around 0800GMT with typical Spanish programming and identification announcements after each recording.

New Products

Beckman 3020 Digital Multimeter

Beckman Instruments, Inc have entered the digital multimeter market with a range of three instruments which have liquid crystal displays. The instruments are rugged and fully protected, and have guaranteed long-term accuracy. Battery life is up to 2000 hours and should last two years under normal use.

We reviewed the Beckman model 3020 which comes in a high-impact-resistant ABS plastic case with a large recessed selector switch and a 3½ digit liquid crystal display. The case measures 174mm long x 93mm wide x 46mm deep and it weighs about 450 grams including the battery.

The model 3020 has many features common to other digital multimeters such as AC and DC voltage measurements from 200mV to 1500V and resistance measurements up to 20 megohms. Other features which are not so common include AC and DC current measurements up to 10 amps and the "Insta-ohm" facility.

The "Insta-ohm" facility operates when the 3020 is switched to any resistance range and causes a small "ohm" symbol to appear on the display whenever there is continuity between the probes. This is a very useful aid in rapid circuit testing.

Range and function selection are performed by a single large rotary switch which has easy-to-read and unambiguous markings. A tilting bail is fitted for convenience of use.

Overload of the meter is indicated by a flashing "OL" display. Maximum input voltage is 1500VDC or 1000V RMS. Low battery voltage is indicated by flashing of the decimal point.

A special diode test function is included in the resistance ranges. It provides a constant 5mA current through the diode under test and the display gives the resulting voltage across the diode.

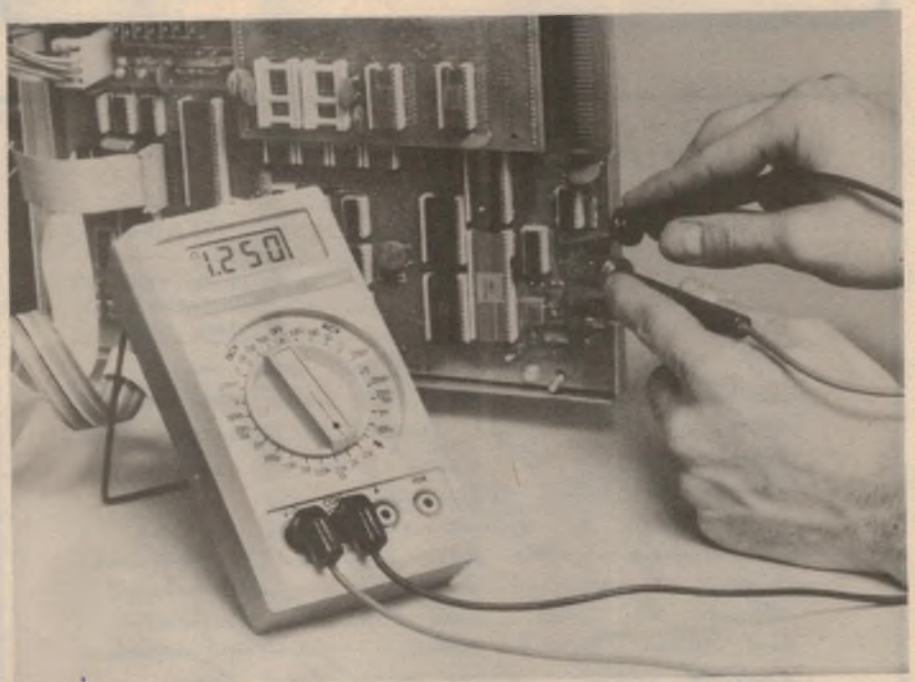
A very worthwhile feature of this DMM is the low open circuit voltage between the test probes when using the resistance measurement ranges. The voltage is less than 250mV which means that it won't turn on a silicon junction, so in-circuit resistance measurements can be readily made — something you certainly can't do with the traditional analog multimeter.

DC voltage accuracy of the 3020 is stated to be within ±0.1% of reading plus one digit. We have few voltage standards which are specified to within those limits but out limited checks indicated that the 3020 certainly meets this specification. Beckman specify this accuracy for a period of one year for temperature limits of 20 to 30 degrees Celsius.

AC voltage accuracy is quoted for three frequency ranges, with the accuracy reducing for the higher frequencies. Over the range from 45Hz to 2kHz, the accuracy is stated to be within ±0.6% of reading plus three digits; from 2kHz to 5kHz, the figure is ±1% of reading plus five digits; and from 5kHz to 10kHz, the accuracy is specified to be within ±2% of reading plus nine digits. Our tests confirmed that the model 3020 was well within this specification.

The more advanced digital multimeters, including the Beckman 3020, feature high AC rejection on the DC voltage range. This very useful feature enables one to measure the true average DC voltage even with quite large AC signal components present. The quoted figure for the normal mode rejection ratio is 60dB at frequencies above 49Hz. We were able to quickly verify this by using a simple arrangement of a transformer in series with a 10 volt regulated DC supply. Even though the peak voltage of the AC voltage exceeded the average DC voltage there was no change in displayed DC voltage — again well within specifications.

In summary, the overall performance of the Beckman model 3020 is very good. The only quibble which we had was that the detent action of the range selector could have been more positive.



Accessories which are available for the model 3020 include a 50kV high voltage probe, an RF probe for measurements up to 200MHz and 2A, 20A and 200A AC current clamps.

The 3020 has a list price of $179 while the model 3010 is $139 and the model 3030, which features true RMS readings, is $199. Further inquiries should be addressed to Warburton O'Donnell Ltd, 372 Eastern Valley Way (PO Box 182), Chatswood, NSW 2067.

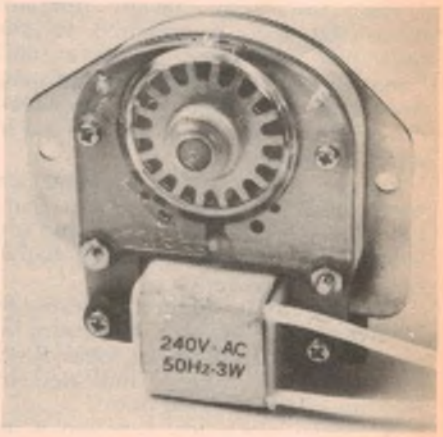
New Products

Hitachi 'Scopes

Pictured above is the Hitachi model V-301 oscilloscopes which is one of four recently released onto the Australian market. The V-301 is a single-trace model with 30MHz bandwidth. Other models in the range are the V-151, single trace, 15MHz; V-152, dual trace, 15MHz and V-302, dual trace, 30MHz bandwidth.

The V-152 is anticipated to be the most popular model and will sell for $540 plus sales tax where applicable. All enquiries should be directed to the distributors, Standard Components Pty Ltd, 10 Hill Street, Leichhardt, NSW 2040.

Christmas Novelty



Buried in A.C.E. Radio adverts is a bargain which has an automatic appeal for the festive season — a motor-driven microswitch rated at 110-250VAC, 10A. It switches every four seconds and can be wired to flash lights long-on short-off, or vice versa. Alternatively it could control two separate strings. $2.50 + 50c P&P. A.C.E. Radio, 136 Victoria Rd, Marrickville 2204.

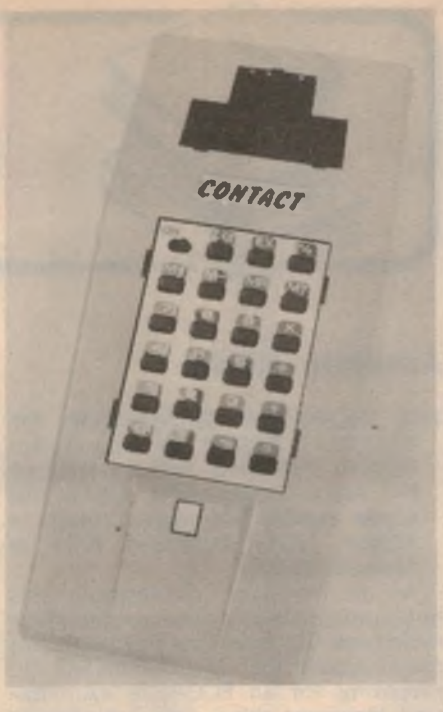
Ultrasonic rangefinder

Just released by Peter Shalley Communications, this new electronic rangefinder uses ultrasonics to measure distances from 50cm to eight metres at the press of a button.

Operation of the "Contact" rangefinder is quite simple. The user simply aims it at the target (eg the wall of a room) and depresses the rangefinding key. The distance from the rear end of the unit to the target is then read off a 3-digit LED display.

Accuracy of the unit is around the 1% mark, which should be adequate for most situations. An in-built 8-digit calculator allows the user to calculate areas, volumes etc. In short, the Contact rangefinder should prove invaluable to anyone who needs instant rangefinding for calculations and cost estimates.

For further information contact Peter Shalley Communications, 554 Pacific Highway, Killara, NSW 2071. Telephone 498 2611.



This 24-page colour booklet on kit building is now included in all Jostykit electronic kits sold in Australia. Entitled "Jostykit Kit Guide", the booklet provides valuable basic information for the beginner. It tells you which tools to buy, shows how components are mounted on a PC board, gives information on soldering, illustrates the resistor colour code, and has colour photographs of just about every type of electronic component you can think off.

The Jostykit kit range comes from Denmark and includes audio amplifiers, radio tuners, RF preamplifiers, car burglar alarms etc. The range is imported by Vicom, 68 Eastern Rd, South Melbourne 3205. Telephone (03) 699 6700.

Books & Literature

Amateur Radio

THE BEGINNERS' HANDBOOK OF AMATEUR RADIO by Clay Laster W5ZPV. Published 1979 by Howard W. Sams, Indianapolis, USA. Stiff paper covers, 384 pages 214mm x 137mm, freely illustrated. Price in Australia $14.20.

As an American publication, this book understandably presents amateur radio from the American viewpoint and pre-supposes that the reader will be preparing for an FCC-style examination. However, this is only a minor disadvantage in a book which is basically an up-to-date theory course for aspiring amateurs.

Tuitional chapters include (abbreviated): Communication Theory — Electricity and Magnetism — Vacuum Tubes — Semiconductors — Power Supplies — Amplifiers — Oscillators — Transmitters — Receivers — Transmission Lines & Antennas — Communications — Practices and Procedures.

Ostensibly, the book is aimed at aspirants to the US Novice amateur licence but my impression is that, with a little rounding out for the local syllabus, a reader with this material under his/her mental belt would be well on their way to a limited or full licence. Well worth looking at. Our review copy came from McGills Newsagency, 187 Elizabeth St, Melbourne 3000. (W.N.W.)

GE SCR Manual

SCR MANUAL, FIFTH EDITION, GENERAL ELECTRIC. Semiconductor Products Department, Syracuse, New York. 1977. Paper back, 687 pages, 210 x 135mm, 697pp. Price $3.00.

The fifth edition is a revised and up to date version of the well known fourth edition. The new edition encompasses not only SCRs, but also TRIACs, PUTs, UJTs and other associated components.

The manual begins with a description of Thyristors, their operation, chip structure and construction. The second chapter gives the graphical symbols used within the manual along with their V-I characteristics. Terminology, an important facet for understanding these devices, is given comprehensive treatment.

To successfully design a circuit using SCRs the ratings and characteristics must be understood. The SCR Manual excels here in that all the relevant specifications are discussed to a depth suitable for design work.

Triggering methods are discussed in chapter four and it is here that the UJT, PUT, DIAC and other devices are discussed. The design information is quite adequate for their use in SCR applications.

Examples and suggested circuits are given for many applications in later chapters. Topics covered include full wave control, feedback systems and power supplies. Waveforms are usually given. Full descriptions of circuit operation aid the reader in understanding the circuits.

A short chapter at the end of the manual is devoted to specifications of diodes and thyristors. A useful supplement to a well written and informative manual.

For the Engineer, Technician and hobbyist alike, this manual will prove invaluable. The only real fault with the manual is the binding. After the book is opened a few times it starts to fall apart. (J.C.)

Computers

THE WAY THINGS WORK BOOK OF THE COMPUTER, published by George Allen & Unwin Ltd, London. Soft covers, 137 x 213mm, 245pp, many illustrations. Recommended retail price $9.95.

The original version of this book was published in German, in 1969. It apparently became so popular that an English translation was made, and the English edition was first published in 1974. This is the most recent reprinting.

Basically, the book is an encyclopedia, covering the fields of computing, information science and cybernetics. It seems to be written primarily for the technically inclined lay person, although there is sufficient mathemetics thrown in to make it of potential value to the professional engineer or scientist as a reference.

The text is clearly written and quite readable, which is a little unusual in a translation from another language. It is also well served by illustrations, most of which are diagrams with pickout in a second colour (red).

Because of the very broad range covered, the treatment of some of the topics seems to me a little unsatisfying.

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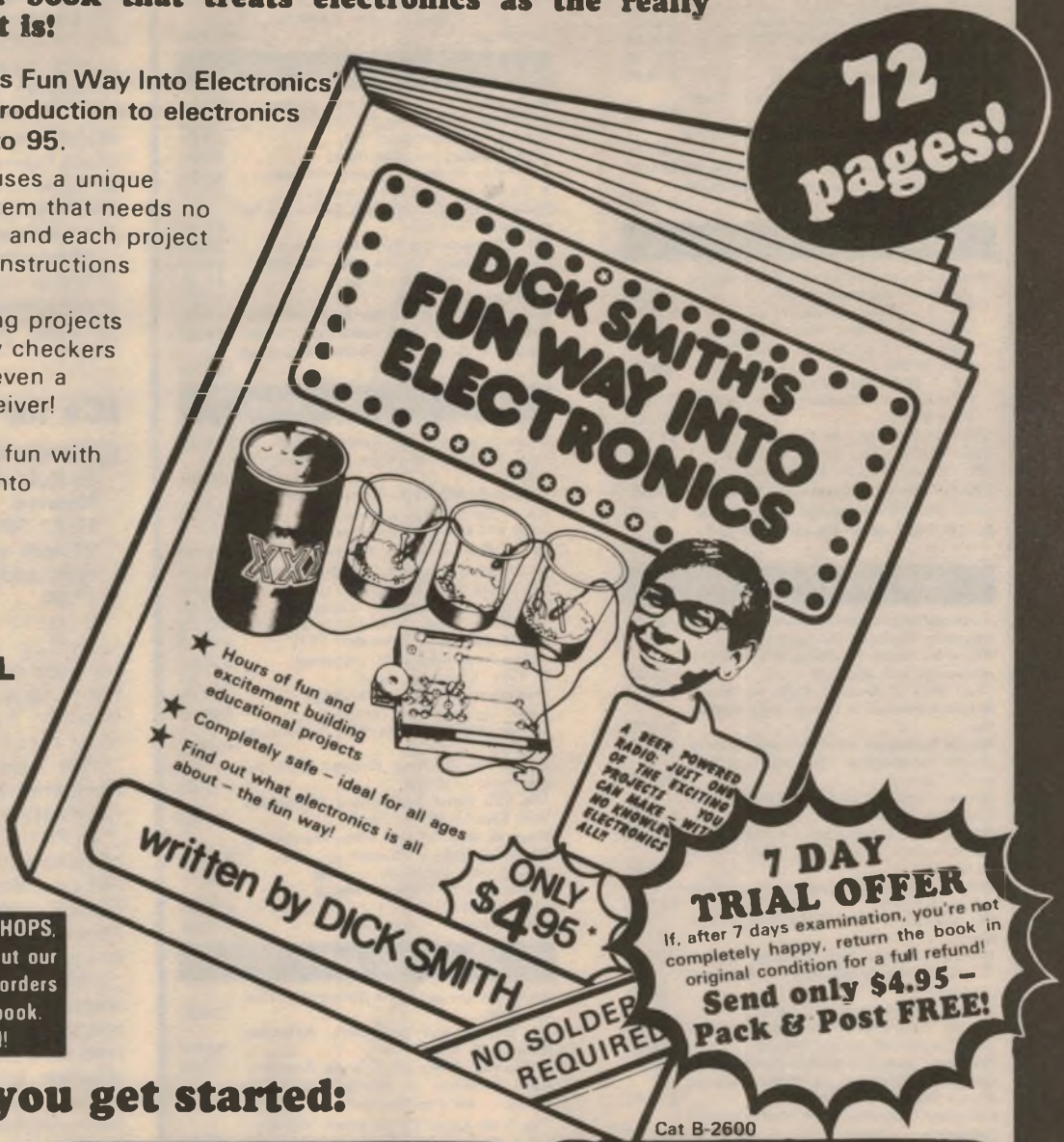

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BOOKS & LITERATURE

It is also beginning to show its age here and there: quite significant space is devoted to electro-magnetic relay logic and thermionic valve circuitry, while I could find no mention of bubble memories or CCD devices.

Still, there is a lot of interesting and informative reading, particularly for those interested in the broad concepts of information theory and cybernetics. So at the quoted price of $9.95 it is really quite good value for money.

The review copy came from the local office of the publisher, who advise that copies should be available from all major book stores. (J.R.)

ICs for Old-timers

GETTING ACQUAINTED WITH THE IC by Rufus P. Turner. Published 1978 by Howard W. Sams Inc, Indianapolis, USA. Stiff paper covers, 112 pages 215mm x 136mm, illustrated by circuits and diagrams. Price in Australia $7.00.

If you're an old-timer who has never faced up to these new-fangled integrated circuits, or a "new-timer" who hasn't faced up to much at all, this new book by Rufus P. Turner should be a most useful acquisition.

Part 1 provides a highly readable introduction to ICs, which sets out what is necessary with clarity and economy.

In Part 2 he describes a whole series of bench style experiments with a type 741 op-amp — an inexpensive and universal type. This should constitute a very meaningful exercise in instrumentation relative to ICs.

This done, the reader is invited to assemble up to 41 small projects, which are simple only because they are centred on a single 741. In reality, the constructor is utilising about 20 in-built transistors and sundry in-built resistors. Many of the projects are useful gadgets in their own right. Recommended.

Our review copy came from McGills Newsagency, 187 Elizabeth St, Melbourne 3000. (W.N.W.)

BASIC Primer

BASIC PRIMER, by Mitchell Waite and Michael Pardee. Howard W. Sams Inc., Indianapolis, 1978. Soft covers, 137 x 216mm, 240pp, many illustrations. Price $12.70.

A further copy of this book has been received from Technical Book and Magazine Company, of 289-299 Swanston Street, Melbourne, Victoria 3000. A full review was given in the August 1979 issue, which in summary concluded that it is a good introduction to BASIC for the beginner, although not especially good value for money. (J.R.)

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INFORMATION CENTRE

BASS DOESN'T BACH: I have successfully constructed the Playmaster 25/25 amplifier together with the Dick Smith 3-53L speaker kit. The system has proved excellent and has, in fact, altered our family lifestyle (for the better). I have however one small problem. I am a fan of J.S Bach, and am in real trouble with very low frequency reproduction of the pipe organ. On some passages all the speakers rattle, and distort the music horribly. Would you give some thought to this problem, bearing in mind that I have a zero knowledge of electronics. (R. H. Bendigo, Vic).

● For a lover of classical organ music, we would have advised the larger system, the 3-75L, using a 30cm woofer. Having said that, however, we wonder whether the speaker systems have been assembled correctly: rigid, airtight and wired as per instructions. We are puzzled by your statement that all the speakers rattle. The low frequency notes should affect only the woofers. If the others are rattling, there may be something amiss with the divider network.

It is possible, of course, that you are simply pushing the speakers and amplifier beyond their capabilities. This would be a very real possibility if you are trying to operate the system at high volume, with the bass boost control advanced beyond "level". A still further possibility is that of acoustic feed-back between the pickup and the loud speakers, perhaps via the floor. Leave the system set in the condition that produces apparent overload, stop the turntable and simply rest the stylus on the stationary record. If a gentle tap on the playing deck produces a sustained "dong" rather than a dull "thud", you have an acoustic feedback problem which will tend to push the system towards overload. Mount the player on a thick foam pad or find another spot for it where the feedback is less evident.

If you feel that everything is in order but you crave for more of everything — particularly Bach bass — it may just be that your family has reached more rapidly than usual the condition that faces most hifi enthusiasts: the hankering for a bigger, better, and more expensive system!

POWER FETs: I was interested to read your article in the September issue, on the design problems of a 100 watt amplifier. Why don't you consider the use of Power FETs? They seem to have many advantages over bipolar transistors and are available in Australia, if somewhat costly. All the reviews on the commercial versions of Power FET amplifiers have been more than favourable. And there are an awful lot of published designs for amplifiers using bipolar transistors, Darlington or otherwise. (P. L., Maylands, WA).

● At the present time, Power FETs with sufficiently high voltage and current ratings to enable use in a high power amplifier are prohibitively expensive and not really an economic proposition. As soon as the prices come down to a reasonable figure, you can look forward to seeing a FET power amplifier circuit in the pages of this magazine.

COMBINATION LOCK: After assembling the above combination lock I had difficulty in getting it to work. After checking the circuit, I found the connection between IC3-13 and IC2-8 and between IC5-3 and IC2-9 different from the wiring diagram and the PCB. Could you please advise me which is right. (EN, Whyalla Norriw, SA.)

● Although there is a difference between the wiring diagram and the circuit diagram as you mention, it only involves two of the inputs of gate IC2d being swapped around. The circuit will work either way, however, as IC2d is a simple NAND gate. The only suggestion we can make as to why you are having difficulty with the circuit is that you may not have realised that a digit not in the code must be entered before the correct combination so as to reset the circuitry. This scheme was used in preference to a separately labelled reset key, and has the advantage of making the code harder to crack.

THUNDERCLAP: Having constructed the Playmaster series of hifi components (and hoping that the Octave Analyser will be available soon for construction) I've had only one real problem which has occurred in the Playmaster 40/40 amplifier. With only the speakers hooked up, and all inputs disconnected, every time a light switch is turned on or off, a resulting clap of thunder is emitted from the loudspeakers.

If the light switch is rapidly turned on and then off, only a click can be heard. Would installing a mains line filter help the situation? (H. G., Bulleen, Vic).

● To determine whether a mains filter is desirable you must first find out whether the interference is entering

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the amplifier via the mains cord or via the speaker leads. Disconnect the speakers and connect a pair of headphones instead. Now switch the lights on and off and listen for the interference. If the interference is still present, then the path would appear to be the mains cord and so a mains filter would be of use.

On the other hand, the more likely result is that the interference path is via the loudspeaker leads. This makes us wonder whether you have omitted the two 0.1uF capacitors which are connected between the earth return lines and the chassis, at the speaker terminals.

PLOP ELIMINATOR: Having constructed graphic equalisers, dynamic range enhancers and other audio equipment, I feel that a "plop" eliminator would be very useful when tape recording records with damaged grooves. Such a unit would also be ideal for eliminating, or at least reducing annoying clicks and plops when copying old 78s.

As many types of ICs are now available, and commercial plop eliminators are quite expensive, a project of this nature should be a practical proposition.

Have you published any information along these lines as yet, or do you have anything planned for the near future. (R.B., Burrendah, WA).

● We have never published information on constructing a plop eliminator. However, the idea is an excellent one, and we shall keep it in mind as a possible future project.

Notes & Errata:

INDUCTANCE-CAPACITANCE METER (June 1979, File No 7/CM/12): It was mentioned in this article that a 0-50uA or 0-100uA meter could be used with appropriate component changes. However, unless major changes are made it will not be possible to obtain full scale deflection on the 100uA meter when measuring capacitance.

DECISION DATA PRINTER (p90, November, 1979): The price of $2395 given for the Decision Data Model 6540 serial printer is incorrect. The correct price is $2700 plus sales tax.

RS-232C interface . . . ctd from p84

interface, and you don't want to modify it — can't you make up a current loop/RS-232C adaptor? Yes, you can. In fact a circuit designed for this very purpose is shown in Fig. 4.

As you can see, it is again quite simple. Opto-couplers are used on the current loop side, while the RS-232C side uses a simplified version of the circuitry in Fig. 3. Apart from the opto-couplers, all components are readily available low-cost items.

The electronics side of Fig. 4 should cost you around $5, apart from a wiring board and a suitable power supply. The power supply can be quite modest, as it only has to supply +12V at around 80mA and -12V at around 90mA.

You may find that the dearest part of the interface is the DB-25 socket, and the matching plug. These are not cheap, unfortunately.

Well, I hope that the "mysteries" of RS-232C are now quite clear to you. It's really not very complicated, and you can provide your microcomputer with a simple RS-232C interface at very low cost. Why not do so, and give yourself the added flexibility?

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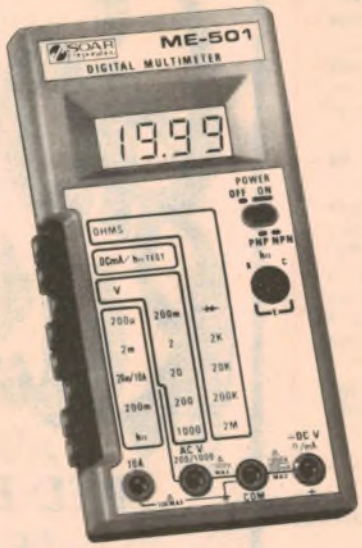

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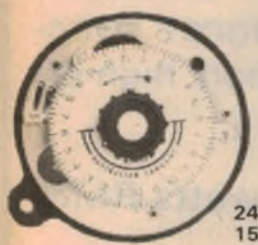

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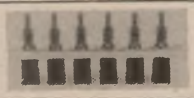


SPEAKER SYSTEMS

INCLUDING TWO 6x4 SPEAKERS
5 Watts RMS $7 each
Pack & Post NSW $1.50
Interstate $2.50 For Singles or Pairs

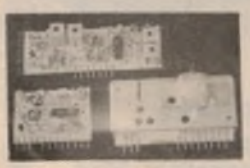
SPEAKER SYSTEMS

15 watt RMS including 2 6in dual cone, each cabinet $16 each. P&P NSW $2.50; Interstate $3.50, WA $4.50

TRANSISTOR EAR PIECES PLUGS AND LEADS, 3 FOR $1 PICK UP ARMS MONO COMPLETE WITH CARTRIDGE, $4.50
PICK UP ARMS STEREO COMPLETE WITH STEREO CARTRIDGE, $6.50

TV TUNER VALVE TYPE

$2.50
Including valves
P&P $1.00
Interstate $2.50



SUPER SPECIALS

FM STEREO TUNER KITS

SETS OF 3 MODULES INCLUDE FM TUNER, DECODER & IF/DETECTOR CIRCUIT DIAG. SUPPLIED; CAN BE USED WITH AMP MODULES.

ONLY $18! PP $1

VORTEX DECKS

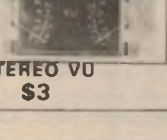
COMPLETE WITH HEADS & CIRCUIT FOR AMPLIFIERS FOR THE DECK.

ONLY $25!

SPARE ERASE HEADS for above $2 ea
PP NSW $2.50 INTERSTATE
WA $4.50 $3.50

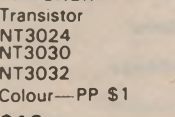
24V MOTORS

REVERSIBLE
only $2.50 each

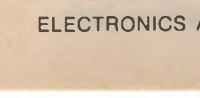


VU & BALANCE METERS

STEREO VU
$3



12 Kn 100uA
$2



PHILIPS
TV TUNER
Transistor
NT3024
NT3030
NT3032
Colour—PP $1
$10 ea

ADVERTISING INDEX

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The truth is, JVC have always produced real hi-fi components and we believe this current range represents JVC's finest range ever. Here are some real innovations and performance features to whet your appetite:— Quartz locked turntables with uncanny accuracy; Receivers/Amplifiers, some with built-in SEA Graphic Equaliser and DC, class A/B amplification; Cassette deck with JVC automatic computerised tape tuning; Computer designed speaker systems; Separate but matching JVC components designed to compliment one another; perfectly. And all this real hi-fi know-how is yours ...merely for the asking.

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National

National

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