ELECTRONICS Australia

AUST $1.60* NZ $1.70

SEPTEMBER, 1980

Acoustically coupled modem

TRS-80 pocket computer!

Twin tremolo for organs

Designing vented speaker enclosures

Who are the computer criminals?

Somewhere on this 3 hour cassette a brilliant goal was scored.

Find it in seconds with Sony 'Picture Search'.

Sony Betamax C7 solves one of home video's more frustrating problems with 'Picture Search'. Now it's simple to locate programme material in the playback mode. Picture Search plays in forward or reverse at 11 times normal speed with all the action on the screen. That means 3 hours of recorded programme can be reviewed in just 16 minutes. Now you can find that last minute goal without playing extra time. But then, Picture Search is just part of the magic Betamax C7.

A choice of viewing speeds.
From 3 x normal speed to single frame advance, or variable slow motion, that's the viewing versatility of Betamax C7. Sony's superior U-loading system ensures optimum quality in every mode.

14 day, 4 programme timer.
Pre-set recording times for up to four different programmes on the same or different channels up to two weeks in advance. Betamax C7 also features a cordless infra-red remote control unit which puts all major functions including 'Picture Search' in the palm of your hand.

Sony leads in home video.
1 million Betamax recorders and 20 million tapes have already been sold. With Sony Betamax C7, you enjoy all the benefits of Sony research and leadership.

Sony Betamax C7

SONY

There are two different Betamax units available, the C7E and the C7EC. For areas which require channels 3/4/5/5A, please specify C7EC. Your television should also have a UHF tuner.

AP3467

ELECTRONICS Australia

Volume 42 No. 6 September, 1980

Australia's largest selling electronics magazine

What are the seven computer sins?

Is the computer criminal a genius or an opportunist? Our feature article on p17 has the facts.

COMING NEXT MONTH – Find out what our plans are by turning to p8.

On the cover

Build our new Acoustically-Coupled Modem and read about the new "TRS-80 Pocket Computer" from Tandy Electronics – that's the invitation on this month's cover. The modem allows you to send computer data over telephone lines, while Tandy's new computer is programmable in Basic yet is easily held in one hand (see p62 and p117). (Photographs courtesy Tandy Electronics and by staff photographer Bob Finnae.)

FEATURES

HIFI TOPICS AND REVIEWS

PROJECTS AND CIRCUITS

MICROCOMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

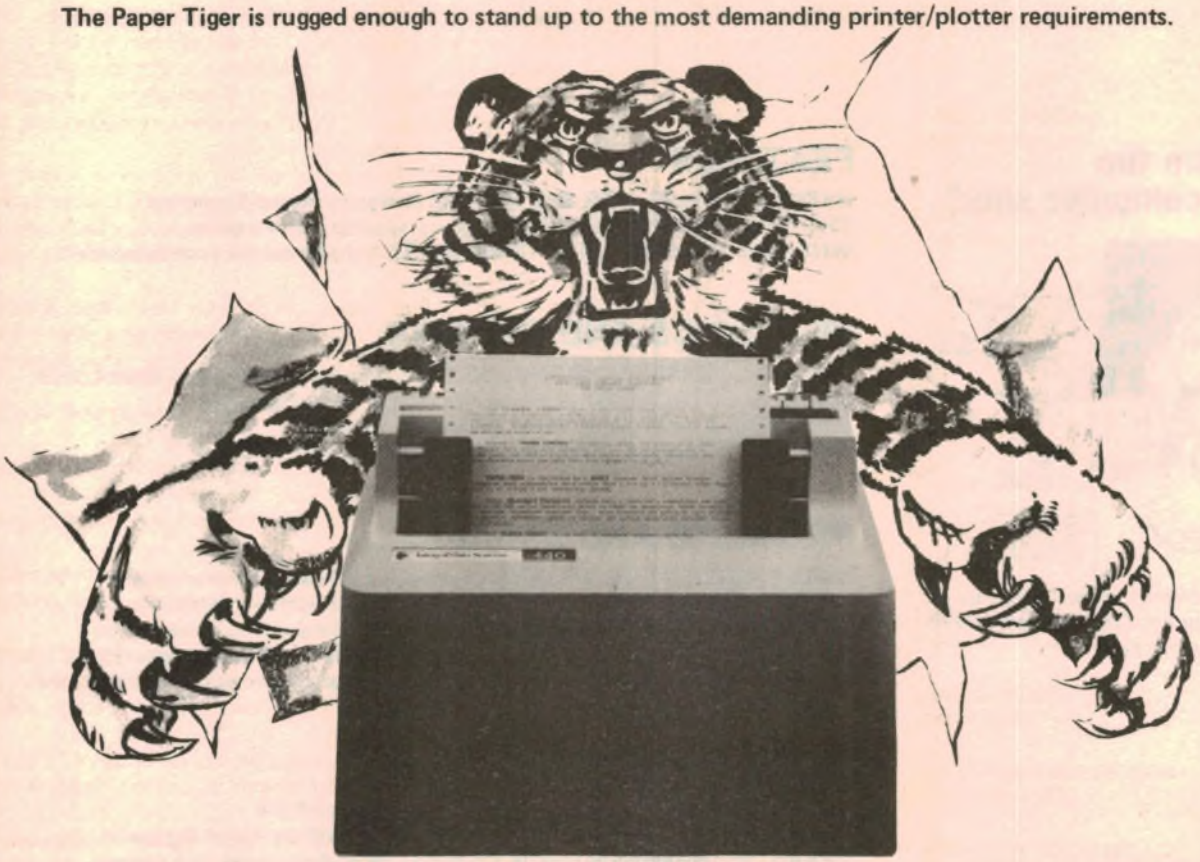
The Paper Tiger IDS440 Impact Printer

Puts more bite into everything you do.

Now available — the Paper Tiger Printer features a graphics option that lets you make the most of your Apple II or other personal computer. And, the Paper Tiger gives you 8 software-selectable character sizes, 80 and 132 column formats, Multi-Part business forms handling, adjustable tractor feed, form control, reliable steppes motor paper drive, serial and parallel interfacing . . . plus lots more.

Don't let our low prices fool you!

The Paper Tiger is rugged enough to stand up to the most demanding printer/plotter requirements.



We also stock:

TEXAS INSTRUMENTS: High speed, high reliability, professional dot matrix, 132 character/line printers.

N.E.C.: Highest standard in professional character printers, for word processing and similar applications.

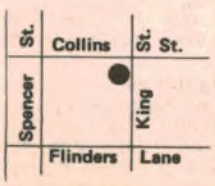
— AUSTRALIA'S LEADERS IN SMALL COMPUTER SYSTEMS —

write now or call us:

ComputerLand®

in Melbourne

Grd. Floor, 555 Collins Street, MELBOURNE. VIC. 3000.
Phone (03) 62 6737 (03) 62 5581 Telex AA37007.



Editorial Viewpoint

Automation: a threat or an opportunity?

When the electronics industry – and this magazine – was much younger, electronics engineers could pursue their activities with untroubled zeal, secure in the belief that what they were doing would contribute positively to the life-style of the community. Few questioned the need for improved communications, emergency services, maritime and aerial navigation, medical facilities, mass entertainment, and so on. Where gaps existed, electronics moved in to fill them.

More recently, electronic technology has moved so far and so fast that the need/response relationship has been overtaken. Time and again, we find ourselves confronted by developments, created or facilitated by electronics, which are not unambiguously welcome. In short order, they have become facts of life to which society somehow has to adjust.

Talking to groups from many walks of life, I sense an obvious fascination with the onward march of electronics, but an equally obvious apprehension as to where it will all lead. Right now, the focus is on automation and its growing impact on the workforce and its – our – lifestyle.

As I write, discussion and argument about the Myers Committee Report has just begun but it is unlikely to alter three widely held points of view:

- Automation always has and therefore always will affect the distribution of labour but, of itself, will not cause unemployment. ("She'll be right, mate!")
- Australia must automate to remain viable in trade and commerce. Sorting out labour problems is a necessary corollary.
- No amount of rationalisation can change the fact that automation replaces people with machines. In the ultimate, there must be fewer person/hours of labour to share. There may or may not be fewer dollars.

A great many people involved in electronics and industry generally regard propositions 2 and 3 as the most likely scenario for the future – and I am one of them. I just don't see how our already over-full lives and over-full homes can, for long, absorb the products of automation *plus* full employment.

On the face of it, this kind of thinking tends to rob electronics of some of its former simplistic zeal. Behind each new and fascinating development lies the shadow of its social implications.

But for electronics engineers to feel guilty or to back off is not an appropriate or even a practical response. If automation can open the way to a lesser workload and (hopefully) to meaningful leisure, the obligation is on the community to take advantage of the opportunity so presented.

The dilemma is social rather than technological.

Neville Williams

Registered for posting as a publication — Category B.
Printed by Magazine Printers Pty Ltd, of Regent Street, Sydney and Masterprint Pty Ltd of Dubbo, NSW, for Sungravure Pty Ltd, of Regent St, Sydney.
Editorial Office
57 Regent St, Sydney 2008.
Phone (02) 699 3622 Telex 25027.
Postal Address: PO Box 163, Beaconsfield 2014.
Advertising Offices
Sydney — 57 Regent St, Sydney 2008.
Phone (02) 699 3622 Telex 25027.
Representative: Narciso (Chit) Pimentel.
Melbourne — 392 Little Collins St, Melbourne 3000. Phone (03) 602 3033.
Representative: Janis Wallace.
Adelaide — Charles F. Brown & Associates Ltd, 254 Melbourne St, North Adelaide 5006.
Representative: Sandy Shaw (08) 267 4433.
Perth — 454 Murray Street, Perth 6000.
Representative: Ashley Croft (09) 21 8217.
Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001
Enquiries: Phone (02) 20944, ext 2589.
Circulation Office
21 Morley Ave, Rosebery, Sydney 2018.
Phone (02) 663 3911.
Distribution
Distributed in NSW by Sungravure Pty Ltd, 57 Regent St, Sydney; in Victoria by Sungravure Pty Ltd, 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty Ltd, 101-105 Weymouth St, Adelaide; in Western Australia by Sungravure Pty Ltd, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

News Highlights

Intelligent robots set for industry takeover

A recent conference in London was told that within 10 years the number of industrial robots in use could be growing by as many as 200,000 a year. By 1990, the conference was told, robot production worldwide could be up to 23,000 a year from existing manufacturers alone. However, the increasing use of microcomputers to control robots may also result in computer manufacturers entering the robotics field, thus giving the 200,000 per year increase.

Robots have developed dramatically since the early '60s when they were mainly used for simple transfer and stacking operations. With the aid of microprocessors, the latest robots have been given visual and tactile senses which allow them to discriminate a particular component from a jumbled pile on a conveyor belt. They can also follow the contours of a workpiece without being told in advance exactly what they are.

Already over 12,000 advanced robots are in use throughout the world. There are about 6000 in Japan, 3500 in the United States, and over 2000 throughout Europe. If less advanced robots are included in the figures the number in use in Japan alone is close to 40,000.

At present the majority of manufactured goods are not produced by mass-production assembly line methods, according to speakers at the conference. Almost three-quarters of total goods produced are made in small batches which are unsuitable for automation. British industrialists, however, say that the low capital and operating costs of the latest robots may change that. A recent survey showed that British managers believe that by the year 2000 half the country's batch production will be carried out by robots that can be programmed to handle a variety of different products.

The operating cost of a $40,000 robot working two eight-hour shifts a day is about $4.50 an hour. A human worker in the UK costs $8 an hour and $14 an hour in the US. The potential for increased profits ensures that the use of robots and automated production equipment will continue to increase, regardless of the social consequences

Fuel cell contract to Westinghouse

The Research and Development Centre of Westinghouse Electric Corporation has received a contract to develop an integrated energy system powered by an air-cooled phosphoric fuel cell. The project, covering two years and costing $US4.4 million, is an important step towards the creation of a fuel cell system capable of providing electricity, direct heating and cooling, and hot water for commercial and residential buildings

A fuel cell is a device which uses an electrochemical process to directly convert fuel to electrical power. The fuel cell system under development by Westinghouse includes a device which converts natural gas into the hydrogen required by the phosphoric acid fuel cell and power conversion equipment for changing the DC output of the cell to AC at 60Hz.

Since the fuel cell system is non-polluting it can be located on the site of commercial and residential buildings. When combined with heat pumps and heat exchangers the system can achieve fuel conversion efficiencies of more than 80%, which means that it is almost twice as efficient as the combined gas-electric power sources used today.

Anti-collison car radar

Scientists at Britain's Lancaster University have developed a prototype of a radar device which will give drivers advance warning of vehicles ahead of them, especially in foggy conditions. The University has received a grant from the Science Research Council to miniaturise the equipment so that it can be fitted to vehicles.

The device is able to distinguish between objects moving at different speeds within a range of 180m, to alert drivers to the presence of a stationary or slow moving vehicle ahead. A horn shaped antenna emits high-frequency radio waves which are focussed into a narrow beam by a polythene lens. The antenna acts as a transmitter and receiver as the microwave signal is reflected back from objects in its path. The frequency shift in the received signal caused by the movement of the target is then detected and used to display information about the speed and direction of the object.

The device can also be used in a stationary role, placed at intervals on the emergency stopping lane of a motorway to inform police about vehicles pulling onto the hard shoulder.

A polythene lens focusses a microwave beam in this prototype collison avoidance radar system for cars.

RCA predicts bright future for "SelectaVision"

Mr Herber S. Schlosser, RCA's executive vice-president, said recently that the company's "SelectaVision" video disc system will be "world-wide in scope" and that it offers "enormous" potential for entertainment and education. Speaking at the 4th International Videodisc and Videogram Conference in New York, Mr Schlosser also spoke of RCA's plans to market the video disc system in Europe.

RCA has already obtained licences to European produced programs which will be used to support the SelectaVision system in the European market. European productions will also be distributed by RCA in the United States under the terms of the licences, including Sir Laurence Oliver in "Henry V", "Hamlet", and "The Merchant of Venice".

RCA is expecting a big demand for its system in Europe due to the limited number of television stations available to the average viewer compared with the US. In the United States about 50% of viewers can receive nine or more stations, and people in New York and Los Angeles have a choice of 15 different broadcast stations, with many more cable stations also available. In contrast a viewer in London, Paris, or Hamburg can choose from only three channels. Presumably RCA is eyeing the Australian market for the same reason.

Introduction of the capacitively coupled RCA video disc system is expected to begin in the United States in the first quarter of 1981.

Work progressing on colour LCDs

Liquid Crystal Displays (LCDs) offer advantages in power consumption over other types of display devices, but more importantly, according to Japanese researchers, they offer a wide range of possibilities of colour displays. In the early 1960s, Westinghouse engineers experimented with chloresteric liquid crystals for the formation of colour images, and since then about 10 colour display devices have been introduced.

The Japanese are investigating other liquid crystal techniques which will improve the display quality of existing monochrome LCD displays and lead to the development of practical multi-coloured displays. The availability of colour displays will considerably expand the applications of LCDs. Future uses could include segmented analog displays, multi-character displays, graphics displays, and perhaps flat-screen colour television.

Handheld computer terminal

The M55 handheld computer terminal measures 88mm x 218mm and weighs only 650g, and is claimed by the manufacturer, UCSL Microsystems Ltd, of Britain, to be the smallest and lightest such terminal in the world. The handheld terminal is intended to provide sales representatives and travellers with a means of communicating with a distant computer. A salesman can use the terminal as an "electronic order book" to record details of an order. At the end of the day he can link his terminal to a telephone and report his orders to a central computer for processing.

Essential to the success of the device is its software. The company has devised a control program which is 90% common to the requirements of a variety of different users. The remaining 10% of the program can be tailored to the needs of specific users, reducing the time and costs of program development for new applications.

The company has conducted a series of exhaustive tests on the terminal which demonstrate that it can reduce errors in the processing of orders by up to 75% and considerably speed deliveries. Further information is available from UCSL Microsystems Ltd, 184 High St, Berkhampstead, Hertfordshire, England.

Tired? . . . Listless? . . . Feelin' Crook Mate?

Why not visit your local computer?

Patients visiting doctors' surgeries in Britain may soon find themselves describing their symptoms to a computer. The development of low-cost microcomputer systems and special medical programs means that computers may soon take over part of the administration and diagnostic work in even the smallest surgeries.

Four special medical computer programs recently announced in London will allow doctors to computerise their practice for as little as $2600. This price includes the computer, visual display unit and the program. Four programs, called appropriately enough, Headache, Drug, Freud, and Practice Monitor are being offered.

"Headache" and "Drug" are diagnostic aids which enable the computer to ask the patient simple questions which help to produce an accurate diagnosis of the cause of his ailment. Questions to the patient are displayed on a TV screen and require only a "yes" or "no" answer. The computer analyses the information derived from the patient's answers and presents the doctor with a list of possible ailments with a probability factor given for each of them.

"Freud" is a program designed with the help of the UK Institute of Psychiatry as an aid to diagnosing depression. Depressed people are said to be less inhibited when dealing with a machine than with a doctor. Combined with the computer's ability to compare many answers to the same questions over a period of time, this fact may offer help to depressed people. (Unless, of course, their depression is somehow related to machines taking over human jobs.)

The Practice Monitor program can be used by a doctor to keep a record of his fees, details of the illnesses he has treated, and the records of patients.

WORLD'S LARGEST "wrist" watch – this watch, some 6½ stories tall, recently made its debut in New York City's Times Square, Broadway and 47th Street. The Casio Time-Scan watch displays the hour, minute and second, switching every 15 seconds to display the month, date and day of the week.

What's happening in energy research? . . .

Heat pipes promise big energy savings

The capabilities of heat pipes to transfer heat energy at rates between 500 and 1000 times those of solid metal connections are being harnessed in Britain to achieve significant energy savings at low cost.

A heat pipe is simply a sealed tube containing a wire mesh wick filled with an appropriate liquid and vapour from the liquid. When one end of the tube is heated the liquid in the mesh turns to vapour, absorbing a considerable amount of heat in the process. The hot vapour travels to the cold end of the pipe and condenses, yielding up its heat, which can be applied to other purposes. The condensed liquid is then absorbed by the wick and travels back to the hot end of the tube by capillary action and the cycle repeats. There are no moving parts, and the pipes last for many years with only minimal deterioration.

A British company, Scurrah Hytech, has been working on a number of applications of heat pipe technology for the recovery of waste heat from flue gases, and has successfully set up two industrial units with heat recoveries of 160,000 and 100,000 kilojoules per hour. In the first application, in a gas-fired sugar boiler, heat is extracted from the exhaust and used to heat water in the plant. The temperature of the exhaust gases has been reduced from 645°C to 390°C, which also extends the operating life of the exhaust flues.

Even though gas is the cheapest fuel for the boiler, it is estimated that the heat pipe system will pay for itself in only 14 months because of the fuel savings.

In the second application, the temperature of boiler exhaust from a dairy has been reduced from 250°C to 190°C, and the recovered energy used to heat intake water. The company has carried out a number of studies of other industries, including pottery operations, and it has shown that savings of $60,000 a year can be achieved with a capital expenditure of one-third of that amount.

Generally, says the company, where there is a continuous process in which exhaust gases are emitted at high temperatures there is an application for heat pipe recovery systems, which are comparatively simple and easy to install. More details can be obtained from Scurrah Hytech Products, 6 Market St, Soham, Ely, Cams. CB7 5JG, United Kingdom.

$50,000 solar grant to Univ. of NSW

Associate Professor John Giutronich of the University of NSW School of Physics has received a $50,000 grant from the NSW Government to continue his research into non-tracking solar concentrators. The National Energy Research Development and Demonstration Council also recently made a grant of $52,000 to Professor Giutronich to enable the study of methods of producing electricity using his techniques.

"I will be working on the basic device which is a non-tracking concentrator both in thermal applications and in photovoltaic electricity," Professor Giutronich said. "Four percent of the total energy used in this country is used in heating hot water in the domestic situation. The way that thermal energy is required in industry could equal 30% of the energy bill of Australia."

Flat plate photovoltaic cells produce electricity at a cost of about $10 to $12 per watt under the most favourable conditions. The concentrators developed at UNSW can reduce this cost to $2.50 to $3.00 per watt, which would make electricity from the Sun competitive with diesel-driven generators which are now used extensively in Australia at places which are not on the electricity grid.

Greater range for electric cars

A recent announcement by Gulf Western Industries in the United States indicates that the zinc-chlorine battery, under development by the company for eight years, offers significantly higher power density than conventional lead-acid batteries.

Gulf Western states that it has tested a zinc-chlorine battery through its charge-discharge cycle over the equivalent of 320,000km. A conventional lead-acid battery would collapse and require replacement after 48,000km!

The company installed the new battery in a Volkswagen Golf fitted with an electric drive and demonstrated that the system could provide a range of 240km at 88km/hr on one charge. The battery/drive combination weights 545kg, about a third of the weight of an equivalent lead-acid system. The company believes that a vehicle designed from the start to use an electric drive could provide a range of over 320km at 88km/hr and considerably more as the average speed is decreased.

Gulf Western has opened a pilot plant at Greensboro, North Carolina, to make the zinc-chlorine batteries. Five test vehicles fitted with the batteries will start evaluation trials at the end of this year.

Multicoloured LED

Sanyo Corporation announced recently that it has developed the first multi-coloured light-emitting diode which emits colours from green to red, including intermediate hues. Presently available tri-colour LEDs actually contain two elements, one for red and one for green, which are activated depending on the polarity of the supply voltage. Sanyo's new LED is made from phosphorised gallium, and is claimed to have a life of "several tens of thousands of hours".

Sanyo's next step is a LED capable of emitting red, blue and green, the primary colours of a television display. Such a development would be a significant step towards flat-screen colour television.

Business Briefs:

- Following the retirement of **Mr H. D. Huyer** as Managing Director of Philips Industries Holdings Ltd, Mr C. Bossers has been appointed Chief Executive as from July 1, 1980. Mr Huyer will continue as a non-executive Director and Chairman of the Board of Directors in Australia.
- **National Semiconductor Corporation** announced recently that it achieved record results during the fourth quarter for the fiscal year which ended on May 31, 1980. Total revenues for the fourth quarter were $US30 million, a 49.7% increase over the fourth quarter last year.
- The Seventh International **Audiovisual and Communications Exhibition** — AVEC 81 — will be held in Paris at the Palais des Congres CIP, Porte Maillot from January 12 to 17, 1981. On the 12th and 13th, entrance to the exhibition will be reserved for the trade, and for the first time the Exhibition will be open to the public, from January 14 to 17.

Coming Next Month*

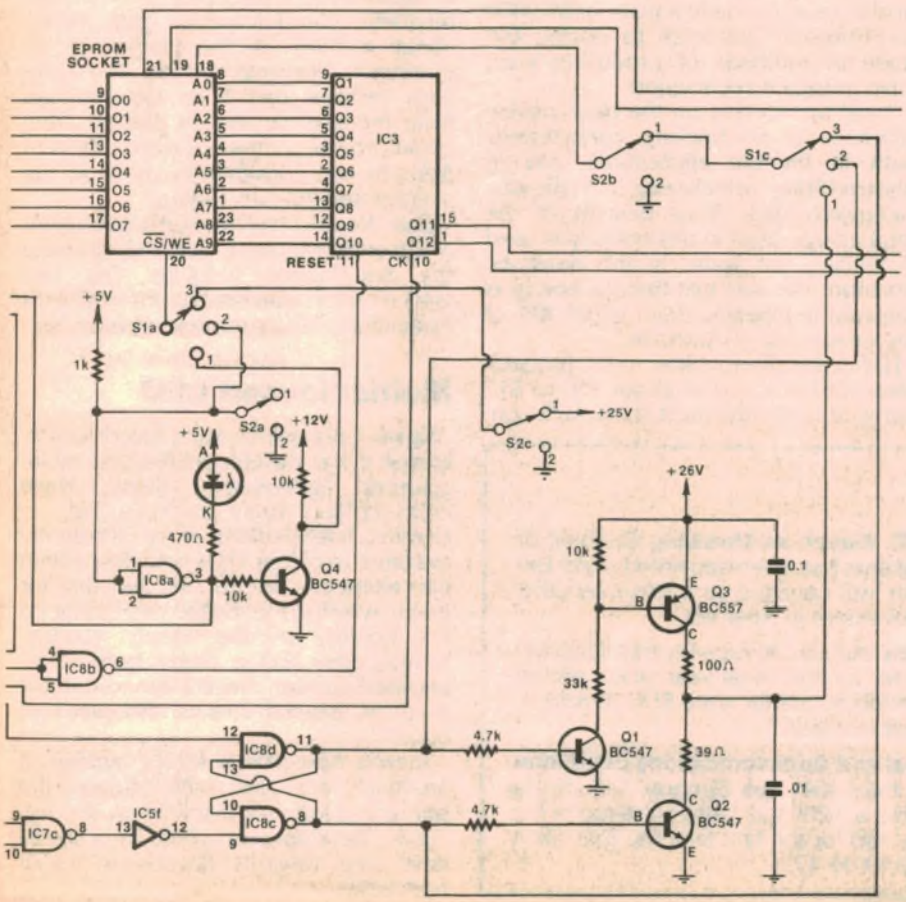
Digital Engine Analyser

With jitter-free easy-to-read LED display this engine analyser measures revolutions per minute, Dwell and Battery voltage on any four, six or eight-cylinder motor. It is fully compatible with any electronic or conventional ignition system and can be put together in just a few hours at modest cost.

Coming Soon: Playmaster Power FET Stereo Amplifier

At last, a fitting successor to the Playmaster Twin 25 and Forty-Forty amplifiers, with more power, more features and much better performance. Watch your newstand for this one!

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



NEWS

Another customer for Prestel

On July 3, Austria became the fifth country to buy the technology of the British Post Office's Prestel system. The agreement was sealed when contracts were signed in Edinburgh where experts from many different countries interested in Prestel services were meeting to discuss plans and progress.

The Prestel system is a combination of telephone and television which gives users access to an information bank stored in a central computer. Using a pushbutton control unit about the size of a pocket calculator, subscribers can call up over the phone information stored on the computer and have it displayed on the television screen. News, sports results, share prices, weather reports, traffic information, and train and airline timetables are all available – literally at the user's fingertips.

British Telecom has already sold its viewdata expertise to West Germany, the Netherlands, Hong Kong and Switzerland. Negotiations are also under way with organisations in the US to set up a Viewdata service there. The announcement of this latest contract follows the adoption of the British Prestel system as an international standard for viewdata systems, a decision made in June by study groups of the CCITT – the International Consultative Committee on Telephones and Telegraphs.

EPROM PROGRAMMER ADDENDA:

EPROM PROGRAMMER (July, August 1980, File No. 2/CC/51,52): Data recently to hand indicates that the circuit published in the first article should be changed with respect to the 2732 EPROM. The change involves the connections to pin 20 (CS/WE) via S1a and S2. The modified circuit, incorporating a three-pole, two-position switch for S2 is shown at left. The reason for the change is that the TTL programming pulse for the 2732 (applied to pin 18) is "active low" rather than "active high" as for the other EPROMs.

While the above circuit changes do not necessitate any software changes, there was an error in three lines of the listing on page 72 of the first article. The change is as follows:

```
7000 B$=LEFT$(A$,1):J=LEN(A$)-1
7010 A$=RIGHT$(A$,J)
7020 IF B$ < "A" THEN
        J=ASC (B$)-ASC("0"):RETURN
7030 J=ASC(B$)-ASC("A")+10
7040 RETURN
```

AT LAST!

DICK SMITH'S FUN WAY INTO ELECTRONICS VOL 2

- **Twenty exciting and useful projects to build**
- **Learn how to make your own printed circuit boards**
- **How to use a multimeter**
- **How to solder**

Yes – the long awaited 'Fun Way into Electronics, Volume 2' is due in stock in September.

The follow-up to the incredibly popular 'Fun Way 1' this book contains another twenty projects which are all useful devices: everything from electronic jewellery to a home and car burglar alarm!

They're all built on printed circuit boards – so we'll not only give you step-by-step instructions, we'll also show you how to solder! And there are attractive cut-out labels in the back of the book to give your projects a really professional appearance.

Dick Smith's Fun Way into Electronics, volume 2: it's a great gift idea, and it will be available from your nearest Dick Smith store or re-seller almost immediately, and from most good bookstores and newsagents shortly.

ONLY $6.95

Cat B-2605

Schools, re-sellers, etc: ask about our incredible bulk discounts!

SPECIAL 7 DAY NO-RISK TRIAL OFFER: We'll send you a copy of 'Fun Way Volume 2' by return mail for just $6.95 – that's pack and post FREE! If you're not completely happy with it, return it to us in original condition and we'll send you a refund. What could be simpler? (7-day offer also available from all Dick Smith company-owned stores. Book must be returned to point of purchase within 7 days, and in original condition, to qualify for refund).

KITS OF PARTS FOR FUN WAY II PROJECTS:

Full kits of parts for all projects in 'Fun Way 2' will be available with the release of the book. These kits include all components required, the printed circuit board, solder and wire etc. For details of the projects, the kit prices, etc, please refer to the 1980 Dick Smith catalogue, page 25.

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

Energy for homes & transport

Hydrogen: fuel for the future

Once feared because it is highly inflammable, hydrogen can now be stored and transported safely, in the form of metal hydrides. It's a clean form of energy, producing just heat and water vapour on combustion, and in the future may power our cars and planes and heat our homes.

by SADIQ HASNAIN

What's lighter than air, contains three times the energy of petrol, and produces water as the byproduct of combustion? It's hydrogen – the simplest of all elements known to man.

Hydrogen may well become the panacea for our energy woes around the turn of the century, but right now much research and development remains to be done to prove its feasibility as a fuel for an energy hungry world. At the National Research Council's Division of Chemistry, Dr Bryan Taylor and his colleagues are investigating one of hydrogen's amazing properties – its ability to be stored safely in combination with certain metals (forming a metal hydride) and to be released on demand.

Prototype electrolysers under development at Noranda Research, Quebec, Canada, for the NRC.

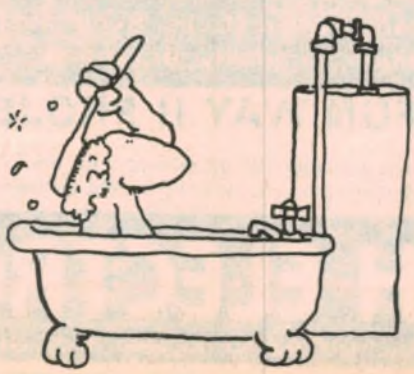
One of the advantages of metal hydrides," explains Taylor, "is that they get us around some of the fears of the 'Hindenburg syndrome'. Many people conceive hydrogen gas to be an extremely dangerous commodity. Its image has been charred by the catastrophe of the German airship, and confusion about hydrogen weapons hasn't helped the situation. In fact, it has been proven that the Hindenburg disaster was survivable (less than half the passengers died) if appropriate measures had been taken. Metal hydrides make hydrogen storage very safe. You can put a flame to them when fully loaded with hydrogen and they will, at worst, burn reluctantly."

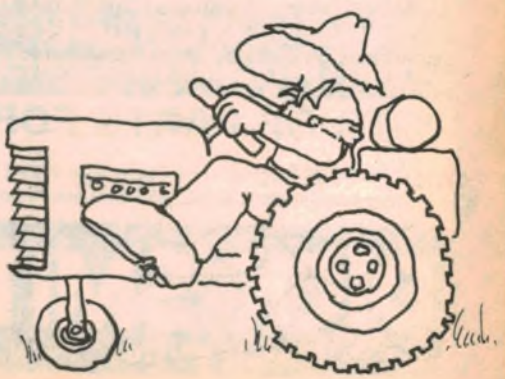
To demonstrate how metal hydrides could be used in a hydrogen fuel system. Taylor has a small model engine in his laboratory. He opens a valve connected to a glass tube containing a metal hydride powder. After a few seconds, he lights a small port exiting from the tube and hydrogen gas burns off with an almost imperceptible blue flame, driving a single piston Stirling-type engine by the heat derived from the combustion. It's an absolutely clean form of energy – just heat and water vapour are produced.

Not only do these metal powders make hydrogen use much more foolproof, but they can also conveniently store five times more hydrogen in a unit of space than liquid hydrogen by itself. This apparent anomaly occurs because the metal overcomes the repulsive forces between individual hydrogen atoms, thus allowing them to be packed much closer together than in liquid form. When the fuel is spent, it's just a simple matter of recharging the metal with more hydrogen under slight pressure.

"One of the disadvantages of metal hydrides," cautions Taylor, "is their weight. We are investigating a variety of hydrides formed by straight metals and alloyed compounds to arrive at just the right combination of low weight, large hydrogen binding capacity, stability and hydrogen release under the desired conditions. But indications are that because of its weight, metal hydride fuel will be relegated to earth-bound applications."

However, other studies indicate that liquid hydrogen (LH2) could be used as an aircraft fuel in the future. Lockheed Aircraft Corporation is planning a demonstration LH2-fuelled aircraft. A program has been proposed to the US government for research and development that should result in an airworthy LH2-fuelled Lockheed 1011 by 1995. The





Dr Bryan Taylor amidst the tools of his trade – the most precise calorimeters available. The calorimeters can sense miniscule quantities of heat which flow from the reaction of metal alloys with hydrogen. Information derived from the measurements will enable the research team to improve hydrides by developing better alloys.

time lag is required to overcome some crucial problems, including metal embrittlement by LH2, super insulation of the fuel tanks (hydrogen liquefies at -252°C), and the production of reliable, long-lived fuel pumps.

It is generally agreed that the safety of the aircraft will be increased through the use of hydrogen fuel. Instead of carrying hydrogen in its wings, as is the case for regular aviation fuel, LH2 will be stored in strong tanks in the fuselage, thus decreasing the chances of a rupture in the event of a crash. Even if a tank ruptures, surviving passengers would stand a much better chance of not being burned because LH2 vaporises rapidly, has a low density (one-tenth as dense as air), and its flame radiates less heat (a hydrocarbon fire of equivalent energy radiates heat over 10 times the area). Equally important, there would be no dangerous pools of flaming fuel, as is the case with regular aviation fuel. In this regard, even spilled gasoline, diesel fuel or liquid natural gas are more dangerous.

Where would hydrogen fuel come from? Presently, it is produced in large quantities from natural gas (methane). Methane's chemical structure consists of one carbon atom linked to four hydrogen atoms, and it is these that are stripped off by a chemical process. Hydrogen can also be produced readily from water by electrolysis, but this requires electricity. Canada has an enviable amount of hydro-electric power, much of which is not developed because the sites are remote, making it inefficient and costly to move the power to population centres. But if hydrogen was needed, these sites could be developed to provide a renewable supply of hydrogen, which could then be pumped by pipeline to wherever it is needed.

Waste wood and paper may also be a convenient source of hydrogen. A bacterium discovered by scientists in the Divsion of Biological Sciences can efficiently convert cellulose into hydrogen and other products.

If hydrogen is looking good to you, it looks even better to Bryan Taylor, a cautious optimist. "We have most of the technology now to start using hydrogen fuel," he concludes. "What we don't have yet is the commitment or the willingness to wean ourselves from our diet of oil. We are not going to change over tomorrow of course, but we have to make initial moves from fossil fuels by the year 2000. Oil will then be scarce and we will be on the verge of serious environmental problems as a result of products discharged into the atmosphere".

This article was originally published in "Science Dimension", journal of the National Research Council of Canada, Vol.12, No. 2, 1980.

The pioneers from

The concept of television is almost a hundred years old, but much hard work was needed to translate the concept into reality. The story of the development of television is a story of intensive, large-scale industrial research efforts working to a specific target, and a chain of little inventions by a large number of people — each of whom contributed some vital aspect to the television system we know today.

by PAT HAWKER

One thing needs to be said at the outset: nobody "invented" television. There was no one minute in history when anyone could accurately say for the very first time "Yes, I've got it". John Logie Baird genuinely felt he could claim this, but Baird was really the catalyst who stirred many others into taking television seriously. Television was conceived long before Baird, and depended on a whole chain of "little inventions" – a chain that continues to be forged even today.

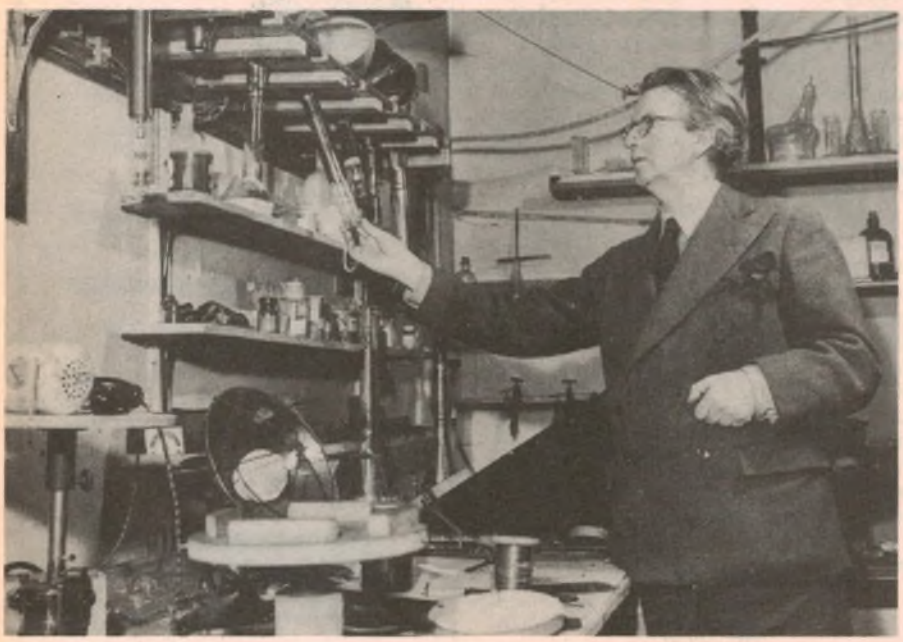
Early ideas

Television, the ability to see at a distance, is a concept rooted firmly in the 19th century – originally a sort of electrical "philosophers' stone". Nowhere can this been seen more clearly than in the drawings of the Frenchman Alfred Robida in the 1890s: he foresaw in detail in his drawings television as entertainment, the large screen display, the video telephone, the video disc – and even some of the problems they would bring.

Robida (to whose work attention was drawn by Dr Walter Bruch of PAL fame) did not bother about how his "Le Tele" machine would actually work, but there were plenty of others who were striving even then to realise real-time electric transmission of moving pictures. Indeed a public service for still pictures was inaugurated in France as early as the 1860s, between Marseilles and Paris – the result of the work of the Italian born Abbe Caselli. The sensitivity of selenium to light was discovered by the telegraph cable operator Lewis May in 1873. In 1880 a method of scanning a picture by means of a mirror was proposed by Maurice Leblanc; Paul Nipkow patented his scanning disc in 1884; and mirror-drum scanning came from Weiler in 1889.

Crude cathode-ray tubes (with cold cathodes) were also a 19th century development, by Ferdinand Braun, following on the work of Geissler, Gassiot, Goldstein (who in 1870 introduced the term "cathode rays") and Crookes. Braun called his 1897 invention a "cathode ray indicator tube", and explored the way in which the beam could be deflected to trace out Lissajous figures on a phosphor screen. Wehnelt warmed the cathode in 1905, and the "hard vacuum" tube was a later development.

Over 70 years ago Boris Rosing in Russia and the Scottish engineer Alan Campbell Swinton (who has been called "the father of television") showed how these ideas could be brought together to form an effective electronic system of television. Contrary to popular belief, Campbell Swinton did not stop at describing the system but later attempted to build an experimental model. He failed to make it work, though some years later the EMI team repeated his experiment with success! His proposed pick-up tube included a mosaic of rubidium cubes, and his cathode ray tube involved phosphor decay to aid the persistence of vision.



A wartime photograph of television pioneer John Logie Baird. Ineffective synchronisation and low definition were problems of Baird's early mechanical scanning system.

Baird's Mechanical System

"Baird arrived at Hastings in 1923 'coughing and choking' and generally in a bad state of health . . . he had little money, about £200, and after the disaster of the soap, socks and jam efforts his prospects were, to say the least, nebulous. Baird surveyed the situation and came to the conclusion 'I must invent something' " – according to Sydney Moseley, one of his many biographers.

He ignored the electronic ideas, and instead went back to the mechanical scanning of Nipkow – though with the tremendous advantage that by now the thermionic valve provided an efficient

# of television

concept to post-war reality

The last word in TV styling – in 1939 that is! RCA's model TRK-9 weighed more than 90kg, measured 120 x 90 x 60cm, used 23 valves and sold for $US450. Also shown is the RCA Victor "Personal" from the late 50s era.

amplifier. He soon had a crude system he could demonstrate, though there are considerable doubts as to whether he ever achieved genuine synchronisation of his transmitter/receiver scanning discs in his early work. Ineffective synchronisation (as well as the low definition) was to remain a major problem with his 30-line system. The limit of 30 lines was imposed not by the mechanics of the system however but by the need to limit the bandwidth to what could be radiated on a medium-wave channel.

The 30-line system was a good training ground, but was never a practical home entertainment system. Baird worried and snapped at the BBC, plagued the Post Office, almost scared the daylights out of the politicians, and at times bamboozled the investors – if he had not done so the UK would certainly not have had a high-definition TV service on the air by 1936!

Electronic TV

Zworykin, von Ardenne, Karolus, Mihaly, Schroeter and many others were all key figures in the development of good television, though in the UK tremendous credit is rightly given to the joint work of VHF EMI (the video side) and The Marconi Company (the VHF transmitters) that led to the successful 405-line system. The team headed by Isaac Shoenberg at EMI included such brilliant research engineers and scientists as Alan Blumlein, Professor J.D. McGee, C.O. Browne, W.F. Tedman and many others.

J.D. McGee has pointed out that when leaving the Cavendish Laboratory to take up his post he was warned: "You had better take this offer, since jobs are scarce. I don't think this television business will ever come to much – but it will keep you going until we can get you a proper job" – an attitude which even after the success of their work was reflected by the editor of *The Guardian* newspaper writing: "Television. No good will come of this device. The word is half Greek and half Latin."

The EMI work (which was initially based on improving mechanical systems) began in about 1931. It was carried out under tight industrial security however, and few details of the progress being made leaked out. Unlike Baird, EMI did

not depend on publicity to attract funds.

Of great consequence was the development of the Emitron camera tube. This resembled Zworykin's iconoscope, which was patented in 1923 but not finally developed until the 1930s. Zworykin was working at RCA but despite the patent agreements between RCA and EMI the Emitron tube was designed independently. As early as 1932 recognisable pictures were obtained at Hayes, though the bad spurious effects present provoked C.O. Browne, who was working on the vision input equipment, to exclaim "What do you expect us to do with signals like those?"

In 1931 EMI ordered a VHF transmitter from Marconi – Germany had already begun experiments at VHF, since engineers there were the first to realise that only by going to VHF would there be sufficient bandwidth for high-definition pictures. This transmitter order led to the creation of the joint Marconi-EMI arrangement.

In 1934, with public recognition that the UK's 30-line system was by now falling well below the results being achieved experimentally on the Continent, an Advisory Committee under Lord Selsdon was set up to advise the government of the day. On January 31, 1935 a report was issued urging the early establishment of a public service with a definition "not inferior to 240 lines, 25 pictures a second" – a standard that had been demonstrated by the Baird Company (which by now included Captain West). No mention you will note of 405 lines.

In fact Blumlein had developed a system with 243 interlaced lines. This was a convenient number, using "divide-by-three" multivibrators to obtain the frame frequency and then lock the chain to the mains-supply frequency – 243 comes down to 1×50Hz since $3 \times 3 \times 3 \times 3 \times 3 = 243$ lines per frame.

To steal a march on the rival Baird Company (or perhaps from curiosity), Blumlein decided he would like to try an even higher definition. The easiest way was to change one multivibrator to divide-by-five. Hence it was now $3 \times 3 \times 3 \times 3 \times 5 = 405$ lines. Shoenberg courageously approved this higher figure, and "405" was written into the EMI specification – as a 50-field interlaced system.

RIGHT: An early Baird television receiver, known in the trade as "Jumbo". Lack of an electronic camera caused the downfall of the Baird system.

Trial period

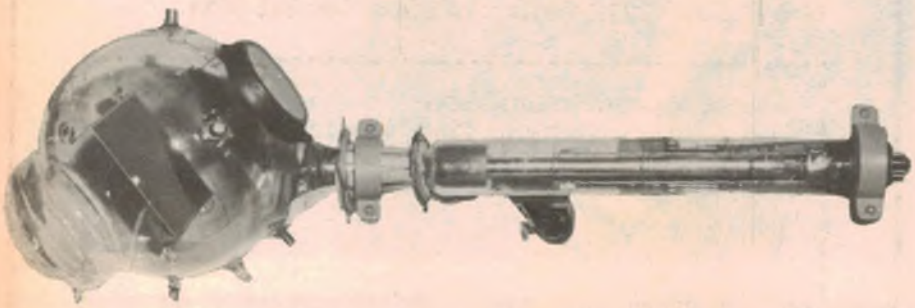
In 1935 the BBC accepted both the Baird and Marconi-EMI proposals for a trial period, alternating weekly. This was despite considerable pressure to keep to a common 240/243-line system which would have met the Selsdon Committee's recommendations. One reason was that Scophony had developed a mechanical, large screen receiver, and it seemed unlikely that this could be stretched to 405 lines (this step was subsequently achieved however).

Limitations in both transmission and reception meant that there was precious little difference between the two sets of pictures actually seen in the home – indeed a 240-line sequential system can even today provide reasonable pictures. The downfall of the Baird system (it was discontinued in February 1937) was its lack of an electronic camera. It had been expected that the Farnsworth camera would have been available in time for the opening of the service (Farnsworth, in the USA, had developed a low-definition electronic camera as early as 1927). Instead, the Baird system used an intermediate film system for "live" broadcasts – the film was processed in less than a minute.

Electronic cameras have in fact been the key to modern television. The principles of a pick-up tube akin to the iconoscope had been outlined in some detail by Campbell Swinton as early as 1911. Zworykin obtained his patent in 1923, but it was not until about 1932 that he had a demonstrable model. Farnsworth had a low-definition image dissector in 1927, and McGee and his colleagues were making good progress with the Emitron in 1932-33.

The superior image iconoscope (Super-Emitron), also the orthicon (CPS Emitron), stemmed from Lubszynski, Rodda and Tedham at EMI. The image orthicon (1946) and the photoconductive vidicon tube (1950) came from RCA, and black-and-white TV reached a peak with the 4.5-inch (about 11.5cm) image orthicon tube (which was proposed by RCA in 1952 but first put into production by EEV at Chelmsford in 1954). The 4.5-inch image orthicon provides brilliantly crisp pictures. A decade of difficult research by E.F. DeHaan and his colleagues at Philips resulted in the Plumbicon (lead-oxide) photoconductive tube becoming available in the mid-sixties – in time to become the work horse of colour TV.

The first broadcast TV camera tube . . .



An original "Emitron" camera tube, as used for the world's first regular television service, inaugurated by the BBC. The spherical portion contains a rectangular mosiac plate onto which the image is focussed through the optical glass window on the right. Scanning is achieved by an electron beam generated in the long neck of the tube.

New York, Nov 1950: spectators gather around a demonstration B&W TV receiver fitted with an external colour converter based on CBS's field sequential system. The field sequential system was abandoned when RCA developed the shadow mask colour picture tube.

Pre-war TV

Radiolympia from August 26, 1936 provided the public with its first chance to see the new systems. Some 100,000 people filed past a display of new receivers which officially remained anonymous but actually came from Baird, Cossor, Edison, Ferranti, GEC, Marconi-EMI and Philips. All were 12-inch (30cm) models, priced 85-105 guineas. Cossor, with a research team that included L.H. Bedford and O.S. Puckle, had originally developed a "velocity-modulated" electronic system, but this was never put into service.

While the official opening, some three months later on November 2, is generally considered to be the start of the world's first regular public high-definition service, it should not be forgotten that some 150,000 viewers at 28 public television rooms in Berlin had been able to see TV pictures from the 1936 Berlin Olympics (August 1-14). Three cameras (one manned by Walter Bruch) had been used with two specially-equipped mobile units. Germany had opened a 180-line service in March 1935, but in August the equipment was destroyed in a fire at the Berlin Radio Exhibition. Is 180 lines "high-definition" or "low-definition"? The British claim for Ally Pally priority depends on your answer!

Sales of receivers were extremely slow. For the price of a small motor car, viewers were at first limited to an hour of programs in the afternoon and one hour in the evening. To get prices down, even 5-inch (12.5cm) models were made. From 300 sets in 1936, the total increased only slowly to about 20,000 by September 1, 1939 when the service suddenly closed down (finishing with a Disney cartoon film) for the duration of the war. (The sound transmitter was us-

ed for a time for "bending" German navigational beams.)

The pre-war receivers used valve circuitry that, even today, most service engineers would have no difficulty in recognising – exceptions were the common use of gas-filled triodes as timebase oscillators and the absence of flyback EHT systems (lethal transformer EHT supplies providing about 4kV were a decided hazard). Flyback EHT had in fact by then been developed, by Blumlein, but was not taken up by setmakers until later. Philips however had developed their projection tube, with its 25kV unit, in the pre-war period.

War-time developments

In 1939 virtually all TV research in the UK was switched into radar (RDF, or radiolocation, to use the original names). This was not the case elsewhere. A regular 525-line service was started in the USA in 1941, following the proposal of a 441-line system in 1936 and the demonstration of a 343-line RCA system at the 1939 World Fair. In Switzerland, the first form of Eidophor large-screen display was a wartime development.

The 1930s were full of "TV is here" and "TV just around the corner" stories. Thirty-line, low-definition TV was never good enough for real entertainment, competing as it did with the excellent picture quality of even the cheapest "flea-pit" cinemas. In the USA high-definition TV was slow in coming because of the classic "egg and chicken" difficulty of finding financial backers until there is a proven audience – or an audience until there are sufficient programs. In the UK, the number of people willing or able to pay around £100 (in 1936 values) for a receiver was pitifully small. Much early effort in fact was directed at cinema television with large screens: the domestic home receiver market in the UK remained relatively small compared with sound radio until after the coming of ITV in 1955.

The Germans had a TV service in Berlin until November 1943, when the transmitter was destroyed by bombing. They also ran, for the Wehrmacht occupation troops, a TV service from the Eiffel Tower. This continued until August 16, 1944 (the pictures were monitored by British Intelligence in Kent).

Post-war TV

VE and VJ days came in the following year – and with them a major effort was made to get BBC TV back on the air. In the rush, however, a serious error of judgment was made. EMI urged that a new 605-line system should be adopted, to take advantage of the improved equipment that could by now be contemplated. Only a few thousand receivers would be made redundant. The Hankey Committee however turned this down in favour of 405 lines for the home, a 1000-line system being recommended for large-screen cinema presentation (which was still believed to be the only way in which millions of people could afford to watch TV). This resulted in all the later problems of switching from 405 to 625 lines. Europe might have standardized on 605 lines, instead of the 625-line standard suggested by later by Walter Brunch!

The style of the 40s – a 1947 "Hampshire model Du Mont 20-inch television receiver" from the USA. Included in the same console were an AM/FM radio and an automatic record changer.

By now the pioneering days were over, though it took many years to build up the networks to cover the entire country, first in Band I and then, with the coming of ITV in 1955, in Band III. No longer could the UK claim to be the centre of the TV world (by 1954 there were over 30 million TV sets in the USA). The three major post-war developments – compatible colour with the shadowmask tube, videotape recording, and trans-ocean geostationary satellite relays – took place in the USA – coming largely from RCA, Ampex and Hughes Aircraft. Philips in Holland contributed the Plumbicon tube that so decisively improved colour transmission, while Henri de France developed the use of delay lines. All these incidentally were the result of intensive, large-scale industrial research efforts, working to a specific target.

This is not to decry the British effort. Thorn produced the world's first all solid-state (except for the picture tube) colour receiver. The IBA were the first with an operational digital video equipment (a line standards converter that preceded the 1972 DICE intercontinental converter), and indeed digital TV systems remain the prime area of development. It's not always recognised that ENG/EFP (electronic news gathering and field production) were made feasible by the digital line timebase corrector (again an American development). More recently the UK has contributed teletext and viewdata and much work on multi-channel UHF transmission.

Pioneers in many fields

Looking back through this all too brief account of the development of television, one is aware of the many names that have not been mentioned because their work was not originally aimed at TV. The Japanese scientist Yagi for example, who has his memorial on millions of rooftops; Southworth of Bell Telephones whose work led to the coaxial cable; Rosen and Williams of Hughes for the geostationary satellite (whose concept came from Arthur Clarke's imaginative 1945 article in *Wireless World*); the work done on high-power valves and later power klystrons, much of it stemming from radar. And of course David Sarnoff and George Brown of RCA, who put the full resources of the company behind the development of compatible colour – and kept it going during the early, difficult days of 1954-60.

But in the end four names stand out: Alan A. Campbell Swinton, John Logie Baird, V.K. Zworykin and Alan Blumlein – even though, as we've seen, television was not born of a single flash of genius but was painstakingly developed by industrial research teams.

Sound safe.

Agfa SUPERFERRO – the sound safe – will record and store your music safe in sound, ready for when you want it. And we mean all the music. The outstanding performance of Agfa SUPERFERRO is achieved through the use of a particular form of ferric oxide particle that is uniform in shape and size. The second factor is an Agfa technique that enables more particles to be deposited per sq. mm of tape, with each particle separated and in line to eliminate cross-over interference.

The advanced technology of the SUPERFERRO tape results in five big improvements:

1. Reduced background noise.
2. Better maximum output level.
3. Improved dynamic range.
4. Improved high frequency output level.
5. Reduced harmonic distortion.

In addition, Agfa SUPERFERRO cassettes feature a special mechanism for improved running properties.

Agfa SUPERFERRO – the sound safe you can bank on for outstanding performance.

Agfa*

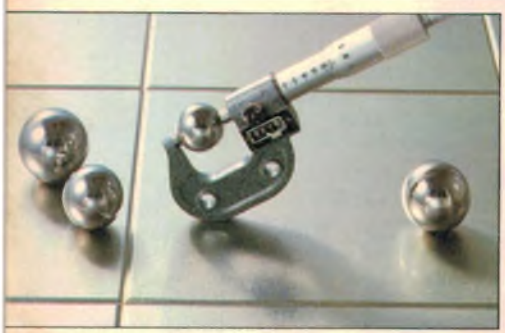
*Registered trademark of AGFA-GEVAERT Antwerp/Leverkusen.

AGFA-GEVAERT FOR STILL CAMERAS, FLASHGUNS, COLOUR FILM FOR SLIDES, PRINTS AND MOVIES, MAGNETIC TAPES. E314

Sansui

Only hi-fi, everything hi-fi.

Non-compromise computerized



Fully computerized operations have many powerful advantages. Flawless decisions, meticulous monitoring, foolproof functions, record protection and the desirable convenience of random band selection are only a few.

But some audiophiles have had reservations about such systems and their reasons are not mysterious. Until now, you had to accept the one particular cartridge that came with the system.

From now, with Sansui's new XR-Q11, you can freely select whichever cartridge you like. This important freedom is possible because Sansui engineers have perfected a dual sensor system which is independent of the cartridge.

Until now, the specs and performance of band selector turntables were usually not the very best. The XR-Q11 now changes the sound picture. Speed is better than 99.99% perfect! Wow and flutter is under 0.015%. And performance is peerless thanks to the direct-drive quartz-servo motor. Speed monitoring is exceptionally fast and accurate with Sansui's dual-heads that read the 960 magnetic "marks" coating the platter's inside rim.

Carefully examine the unique, straight D-O-B tonearm. Using basic principles of physics in a new configuration, this tonearm radically reduces all kinds of spurious vibrations, including feedback from the stylus. Combined with the BMC super-dense cabinet and PAT. PEND. floating sub-base, mechanical interferences of the most overt and subtle types have been virtually eliminated for superb reproduction of even the most difficult dynamic musical qualities.

The facts are clear. The XR-Q11 is one of the world's finest turntables by any standard. And it is the only turntable in its class with the sophisticated convenience of computerized operation including Sansui's Computerized Track Sequence Selection (CTSS).

The new XR-Q11 CTSS turntable: when you want to approach the ultimate.

SANSUI

XR-Q11

SANSUI ELECTRIC CO., LTD.
14-1 Izumi 2-chome, Suginami-ku, Tokyo 168, Japan
VANFI (AUST.) PTY. LTD.
297, City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293

Who are the computer criminals?

And what are the seven computer sins?

Technology has created a new class of criminal — the computer criminal! But who are the computer criminals? Are they geniuses gone wrong or is it environment, rather than expertise, that is the deciding factor?

by JAY BECKER*

The fashion, for journalists and criminologists, is to see all computer criminals as geniuses. Donn Parker, in his book *Crime by Computer*, reflects this when he writes: "Perpetrators are usually bright, eager, highly motivated, courageous, adventuresome, and qualified people willing to accept a technical challenge. They have exactly the characteristics that make them highly desirable employees in data processing." F. W. Dennis, writing in *Security World* in September 1979, paints the same picture: "The common denominator in nearly all cases of computer fraud has been that the individual is very much like the mountain climber – he or she must beat the system because it is there."

But is the picture accurate? Does it help us to prevent computer crime? Based on my analysis of many of the cases in the files of the National Center for Computer Crime Data, I must answer both questions with a resounding "No".

Many computer criminals just aren't that clever. Their crimes are not that technically sophisticated. And even if it were true, this view of computer crime wouldn't be very helpful. No test has been devised to separate computer geniuses who are prone to crime from law abiding computer geniuses. Lacking this type of test, it wouldn't make much sense to ask a personnel director to screen out all geniuses lest they commit computer crime.

Environment, not personality, seems the most useful factor in predicting computer crime and preventing it. The data suggests that certain "criminogenic environments" are present in most computer crimes. By criminogenic environments I mean the computer system, *as the criminal perceives it*, immediately before he or she decides to commit a computer crime. For example, one type of computer criminal will see the computer environment as a cookie jar – the source of enough money to meet sudden needs. Another may see it as a playpen – simply a place to play computer games as long as he or she likes. These different perceptions, and the attitudes they reflect, will generally lead to very different types of computer crimes, and require different types of security to prevent them.

In this article, I shall suggest seven views of the computer system which seem to summarise most of the cases that I have seen.

The Playpen

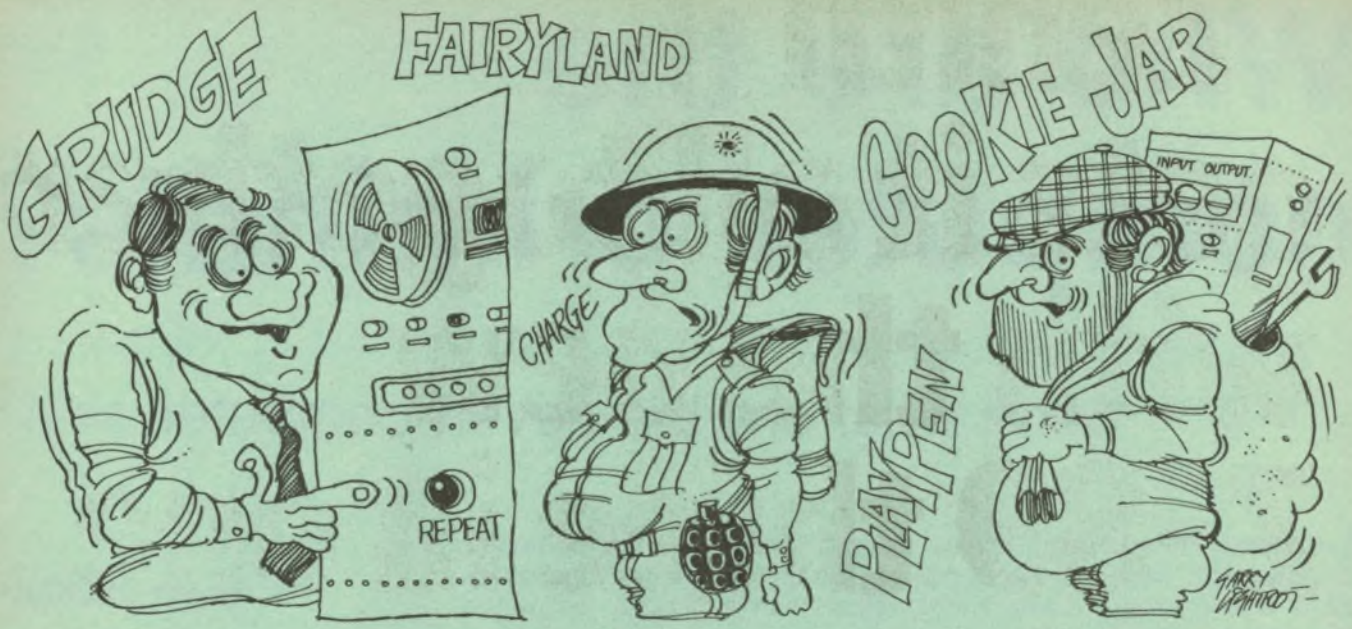
The American educational television network recently broadcast a one-hour show about computers as tools in the education of nine and ten year olds. About the only discordant note in this paean was one teacher's observation that her students kept erasing each other's names from computer sign-up lists, or destroying the sign-up lists altogether. The teacher tolerated this aberrant behaviour, apparently delighted that her students enjoyed playing at the computer.

Older students have the same morality. Professor John Carroll found that 34% of the students in two courses on advanced information systems at the University of Western Ontario had tried to obtain computer time without paying for it. The same percentage had tried to penetrate the computer's security system.

These examples demonstrate the fact, obvious to anyone who has watched people play computer games, that simply using a computer can be intrinsically satisfying. They also suggest that the drive for this satisfaction can violate others' rights. When computer crime results from the attempt to gain satisfaction from working with the computer, I categorise it as an example of the playpen perception getting out of hand. Unfortunately, there is no standard within the computer industry to define precisely *when* the playing has got out of hand. Thus, if a student uses an hour of computer time without permission, one university computer department considers it criminal theft of services and another views it as commendable ingenuity.

In addition to the unauthorised use of time (and often as a necessary prerequisite to it), attempts to compromise computer security systems are common to those with a playpen point of view. An English group calling itself Crank boasts of expertise in "computer piracy and security cracking". Members of Crank claim to have obtained files from universities and companies in England, including one whose security "has never been broken", all with the ostensible purpose of making sure that computer security is improved. But it would take only a small change in the motivation of Crank members to wind up with someone who seeks to outsmart the computer for his or her own benefit.

*Director of the National Center for Computer Crime Data in Los Angeles.



This may have been the dominant motivation behind Stanley Rifkin's infamous computer crime. When Rifkin pleaded guilty to charges arising from his theft of £5.1 million from an American bank, he described his reaction to what he had done. "I was aghast," he said, explaining that his arrest was the first indication he had had that his scheme really worked. He further explained his failure to hide the diamonds he had bought with the stolen funds, saying he hadn't made any plans for this contingency. Implausible as this story may seem, it is consistent with Rifkin's general ineptitude as a thief and his rapid arrest once he returned to America. Further support for the idea that Rifkin had a playpen perspective comes from an associate who once taught with Rifkin. "The guy is not a bank robber, he's a problem-solver," was Professor Gerald Smith's opinion.

In view of what I have already said about the playpen attitude towards computer environments, certain security implications immediately become evident. Norms that clearly define allowable and excessive computer use will develop, and if the industry does not develop them, it's quite likely that the law will. In the meantime, each computer user must evaluate its rules and practices. Unless these clearly communicate the limits on unauthorised computer use, and the rationale for these limits, the user will continue to be vulnerable to the computer "game player" who goes too far.

Land of Opportunity

Not too far removed from the playpen perspective is the attitude that there's nothing much wrong with exploiting an obvious vulnerability in a computer system. Unlike the game players in their playpen, those who see the computer environment as a "land of opportunity" seem to be motivated not so much by challenge as by lack of challenge. Where the game player might try hundreds of codes to find one which gives entry to the computer's operating system, the employee in the "land of opportunity" just finds and exploits a vulnerability in the system – often in the course of learning his or her job.

For example, the operator of a device for printing cheques pressed the REPEAT button again and again when his own cheque was being produced. Hardly the computer genius the media would have us think all computer criminals are, he took a dozen cheques and attempted to cash them all at the same time. More sophisticated, but similarly opportunist, Jack Polak exploited his position as a purchasing agent in the county of San Diego, California. Knowing the troubles the county was having in installing a new computerised system to control its payments for goods bought, Polak set out to compromise the system. He created fictitious vendors, charged the county for non-existent supplies that had ostensibly been delivered, and collected approximately $50,000 in payments. He knew the county's system too well. Only his impatient questioning about a $70,000 cheque he awaited led to his detection.

One needn't be a profound criminologist to realise that motivation is directly proportional to opportunity, and opportunity is inversely proportional to the security of a system. If the opportunities are obvious enough, even the least sophisticated employees (or outsiders, for that matter) may be expected to try to exploit them. Consequently, the need for systematic and extensive security cannot be underestimated. Simple measures – such as taking particular care of employees' accounts which are under the computer's control, rotating personnel from job to job, and looking for any trends of irregular work habits which might either give rise to or explain computer crime, are just some of the measures that a company might take to reduce its vulnerability to those who see the computer as a land of opportunity.

The Cookie Jar

A gambling debt, a drug habit, sudden losses on the stock market, may all lead an employee to see the funds in a computer as the best solution to his problem of the moment. As though it were a cookie jar, the "hungry" criminal dips into the computer to take what he needs. In such circumstances, the criminal's motivation is much more pressing than his observation of a loophole in the system's security. Criminologists have identified such "situational pressures" as frequent accompaniments to white collar crime in general; as computer crime is a subclass of white collar crime, I am not surprised that these pressures operate here as well. Case histories of computer crimes bear me out.

One head teller at a bank in New York City was found to have stolen $1.5 million when his bookie was raided and it turned out that he was betting up to $30,000 a day. And in Denver, Colorado, Raymond Ressin financed numerous gambling trips to Las Vegas by falsifying

Zenith gets it all together with the new Z-89 three in one desk top computer.

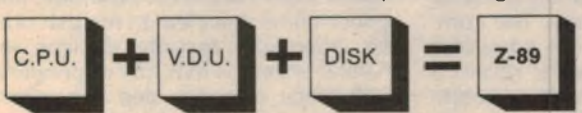
The All-In-One Computer brings you all the power and built-in peripherals needed for any business computing task—all in one compact, desk-top cabinet.

C.P.U. The popular Z-80 microprocessor gives you abundant computer power. Features include 48K of user RAM, and two serial I/O ports complete with standard RS-232 interfacing for printers and modems.

V.D.U. All terminal functions are controlled by a separate Z-80 microprocessor for significantly increased throughput. It never shares processor power with the computer as do most desk top computers. A crisp, clear video image reduces eye strain and an excellent keyboard layout and touch make data entry fast and easy.

Disk Storage. A builit-in 5¼" floppy disk unit gives instant loading and fast access. An optional **Z-87 dual disk unit** in a separate housing provides an additional 200K bytes for enhanced merging, sorting and copying capabilities.

Software. HDOS operating systems software includes BASIC interpreter, 2-pass absolute assembler and a powerful text editor. The popular CP/M™ operating system runs on the **Z-89** allowing the system to be programmed in microsoft BASIC, FORTRAN, COBOL and others. Application software available includes word processing.



For further information contact WARBURTON FRANKI at any of the following locations.

WARBURTON FRANKI

● ADELAIDE (08) 356-7333 ● BRISBANE (07) 52-7255 ● HOBART (002) 28-0321
● MELBOURNE (03) 699-4999 ● PERTH (09) 277-7000 ● SYDNEY (02) 648-1711
● AUCKLAND N.Z. (09) 77-0924 ● WELLINGTON N.Z. (04) 69-8272

WF 711/80

the input to the computer of the stock brokers for whom he worked.

To counteract people whose need drives them to cookie jar crimes, companies must investigate employees before they are hired. But situations change, and security must be responsive to these changes. Ideally, the relationship between employees and their supervisors and management in general will be such that the employee will seek out help when a problem arises.

The War Zone

Some people see the computer not as a solution to life's problems, but as a symbol of their cause. Disgruntled employees, who feel that management is out to get them or that they have already been hurt unfairly, may express their resentment in attacks on the company computer. This type of employee sees the computer as a "war zone", the battlefield in the struggle between employer and employee.

In Sacramento, California, three employees of the State Department of Justice, apparently annoyed by the paltry amount of their pay increase, deleted certain arrest records from the State's criminal records. There are numerous other tales of computer library tapes erased, misfiled, or mislabelled, or instructions to erase all company records two years after a certain programmer is fired. Employees have even literally attacked the computer with sharp instruments, screwdrivers, and guns.

In one of the most extreme cases I know of, an employee of a large produce company, feeling cheated out of a substantial pay rise, created a "shadow corporation" for revenge. The shadow was almost exactly like the real corporation, except that it was about 0.75 per cent less efficient – more vulnerable to theft, spoilage, and so forth. All of the financial differential between the shadow corporation and the real corporation went into the pockets of the disenchanted employee.

As in the case of the "cookie jar," good management is the best prevention. Where there are no acceptable avenues to express resentment toward the employer, management should not be surprised when unacceptable avenues are used instead. There is also the possibility that the employee's resentments are well-founded. Corrective action will not only reduce the threat of the resentful employee, but also demonstrate to all employees the folly of perceiving the computer as a war zone.

The Computer Grudge

In the war zone, the criminal gets at the employer through the employer's computer. The computer grudge criminals find computers themselves anathema, and see computer crime as a way to strike out *against the computer.* Thus, they see a war going on, not between the employer and themselves, but between themselves and any one of a number of different forces.

In some cases, the slogan of the 1960s – I am a human being; do not fold, staple, or mutilate me – has been converted into an unreasonable dislike for the computer itself. In one case, a programmer sabotaged a computer by short-circuiting the computer's memory. He told the police that he had an "overpowering urge" to shut the computer down, and had no grievance against the owners of the machine.

Terrorist bombings reflect a much more extensively developed symbolism. In Italy, the Red Brigades produced a telling document, *Resolutions of the Strategic Directorate* that depicts increasing computerisation in Western countries as part of a sinister plot to "maximise social controls". The *Resolutions* explain that because computers are instruments for the "repression of the class struggle . . . it is important to attack, unravel, and dismember these networks of control".

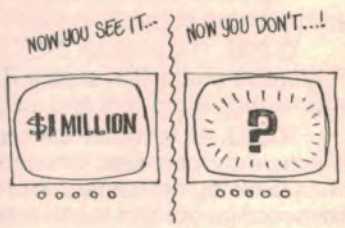
Where the computer symbolises personal frustrations, the security measures to deal with the problem are not much different from those called for in the war zone. But grudge crimes are as likely to be committed by non-employees as by dissidents within. These sorts of attacks on the computer emphasise the need for attention to physical security. The common practice of making the computer centre the highlight of a public relations tour is thus a questionable risk, and companies should ensure that they stay aware of the activities of terrorists.

The Fairyland

If any category of computer criminal completely belies the major myth, it is this one. Some of the participants in computer crime appear to act as though the computer environment were totally divorced from reality. A telex operator may routinely transfer millions of dollars from bank to bank without recognising how important each transaction is. The computer simply isn't real.

In *Computer Capers,* Thomas Whiteside tells of a fraudulent transfer of $2 million. The culprit convinced his girlfriend to transfer this amount to his bank in New York, telling her he wanted to play a joke on a computer-operator friend who worked at the bank. The friend and the money disappeared before the girlfriend realised that she had been conned as well as jilted.

Although it is perhaps dangerous to take assertions of ignorance at face value, the message behind cases such as this is quite clear. Where people associated with computer systems are unaware of their own power, and act as though there were no dangers of computer crime, the company who employs them is exposed to an enormous risk. Just as management cannot afford to ignore the new vulnerabilities a computer creates in any business, so it cannot afford to have employees who are ignorant of these vulnerabilities. Clear communication of the responsibilities of



the job, as well as clear standards for its performance are the most obvious management tools to combat this problem; the company should make it clear that each employee has a stake in computer security.

The other side of the fairyland mentality is that even if the employee's ignorance of computing does not facilitate a crime it may stand in the way of that employee detecting the early warning signals which, acted on promptly, might reduce crime. It is clear to me that one of the important security devices in a manual system is that lots of people see each piece of paper, and they can tell unusual entries just because they run counter to common sense. To some extent we lose this security advantage when systems are computerised – and no longer easily understood by many people. If we could only get the game fanatics to teach the residents of fairyland about computing, both might develop more realistic perceptions of the computer environment.

The Toolbox

To some computer criminals, a computer is simply a computer. Thus, we have cases of so-called computer crime where the computer is not the target, but the implement in a crime that in no other way involves computing. The phone freaks, who use microprocessors to test phone circuits and develop strategies that enable them to use phones for free, exemplify this attitude towards computers. The Equity Funding personnel, who used computers to create false insurance policies by the thousands, seemed similarly clear-headed about what a computer can do. Perhaps the most ludicrous example is the Los Angeles brothel owner who used a minicomputer to keep track of his customers.

These examples suggest a type of computer criminal we can call the technological crook, who sees the computer as another tool in his kit. This type of person is more likely to already be a criminal than any of the individuals whose attitudes I described above. As the key to this sort of crime is computer *use*, all those strategies which limit access to the computer are important security. But none of these "limited access" security procedures will be at all effective against the owner of a micro- or minicomputer who has worked out a way to use the computer to commit crime.

The categories listed here are not mutually exclusive, exhaustive, or chiseled in stone, and I encourage feedback — particularly as to attitudes I appear to have missed. Furthermore, the categories may not be much use when we want to predict whether a specific individual is likely to become a criminal (unless we can develop tests to discover if a "suspect" is abnormally likely to perceive the computer environment along the lines the categories suggest). Still, if the company sees the environment as a playpen, a cookie jar, or any of the other models I've discussed, it may be inferred that some would-be computer criminals will see it that way as well. I hope that the security measures I have outlined here will offer some strategies to change or prevent these potentially dangerous perceptions.

PARTS FOR NEW KITS

If a kit you want to build is not listed, the parts may be available anyway. Check the Dick Smith Catalogue or call in to your nearest Dick Smith store.

ACOUSTIC COUPLER (See EA September)
Complete kit, including metalwork, etc ... Cat K-3605 $75.00
Printed Circuit Board only ... Cat H-8380 $4.00

EXPANDED SCALE AUTOMOTIVE VOLTMETER (See ETI Sept.)
Printed Circuit Board ... Cat H-8630 $1.50
LM3914 IC ... Cat Z-6295 $4.25
Choose round or rectangular, large or small LEDs to suit your particular application.

(Above kits are from magazines' forecasts. We will endeavour to have these kits on sale when the magazines are released; however, delays can occur! Please enquire at your nearest Dick Smith Store.)

CHASER (See EA August)
Complete kit, including front panel ... Cat K-3145 $69.50
PCB only ... Cat H-8379 $6.95

NASA POWER CHOPPER (See EA August)
Short form kit (All components & PCB) ... Cat K-3325 $16.50
PCB only ... Cat H-8378 $3.00

LEDS AND LADDERS GAME (See EA August)
Complete kit inc. printed panel ... Cat K-3390 $15.75
PCB only ... Cat H-8378 $3.00

LED TACHO (see ETI August)
Short Form Kit (includes PCB components etc, but no case – build it into your dash board) ... Cat. K-3240 $24.50

FAST NICAD CHARGER (See ETI August)
PCB only ... Cat H-8627 $3.00
(All other components in this kit are normal stock lines)

GUITAR/PA PREAMP (See ETI August)
Short form kit PCB & components, no transformer or case) ... Cat K-3035 $29.50

300 WATT AMPLIFIER (See EA June)
Printed Circuit Board only ... Cat H-8376 $9.95
(Most other components are normal stock lines)

TV CRO ADAPTOR (See EA May)
Complete Kit ... Cat K-3080 $29.95
Printed Circuit board ... Cat H-8375 $3.75

EA'S NEW ACOUSTIC COMPUTER COUPLER:

We've lost count of the number of customers who have asked for this project: well here it is! This acoustic coupler acts like a modem without any physical connection to the phone lines.

It uses your standard telephone handset, placed over a small microphone and speaker in the coupler case, and transfers the information from your computer by sound. Hence the name, acoustic coupler. Now you can have your computer talk to another across the street, across the town – even across the country (or further!) It is a must for all serious computer users and we hope to release the kit by the time this magazine is published.

KIT ONLY $75.00
Cat K-3605

SPECIAL OFFER FOR PROJECT BUILDERS

BUY A SHEET OF RED SCOTCHCAL, AND WE'LL GIVE YOU A BOTTLE OF DEVELOPER FOR NO EXTRA CHARGE!

Red Scotchcal (H-5892) **$8.00**
Developer (H-5898) **$1.00**
YOU PAY: $8.00

Have you found out how easy Scotchcal™ is to use? And how it makes very professional front panels for all your projects?

All you do is make up artwork (with ink, 'Letraset', etc), expose the Scotchcal™ to UV light (eg the sun) and develop it with Scotchcal developer. It's that easy!

We're sure there are many hobbyists who haven't found out about Scotchcal™ yet – so to introduce it to you, we're making a special offer: buy a sheet of Red Scotchcal for the normal price, and we'll throw in a bottle of developer as a bonus!

Each sheet of Scotchcal comes complete with instructions for making your own front panels and labels, easily & quickly.

HERE IT IS: THE NOVA 80

ONLY $399.00
Cat K-3600

You'll find full details of this exciting new computer beginning in the October issue of Electronics Australia. But to whet your appetite, check this out:

- Powerful BASIC interpreter included
- Z-80 based microprocessor
- Up to 48K RAM on-board!
- S-100 compatibility
- Full 63 key keyboard 'on board'
- Both RF and Video outputs 'on board'
- Extremely reliable cassette interface
- All components (except power transformer) 'on board': simple assembly!

We're very excited about this dramatic new breakthrough in home computers. A really professional quality design with the incredible versatility only S-100 can give you. If you've been putting off buying a home computer, lucky you now you can build your own at a fraction of the cost of built-up models! (Full, explicit instructions supplied). Check out the Nova 80: you won't be disappointed!

LEDS AND LADDERS GAME

(See EA August): New, up-graded circuit is $1 cheaper than it was 4 years ago!!!

One of our most popular kits of the past was the intriguing 'LEDS AND LADDERS' game described in Electronics Australia in 1975. Now EA have come up with a new version of the game which is not only easier to build, it is also easier to play! Can you climb out of the well without being plummeted down again?

And the best news of all: this kit is actually $1.00 cheaper than it was in 1978 – despite four years of inflation! Hurry while this low price lasts!

WAS $16.75 IN 1976
NOW ONLY
$15.75!
Cat K-3390

FOIL THE CHRISTMAS CROOKS!

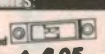
Statistics show most robberies occur around Christmas time. Foil the felon's filching this festive funtime: install a burglar alarm now and be really protected! (Don't put it off: you could be next on their list!)

This outstanding new Dick Smith two sector composite alarm module is made right here in Australia! It features very high reliability – a completely professional quality system for the home handyman to install. Entry and exit times are variable to comply with various state noise pollution laws; system gives positive indication of 'seal' by LEDs. Accepts all types of alarm triggering devices; both normally open and normally closed.

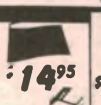
$49.50
Cat L-5065

ALARM ACCESSORIES:

REED SWITCHES: Twin set of magnet and reed switch. Wire them into windows and doors for protection.
$1.95
Cat L-5210



PRESSURE MAT Hide under carpets, mat etc. Pressure of person walking sets it off
$14.95
Cat L-5270



HORN SPEAKER Highly efficient horn plugs into alarm module. Mount under eaves for distant warning.
$9.50
Cat C-2305

GLASS BREAKAGE DETECTOR Sticks to glass, responds only to sound of glass actually breaking. Easy to install.
$29.50
Cat L-5230

PROTECT YOUR CAR, TOO . . .

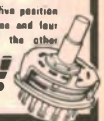
$49.50
Fully integrated car protection with alarm & horn unit in one. Current sensing system: no external switches. Cat L-5090

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

Well, actually it's more of a stock up than a bulk buy! We ordered the wrong switch: so we've slaughtered the price just to get rid of them! It's a five position single pole rotary switch, selling for just 55 cents: that's nearly $1.00 under normal price!!

Remember, you can use a five position switch as a one, two, three and four position, too: just ignore the other positions!

55¢!
Cat S-3215



WOTTA BARGAIN!

We've just bought a HUGE shipment of these incredibly popular push button telephone dials in – so our cost has dropped. You reap the benefit of Dick's huge bulk buying power!

Simply substitute for any rotary dial. Although these units fit perfectly into standard Aust. phones (no soldering required) current regulations do not allow you to use them for this purpose.

Cat X-1175
NOW: $39.50

$49.50

INCREDIBLE CRO VALUE!

Since the superb CRO was released we've sold hundreds: it offers the hobbyist incredible value for money! A useable response up to 6.5MHz, plus a range of controls which make it easy to drive – you'll wonder how you got along without a CRO for so long! Check it out at your nearest Dick Smith store soon. It's worth it!

Cat Q-1280

ONLY $199.00

NEED A SAFE AC SUPPLY FOR YOUR PROJECTS?

How about 12 volts at 500mA!!!

Most plug-packs give you around 200mA. This one gives 500mA! The reason: it is ALL transformer. You put the rectifiers, capacitors, etc, in the project and plug in the AC supply. It's a great space saver!

$9.50
Cat M-9555

ADAPT IT!

This snazzy plug converts banana sockets into a BNC type socket. Suits above CRO, lets you use many more accessories.

$9.50
Cat Q-1281

PROBE IT!

Make your job easier with this versatile probe set. Has 3 position slide switch and 1.5m cable. Complete with all accessories. Great value!

$34.50
Cat Q-1245

NEW! AF & RF WIDEBAND SIGNAL GENERATOR

Here's a great new test instrument for the hobbyist and the professional. It's a wideband AF & RF signal generator, offering sine and square wave capability from 18Hz to 200MHz in 8 ranges (AF is 18Hz to 220kHz; RF is 100kHz to 60MHz on 6 fundamental bands and 60MHz to 200MHz on fundamentals). It is all transistorised, compact and light weight – making it ideal for bench work or for the servicemen's toolbox. 240 volts AC operated.

ALL THIS FOR ONLY $149.50
Cat Q-1305

EVER WONDERED WHERE TO BUY AN AUSSIE FLAG?

$9.95
Cat X-1001

Dick couldn't buy an Aussie flag. So he thought "I'll cure that problem!" Now Dick sells Aussie flags, so every true blooded, dinky-di Aussie can buy their very own Aussie flag to raise up the flagpole every morning. These are the small economy size, (about 1 metre long). Just imagine: the only house on the street with your own flag!

Special note for Pommies: Buy the flag, cut out the corner and you'll have your own personal size flag to remind you of home!

MAJOR DICK SMITH RE-SELLERS:

Listed below are re-sellers who stock a large proportion of our range. However, we cannot guarantee that they will have any or all of the items, or at the same prices, as those advertised on these pages.

ATHERTON, QLD: Tableland Radio Service 2 Jack Street Phone 912 017
BAIRNSDALE, VIC: Odyssey Electronics 101 Main Street. Phone 525 282
BENDIGO, Vic: Sumner Electronics 95 Mitchell Street. Phone 431 077
BLACKHEATH, NSW: Goodwin Electronics 123 Station Street Phone 878 378
BROKEN HILL, NSW: Crystal TV Rentals 66 Crystal Street. Phone 8887
COFFS HARBOUR, NSW: Coffs Harbour Electronics 3 Coffs Harbour Plaza. Park Ave. Phone 525 684
DARWIN, NT: Kent Electronics 42 Stuart Highway. Phone 814 748
FAIRY MEADOW, NSW: Trilogy Wholesale Elect. 40 Princes Hwy. Phone 831 218
GEELONG, VIC: Electrofix 133 Malop Street. Phone 87 827
GERALDTON, WA: KB Electronics & Marine 381 Main Terrace. Phone 212 176
GOSFORD, NSW: Tomorrow's Electronics & Hi Fi 68 William Street Phone 247 248
HOBART, TAS: Aare Electronics 123a Bathurst Street Phone 348 232
KINGSTON, TAS: Kingston Electronics & Records Channel Court Phone 298 802
LAUNCESTON, TAS: Advanced Electronics 5a The Quadrant. Phone 317 076
LISMORE, NSW: Decro Electric Cnr Magellan St & Brunker Hwy. Phone 214 137
MACKAY, QLD: Stevens Electronics 42 Victoria Street. Phone 511 723
MARYBOROUGH, QLD: Keller Electronics 218 Adelaide Street Phone 214 668
MORUYA, NSW: Coastal Electronics 43 Vulcan Street. Phone 742 546
MT GAMBIER, SA: Hutchesson's Communications 6 Elizabeth Street Phone 268 404
MUSWELLBROOK, NSW: Silicon Chip Electronics Suite 3, 98 Bridge Street. Phone 43 1088
NAMBOUR, QLD: Nambour Electronic Shop Shop 4, Lawes House, Ann St. Phone 411 804
NEWCASTLE, NSW: Elektron 2000 181 Wharf Road. Phone 262 644
NOWRA, NSW: Lyrebird Electronics 60 Berry Street. Phone 26 626
ORANGE, NSW: MAW Electronics 48 McNamara Street. Phone 626 481
ROCKHAMPTON, QLD: Purely Electronics 15 East Street. Phone 21 058
SOUTHPORT, QLD: Amateur's Paradise 121 Nerang Street. Phone 322 844
SURFERS PARADISE, QLD: Viking Electronics 3108 Gold Coast Hwy. Phone 322 644
TAMWORTH, NSW: Sound Components 78 Brisbane Street. Phone 661 303
TOOWOOMBA, QLD: Hunts Electronics 18 Neil Street. Phone 328 944
TRARALGON, VIC: Power 'N' Sound 15 Franklin Street Phone 743 838
VINCENT, QLD: Tropical TV 248 Fulham Road Phone 781 421
WAGGA, NSW: Wagga Wholesale Electronics 82 Forsyth Street
WALGETT, NSW: P.J. O'Brien Electronics 82 Wee Waa Street Phone 243
WINDSOR, NSW: Hawkesbury Electronic Centre 111 George Street Phone 773 411
WODONGA, VIC: A & M Electronics 70a High Street Phone 244 588
WHYALLA NORRIE, SA: Mellor Enterprises Shop 2, Forsythe Street Phone 454 784

BUYING BY MAIL?

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 $6.00 – 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.)

DICK SMITH ELECTRONICS

MELBOURNE

399 Lonsdale Street
Ph (03) 67 9834

RICHMOND

656 Bridge Road
Ph (03) 428 1614

BURANDA

166 Logan Road
Ph (07) 391 6233

CHERMSIDE

842 Gympie Road
Ph (07) 59 6255

CANBERRA

96 Gladstone Street
Ph (062) 80 4944

ADELAIDE

60 Wright Street
Ph (08) 212 1962

PERTH

414 William Street
Ph (09) 328 6944

PLANNING SUMMER HOLIDAYS?
GO PROSPECTING . . . ELECTRONICALLY!

We've sold thousands of these . . . this amazing discriminator transmits and metal locator actually uses a microprocessor to sort out the treasure from the trash! This incredible technological breakthrough means that most of the hard-to-master controls are gone; they're replaced by automatic circuitry. Do something different on your next holiday; who knows: you could pay for your trip with your first lucky strike!

STOP PRESS: 3 Victorian schoolboys find nugget worth over $120,000!! They used a metal detector!

$99.00 Cat X-1085
WAS $125.00!

Cat B-4525

DON'T KNOW ANYTHING ABOUT PROSPECTING? This book is for you . . . Tells you just about everything you need to know: where to go, what to look for, what to do when you get there . . . It's up-to-date and it's authoritative.

$1.95

BUY NOW AND BEAT THE SUMMER PRICE RISE!

ELECTRONICS FOR YOUR CAR . . .

DON'T LEAVE YOUR LIGHTS ON!

There's nothing more annoying than finding you've left your lights on and . . . flat battery! Solve the problem: fit this light reminder. Gives ten second warning after you turn the ignition off if lights are still on. Easy installation.

$4.50 Cat. A-8509

'INDY' IGNITION

Fit one of these beauties and notice the difference. Keeps your car in tune longer, therefore you save money on fuel! Incredible performer.

$29.95 Cat. A-8530

X & K BAND RADAR DETECTOR

Amazing sensitivity. Both the usual X band and the new K band detection, easy installation. Positive warning, both audible and visual. Exclusive to Dick Smith, a must for every conscious driver. Cat A-8504

$89.50

FM AM CASSETTE

Move your car sound into the 80's with this superb FM/AM/Stereo cassette. Fits into normal car dash cut-outs gives superb performance on radio or tape. Speakers not included. Cat A-8480

$149.00

QUALITY CO-AX SPEAKERS

While you're improving your car sound, why not install a set of co-axial speakers. They make a world of difference! A-7000

$39.50 pr

Or a set of dust cone speakers. For the budget conscious who still want their car speakers to sound as good as possible. Easy installation.

$29.00 pr Cat. A-7080

- **QUALITY**
- **PRICE**
- **VALUE!**

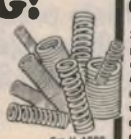
That's what you look for in a cassette tape. You can't have value without high quality, or a bargain price. Most often, you have to settle for one or the other. Dick Smith cassettes

		10 OR MORE:	
C60	LOW NOISE	$1.50	C-3350 $1.00
C90	low noise	$2.00	C-3352 $1.20
C90	Extended dynamic range	$2.75	C-3354 $1.80

SPRING INTO SPRING!

To celebrate the arrival of spring, our handy spring pack has been slashed! 1/3 off springs that will last you for all seasons. Just because it's spring!

NOW 1/3 OFF!!!
NORMALLY $2.95: FOR 1ST MONTH OF SPRING ONLY $1.95!!!



Cat H-1690

TWO OUTSTANDING AUDIO BARGAINS:

GRAPHIC EQUALIZER WITH LED LEVEL DISPLAYS

Music sound a little dead? Liven it up with a graphic equalizer! This outstanding unit features twin LED VU meters, too! You really won't believe the difference a graphic equalizer can make to your sound system until you try one!

Cat. A-1650

$169.00

DIRECT DRIVE TURNTABLE: UNDER $200.00!!!

Incredible! A true direct-drive turntable offering outstanding performance, housed in deluxe plinth with clear acrylic cover and complete with a Shure magnetic cartridge – and it is less than $200!!! If you are after the ultimate for your records but have a limited budget, this fits both requirements. Check one out at your nearest Dick Smith store: you won't be disappointed!

Cat. A-3078

$199.00

COMING SOON!

3 CHANNEL PROPORTIONAL RADIO CONTROL SYSTEM

UNDER $100!!!

Imagine! A three channel, fully digital proportional radio control system under $100!!! Yes, you get the three channel transmitter, receiver, battery holder with on/off switch PLUS three servos, all for the one low price. It's ideal for model planes, boats, cars, etc etc etc – and the frequency can be changed by simply plugging in alternate crystals! Two of the channels even have a "pre-set" control for trimming, etc. What a beauty!

$99.00 Cat X-1230

COMPARE SIMILAR MODELS SELLING FOR $150 AND MORE!
DUE IN STOCK SOON*
DELIVERY EXPECTED MID – END SEPTEMBER. WORTH WAITING FOR!

GO-ANYWHERE STEREO CASSETTE WITH AM & FM

Superb quality, superb performance. This super sound centre has AM, FM and stereo cassette, goes anywhere (battery, mains or car battery adaptor operation). Yes, you can record "off-air" if you wish. It has a huge 5 watt output, and you can plug in external speakers for even wider stereo separation if you wish. For full specifications see page 13 of the Dick Smith 1980 catalogue.

$129.95 Cat. A-4020

A GOOD CASE FOR BUILDING PROJECTS

FOR SMALL PROJECTS

Superbly made folded aluminium cases in a variety of sizes, fitted with rubber feet and have ventilation slots. Look really great!

SIZE	CAT	1-9	10 up
102 x 58 x 83	Cat H-2741	$2.75	$2.55
150 x 81 x 103	Cat H-2742	$4.35	$3.95
150 x 70 x 143	Cat H-2743	$4.90	$4.40
184 x 70 x 180	Cat H-2744	$5.45	$5.00

FOR MEDIUM PROJECTS

Here's a bargain! This passivated steel case with vinyl covered lid was selling for almost $11! Suits variety of projects; holes suit Musicolor but add your own dress panel and it suits anything! Size is 250 x 200 x 80mm.

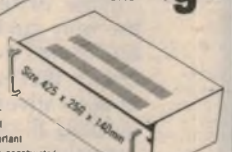
Cat H-3180 **$7.95**

FOR LARGE PROJECTS

Or this one made for the Playmaster amplifiers, size is a whopping 270 x 250 x 80mm. Holes for pots, switches, terminals, etc.

Was $12.50
Cat H-3110 **$9.95**

FOR HUGE PROJECTS



A standard 19" rack-mounting case to suit those really big, important projects. Very sturdily constructed, comes apart for easy assembly or service. Very heavy gauge front panel. A top quality case for projects where quality is important! Cat H-2480

$49.50

BUILD A KIT:

It's simple and it's FUN. Quality Dick Smith kits, complete with instructions to make electronics really enjoyable!

AUDIO MIXER KIT

$49.50

Here's a great kit for the audio buff: a "universal" mixer designed to do those jobs the others can't – for example, sound on home movies! Professional quality with autofade, tone controls & VU meter.

Cat K-3492

MORSE KEYER

For all hams or would-be-hams! This kit includes paddle & all components, inc. case (panel is not marked). Variable speed in correct proportion, inbuilt oscillator. Suits most transceivers.

Cat K-3470 **$39.50**

MORSE CODE TRAINER

$5.90

Easy-to-build Morse Code trainer has code printed on front; battery operated. Key not supplied in kit.

Cat K-3472 (battery extra)

BUDGET MORSE KEY AVAILABLE: Cat D-7105; only $1.95. Ideal for trainer.

We're often asked which of the electronics and computer magazines we have available. All of the following are normally stock; however some (especially overseas) magazines are in very limited quantities. Check with your nearest store.

Cat No:	Title:	Price:
B-5010	Electronics Australia	$1.80
B-5015	Electronics Today Int.	$1.80
B-5030	Everyday Electronics (UK)	85¢
B-5032	Practical Electronics (UK)	95¢
B-5040	Wireless World (UK)	$2.00
B-5044	Amateur Radio Action (Aust)	$1.30
B-5050	QST (USA)	$2.00
B-5059	Australian Personal Computer	$1.95
B-5081	Byte (USA)	$2.95
B-5082	Micro 80 (Aust)	$2.50
B-5084	80 Microcomputing (USA)	$2.50
B-5085	Kilobaud (USA)	$2.95
B-5088	Creative Computing (USA)	$2.95
B-5071	Popular Electronics (USA)	$1.25
B-5074	Radio Electronics (USA)	$1.65
B-5075	Scientific American (USA)	$2.65
B-5080	Popular Science (USA)	$2.00
B-5090	Elektor (UK/Europe)	$1.50

PLEASE NOTE: Above magazines are not available from our Mail Order Centre.

Dear Customers . .

Quite often the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up goods so that advertised lines are not in the stores by the time the advert appears. Please don't blame the store manager or staff if they cannot solve a dock strike on the other side of the world, or even locate a shipment that has gone astray.

What we are trying to say is that, if you're about to drive across town to pick up a particular line at a Dick Smith store, why not give the store a ring first (addresses & phone numbers below) . . . just in case! Thanks.

Dick Smith and Staff

FREE CATALOGUE

(Offer expires September 30, 1980)

Did you know you can save 50% and more by buying from Dick Smith Electronics. Have a look through our current catalogue. Compare it with theirs: notice the savings!!!

And there's another reason for buying from Dick Smith Electronics: you're buying from a 100% Australian owned company: your dollar stays right here, in Australia.

Haven't got a copy of the Dick Smith catalogue? Send the coupon below to our Mail Order Centre. We'll send you, free and post free, a copy of our catalogue. (It is normally so popular we sell it for 75¢ – but for this month only, we'll send you one absolutely FREE)

Yes, I want to compare your prices with theirs. Please send me a copy of the 1980 Dick Smith Catalogue.

Name ..... Address .....

..... Postcode .....

$139 DIGITAL DISPLAY BONUS WITH EVERY YAESU FT-101Z!!

ADD-ON DIGITAL DISPLAY KIT IS ALSO AVAILABLE FOR EXISTING FT-101 CONVERSIONS: Cat D-2861 $139.00

YES! With every FT101Z, we're including a digital frequency display kit, normally worth $139.00, at no extra charge! It's a simple "drop-in" replacement display, any ham can install it in an hour or so. Full installation instructions are included. You know how good the FT-101Z is: now it is even better: it becomes an FT-101ZD for the same price! Offer is open strictly while current stocks last: be quick for this bargain.

FT-101Z (Cat D-2862): $775.00
Digital Disp. (D-2861): $139.00
YOU PAY: $775.00

DICKSMITH ELECTRONICS

SYDNEY

125 York Street
Ph (02) 290 3377

GORE HILL

162 Pacific Hwy
Ph (02) 439 5311

CHULLORA

147 Hume Hwy
Ph (02) 642 8922

PARRAMATTA

30 Grose Street
Ph (02) 683 1133

BLAKEHURST

613 Princes Hwy
Ph (02) 546 7744

WOLLONGONG

263 Keira Street
Ph (042) 28 3800

MAIL ORDER AND SERVICE CENTRES:

Cnr Lane Cove & Waterloo Rds, North Ryde NSW 2113
Ph (02) 888 3200

(Monday to Friday, 9AM to 5PM only)

SHOPS OPEN:
9AM TO 5.30PM
MON. TO FRI.
12 NOON SATURDAY
(Brisbane ½ hour earlier)

bankcard
master charge
VISA

Vented Enclosures

The gospel according to Thiele & Small

Much of the early information on the design of vented loudspeaker systems ignored certain vital parameters. This new article presents, in a readable and practical form, up-to-date thinking on the subject — much of it pioneered in Australia by Neville Thiele and Richard Small.

By DAVID B. WEEMS*

A decade ago the bass-reflex speaker was an endangered species. During the last few years, however, it has made a spectacular comeback, and is now a respected competitor of acoustic suspension systems.

The arrival of acoustic suspension speakers in the 1950s was an important milestone in loudspeaker development. Reversing the traditional practice of putting a stiffly suspended speaker in a large cabinet to achieve good low-bass response, the acoustic- or air-suspension system used a driver with an ultra-compliant suspension mounted in a small enclosure.

A vented loudspeaker system. The ducted port can be seen in the bottom right hand corner, below the woofer.

The timing was fortuitous. Stereo, just around the corner, would put a premium on space-saving speakers. When demonstrations proved that the little acoustic-suspension speakers could outperform many larger systems, the era of the compact speaker system had begun.

Though the closed box beat the reflex competition on several counts, there was a single overriding reason why many manufacturers converted their production to sealed systems: the reflex was just too complex and unpredictable. Leading engineers argued about how to tune the system and how big to make the box.

G. A. Briggs, the late English authority, once compared reflex enclosures to heads of lettuce, saying that one rule, "the bigger the better," applied to both. Later he added the qualifier, "within reason." "Like lettuce," he said, "loudspeaker enclosures can get so big they go to seed."

In the 1950s, "within reason" was about the only guide available. Hobbyists built enclosures to dimensions obtained from charts that scaled box volumes according to advertised speaker diameter and ignored all other parameters. Thoughtful experimenters, suspicious of such reliance on cone size alone, wished for a more precise guide. So it wasn't surprising that the audio world greeted the acoustic-suspension speaker with enthusiasm — and almost abandoned the reflex.

The surrender to the closed box was not quite total, though. James F. Novak, now Vice President of Engineering at Jensen Laboratories, made an analysis of enclosures for high-compliance speakers in 1959 that reiterated some of the virtues of the reflex. He claimed that high-compliance drivers in properly designed vented boxes reduced distortion and extended bandwidth.

Novak described an ideal reflex system consisting of a driver with relatively high magnetic damping in a box that had an air compliance lower than that of the driver's equivalent suspension compliance. He specified the relatively low Q (amplitude of the peak at resonance) of 0.3 to 0.4 for the driver. Novak's speaker/box compliance ratio was 1.44. (The compliance of an air volume for a given driver varies directly with the volume of the air and inversely with the square of the driver's effective piston area.)

Novak's work introduced a new principle to vented speaker design, the optimum volume concept. His compliance ratio brought precision to the drivers in the specified range of Q. With drivers outside that range, particularly those with higher Qs, the results remained unpredictable.

A. N. Thiele, an Australian electrical engineer, saw Novak's paper and noticed that Novak's mechanical equivalent circuit for the reflex had the same general form as an electrical high-pass filter. Applying filter theory to reflex design, Thiele found that he could predict characteristics such as cut-off frequency, optimum enclosure tuning, and the shape of the response curve near cut-off.

In 1962 he published a definitive paper in an Australian journal that laid the foundation for a new approach to vented loudspeakers. He included data for 28 different designs, or alignments.

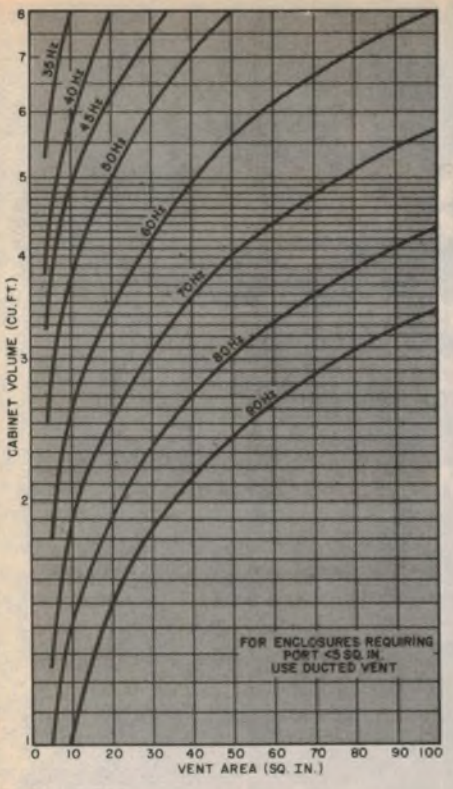


Fig. 1: Design chart to be employed for enclosures with a simple vent (see text for explanation).

Although his work was largely ignored in the United States, after about 10 years it was "discovered."

Thiele's analysis was expanded by Richard Small, an American engineer who subsequently emigrated to Australia; it was then put to practical use by Ray Newman, Senior Systems Engineer at Electro-Voice; D. B. Keele, Jr, now Senior Transducer Engineer at JBL; Pat Snyder of Speakerlab, and others.

Woofers and resonators.

To fully appreciate Thiele's contribution, you must compare the present state of the art to that of just a few years ago. Vented speaker systems have been in use for about 50 years, but that half-century has been filled with widespread misconceptions and even superstitions about how such speakers work. During that time there was no mystery about the performance of Helmholtz resonators themselves.

Helmholtz, studying the resonance behaviour of air volumes in the mid-19th century, showed that any enclosed air volume that is vented will have a single natural frequency of resonance determined by the volume of the enclosed air and the area of the vent. Specifically, it is the mass of air in the port coupled to the compliance of the air in the enclosure that produces the resonance. As the vent is made smaller, the air directly in the vent reaches a higher velocity and forces air in front and back of the opening to move with it. The increased moving mass lowers the frequency of resonance.

To tune a small volume of air to a very low frequency, a simple vent must be small in area. Alternatively, a duct can be coupled to the vent to trap an even larger mass of vibrating air, reducing the frequency of resonance still further or allowing a larger vent for a given resonant frequency.

Dimensions of vents and ducts (made from cardboard tubing obtainable from stationery or business supply stores) for tuning various enclosure volumes are given in Figs. 1 and 2 (the latter developed by Novak).

When a driver is installed in a ported box, the cone action alternately compresses and expands the enclosed air. Near the tuned frequency of the enclosure, the air "piston" in the port moves in phase with the driver cone, damping the movement of the cone rather heavily and making it appear to stand still at resonance.

This damping, which offers some relief from the prodigious cone excursions that occur at low frequencies, is what attracted experimenters to vented designs in the first place. But too often their speakers exhibited a low-frequency hump that gave the reflex the derisive nickname "boom box."

In 1969, while researching an article for "Popular Electronics," I asked engineers at several major companies for advice to hobbyists on how to design and tune a vented speaker. One group suggested that the box be tuned to the frequency of the driver's free air resonance, a traditional practice.

A few advocated putting the box resonance above the driver resonance because such tuning produced a flatter impedance curve in the usable band. (Instead of the familiar double-humped curve, with the humps approximately equal in amplitude, this produced a large hump at a very low frequency and a minor hump at the upper resonance.)

Still others contended that the box should be tuned below the driver's free air resonance so that the port could control distortion at the lowest frequencies.

Thiele's answer to the tuning question, interestingly, gives a clue as to why engineers from different companies offered such sharply conflicting advice in 1969. It's all a matter of driver Q. If Q lies in the range specified by Novak, the box should be tuned to the driver resonant frequency; higher Q demands a tuning below resonance and lower Q a tuning above. To see the details of how this works we'll have to look at Thiele's alignment chart. This, as rewritten by Keele, appears in Table I. Definitions are given in Table II.

Let's examine the data for alignment #5, a fourth order Butterworth (maximally flat) alignment. A good starting point is the value for QT, 0.383. This is the total Q of the speaker in the system, including internal amplifier resistance and

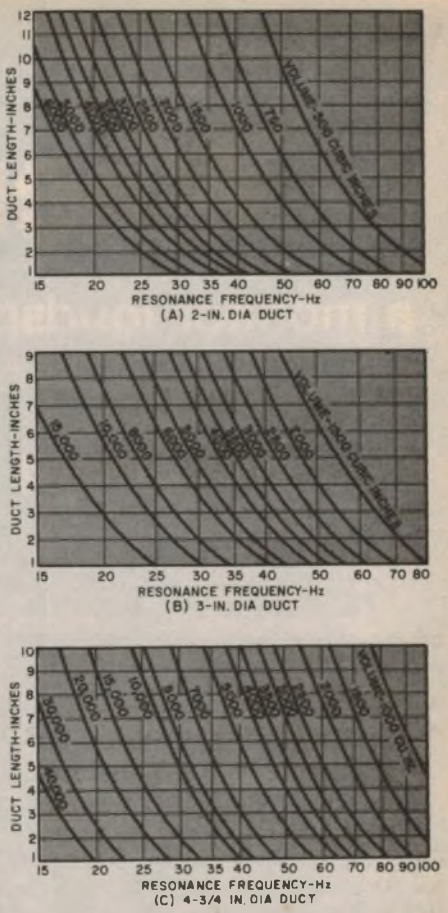


Fig. 2: Design charts for cardboard tube ducted enclosures. Tubing diameters given are inside measurements; duct length is measured from the front of the cabinet baffle board.

resistance added by the speaker cable. For amplifiers with high damping factors, and with adequate speaker cables, QT can be considered to equal that of the driver alone. So for alignment #5 a speaker with a Q of about 0.38 would be ideal. Notice that this fits within the range specified by Novak.

Next we look for VB, box volume. The table specifies the ratio of box volume to speaker compliance volume (VAS) as 0.7072. A designer would either obtain the value of VAS from the manufacturer of the driver or he would measure it himself. Then he would multiply VAS by 0.7072 to get the theoretically correct box volume. In the real world no reflex enclosure is perfect so this volume must be enlarged.

When Small applied Thiele's original data to typical vented enclosures, he found that he had to add about 30% to the theoretically correct volume to get the low-frequency performance predicted by the data.

In Thiele's original paper, the box volume ratio was not included in the table; instead a speaker/box compliance ratio was stated. A speaker/box compliance ratio would give the same value

When you design

a monitor loudspeaker as famous as the Model SIX, it's very hard to go one better.

After 4 years of research we did!

ELEVEN SERIES II

In hand finished Amercian Walnut, individually assembled and tested.
120 watts RMS per channel.
Recommended resale $750 pr.

A TOUGH ACT TO FOLLOW

Available at most reputable high fidelity sound centres or information from

Peterson SPEAKER LABORATORIES Pty Ltd

7 Alex Avenue, Moorabbin 3189. Telephone (03) 553-1055.

as a VAS/VB ratio, the inverse of the ratio shown in Table I. For alignment #5 that would be 1/0.7072 or 1.414. If that figure looks familiar it is almost exactly the ratio specified by Novak as optimum.

Moving to other aspects of box design, the f3/fs ratio is 1.000. That shows that the system's bass response will be 3dB down at the frequency of the driver's free-air resonance. The fB/fs ratio is also 1.000, so the box should be tuned to the free air resonance of the driver.

Now look at alignments #1–#4, for speakers with higher magnetic damping (lower Q). In #4, for example, a driver with a Q just slightly lower than that of #5 has a VB/VAS ratio that is less than half that of #5. Thus if you had two drivers that were identical except for Q, the one with the Q of 0.303 could be put into a box less than half the volume of that required by the driver with the Q of 0.383. But the other data for #4 show that the speaker with the lower Q will have its low-frequency cut-off moved up to 1.45 fs when the box is properly tuned to 1.23fs.

On the other hand, speakers with higher Q's fit into the alignments beyond #5 and demand larger boxes, larger at least in the acoustical sense – in relation to the driver's equivalent air compliance. These boxes should be tuned to frequencies below the driver's resonant frequency.

The reason for this kind of tuning is shown in Fig. 3. High-Q speakers have smaller magnets which give less control on the moving system at resonance. Coupled with a resonator these speakers may be subject to peaking before cut-off, but if they are matched to a box tuned too low, the combination of a box that rolls off the bass response and a driver that peaks can produce a flat response down to cut-off.

Some of the Chebychev alignments extend the low-frequency cut-off to well below the driver resonance, but at the expense of some ripple in the passband. And if the Q is higher than about 0.7, distortion is greater.

Many engineers consider alignment #5 a good choice. Although this alignment will normally require a driver with a Q of approximately 0.38, it can be used with drivers of lower Q – with a sacrifice in system efficiency – if a resistance is put in series with the driver. The added resistance raises the QT to 0.383, and the design is executed as if the driver had been designed with a Q of 0.383.

To summarise the Thiele alignment data and make some comparisons, a driver with a very low Q can have an optimum box volume that is small compared to the driver's equivalent air volume compliance. This doesn't necessarily mean small boxes because low-Q speakers typically have a high compliance. Table III shows this correlation clearly.

A system composed of a low-Q speaker in an optimum box volume should be tuned to a frequency above that of the driver's free-air resonance and it will cut off above that frequency. While this may seem to limit the low-frequency range of these speakers, note that speakers with low Qs also usually have low resonant frequencies.

A high-Q speaker needs a box volume that is large compared to its equivalent compliance air volume, but this box will be tuned below the speaker's free-air resonance. Again, high-Q speakers typically have lower compliance and higher resonance frequencies, so the box volume that is acoustically large for them may seem rather moderate to the beholder.

These relationships may explain why engineers who worked with different kinds of drivers in the 1950s and 1960s offered such divergent advice on box design and tuning. Each school of thought was working on a single aspect of a larger problem. Thiele put it all together and developed a general theory of vented loudspeaker systems.

The Thiele data can be used in various ways. One obvious application is to design a box to match an existing driver. But it can just as easily show how to design a driver to fit a certain box size. The designer can compute an ideal cone mass, magnet size, voice-coil resistance, and other specifications for a driver that will work well in such a box. Or, knowing the specifications of this driver, he can calculate the performance of the driver in various boxes.

Although the Thiele alignments show optimum values, systems based on them may have box volumes other than those indicated by the table. Proper use of the data can let the designer predict system performance by computer, instead of by guesswork and trial and error.

As mentioned earlier, Thiele's original publication provided 28 different alignments. Table I shows 11: Thiele's first 9, an additional one labelled "9.5" by Keele, and an example of an electronically assisted design in #15. The table shown here was revised by Keele to make it more useful for designing a box to fit a driver rather than designing a driver to match a specific box volume.

Here is a concrete example of how to

TABLE I—THIELE ALIGNMENT DATA AS REWRITTEN BY KEELE

Alignment details			Box design				Aux. circuit	
No.	Type	Ripple (dB)	f_3/f_S	f_B/f_S	V_B/V_{AS}	Q_T	Peak Lift (dB)	f_{PK}/f_S
1	QB_3	—	2.68	2.000	0.0954	0.180	—	—
2	QB_3	—	2.28	1.730	0.1337	0.209	—	—
3	QB_3	—	1.77	1.420	0.2242	0.259	—	—
4	QB_3	—	1.45	1.230	0.3390	0.303	—	—
5	B_4	—	1.000	1.000	0.7072	0.383	—	—
6	C_4	—	0.867	0.927	0.9479	0.415	—	—
7	C_4	0.13	0.729	0.829	1.372	0.466	—	—
8	C_4	0.25	0.641	0.757	1.790	0.518	—	—
9	C_4	0.55	0.600	0.716	2.062	0.557	—	—
9.5	C_4	1.52	0.520	0.638	2.60	0.625	—	—
—	—	—	—	—	—	—	—	—
15	B_6	—	1.000	1.000	0.366	0.299	+6.0	1.07

Reprinted with permission from the Journal of the Audio Engineering Society.

TABLE II—DEFINITIONS OR SYMBOLS USED IN THIELE DATA

Symbol	Definition
B	Butterworth—alignments with flat response down to cutoff.
C	Chebychev—alignments with some degree of ripple in response.
QB	Quasi-Butterworth alignments.
f_S	Frequency of driver's free-air resonance.
Q_{TS} or Q	Q of driver at f_S.
Q_T	Total Q of the driver in the system at f_S. With modern amplifiers of low internal resistance, and a high damping factor, Q_T will be approximately the same as Q_{TS} unless speaker cable is excessively long or of inadequate gauge.
V_{AS}	Equivalent air compliance of driver. The volume of air that offers a compliance to the driver that is equal to the compliance of the driver's suspension.
V_B	Volume of air in box.
f_3	Cutoff frequency, response down 3 dB from mid-band level.
f_B	Frequency of box resonance, determined by internal volume of air and vent characteristics.
f_{PK}	Frequency of peak lift produced by auxiliary equalizer.

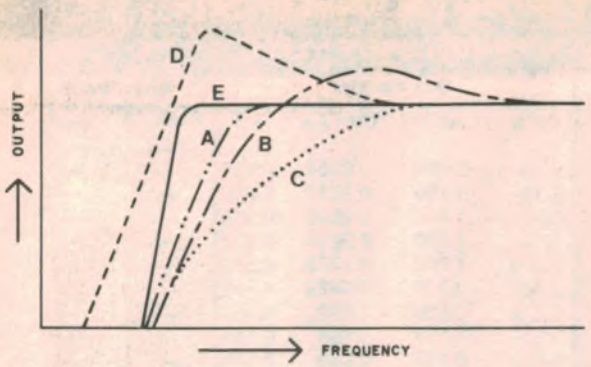


Fig. 3: Characteristic response curves for various reflex systems: (A) Fourth-order Butterworth; (B) reflex box with f_B too high; (C) reflex box with f_B too low, similar to system before equalisation; (D) equaliser output to complement B_6 speaker; (E) response of system that combines detuned box (C) with equaliser (D). If driver Q is 0.383, (A) represents optimum tuning for alignment No. five. If box is tuned too high for this driver, response has a hump; if too low, bass is weak. Speaker with lower Q might require higher tuning to avoid weak bass; higher-Q driver requires lower tuning for flat response. Comparisons assume drivers are identical except for differences in magnet strength—or Q.

use the Thiele data. Let's assume a woofer with the following specifications: fs = 40Hz, Q = 0.41, VAS = 5 cu ft. The box should be tuned to 0.927fs, or 37Hz. This system will have a cut-off frequency of 0.867fs, or about 35Hz. If the value for the driver's Q had fallen between the values indicated in the table for adjacent alignments, the designer would interpolate to get correct box volume, resonance, and cut-off frequency.

Equalised alignments.

The first 9 alignments, and Keele's 9.5 alignment, consist of simple speaker/box combinations driven by a typical power amplifier. Thiele's complete listing shows systems with significant bumps or dips in the response curves that must be corrected by auxiliary electronic equilisation. Some of these alignments are of little more than academic interest.

For example, one group requires a great amount of bass boost at frequencies below the box resonance. Such systems would show excessive cone motion, a potential problem for all unfiltered vented speakers but one that extra boost below resonance would surely aggravate.

Unloading occurs because below resonance the air in the vent moves as if in series with the cone, and out of phase with it. Now hardly at all restrained, the cone can be driven into distortion or even damaged by low-frequency noise or pulses.

Many amplifiers and receivers have low-frequency filters, effective at infrasonic frequencies, but many listeners mistakenly fail to use them because they don't want to impair their system's frequency response. With vented speakers a correctly designed filter will give the effect of more bass, not less, because the bass is firm and undistorted.

Cone surging can also be eliminated by choosing Thiele's 15th alignment. It offers a double dividend: a bass boost gives extended bandwidth in a small box and a cut-off of infrasonic noise. Alignments #15 and #4 use drivers of about the same Q and boxes close to the same size. But check the two systems for bass range. The assisted system gives response down to the free-air resonance of the driver instead of cutting off at 1.45fs as does #4. A driver with a free-air resonance of 35Hz would cut-off at about 51Hz in alignment #4; alignment #15 with electronic assist extends its response to 35Hz.

Keele has greatly expanded Thiele's data to include a wider range of drivers. His method is roughly this: design a system according to one of the first 9 alignments, then lower fB by a half octave to produce a drooping low-frequency response. By adding a second-order high-pass filter with a Q of 2 and a 6dB boost at 1.07fb, we can flatten the response and reduce the cut-off point to fs.

Keele suggests that any driver with a resonance and a Q so placed that the ratio fs/Q falls between 80 and 160Hz is suitable for this alignment. The alignment works with relatively high-resonance, high-Q drivers as well as with low-resonance, low-Q drivers.

An appropriate driver in this sixth-order Butterworth alignment (all vented systems are at least fourth-order) should give a cut-off at 25 to 50Hz. To use Keele's method, the designer chooses a box volume that is approximately equal to $4.1Q^2VAS$, then tunes that box to 0.3fs/Q. These same relationships hold in the data shown in Table I. Where the table shows only a single Q value, the Keele technique can be applied to any driver with a suitable ratio of resonance to Q.

Considering the advantages of the B_6 alignment, it would be helpful if manufacturers would include tunable, 6dB boost circuits in their amplifiers. An owner of a typical fourth-order Butterworth system could convert to sixth-order assisted operation by adding a longer tuning duct to the enclosure and switching in the boost that gives the proper response.

For the present, if you want to experiment with equalised alignments you will have to build your own equaliser. Pat Snyder of Speakerlab has designed an equaliser to be inserted into the tape-monitor circuit of almost any amplifier or receiver. As originally designed, his circuit offers a variable degree of boost – from 0dB up to about 10dB. You can adjust the frequency of the boost by choosing two matched capacitors for each channel.

Vents and "vent substitutes."

A small box can be tuned to a low frequency by a small simple vent, but a port can be too small for good performance. A small vent radiates just as much power as a larger one but causes air to move through it at higher velocity. If the velocity is great enough it will cause whistling and hissing and possibly even distortion. A box with a small vent can be tuned to the same frequency by enlarging the vent and adding a duct behind it.

In some small enclosures where a very low box resonance is necessary, the duct can occupy so much volume that the

TABLE III—THIELE/SMALL PARAMETERS FOR SEVERAL TYPICAL DRIVERS

Brand	Model	Advertised diameter (in.)	f_S (Hz)	Q_{TS}	V_{AS} (cu ft)	V_{AS} (liters)
Electro-Voice	SP12C	12	45	0.67	5.9	165
	SP15C	15	40	0.45	9.9	280
JBL (Prof. Series)	2145	12	30	0.51	5.5	155
	2135 (Ext. range)	15	40	0.25	10.5	300
	2231 (Low Freq. driver)	15	16	0.21	26.0	735
Speakerlab	1204A	12	16.1	0.176	17.9	500
	W1508S	15	18.8	0.239	31.9	900

Vented Loudspeakers ctd. . .

enclosure must be enlarged to accommodate the duct.

Such systems can be tuned to the proper frequency by use of a "drone cone," or passive radiator. This "vent substitute" is a suspended cone, essentially a speaker without a motor. The drone can be tuned by adjusting its mass; the greater the mass, the lower its frequency of resonance. Because a vent substitute is solid and far denser than a gas, such as the air in a duct, the passive radiator requires hardly any more space than the panel area it occupies.

Early systems of this type usually had drones equal in diameter to that of the woofer, but current practice makes the drone's effective cone area about twice that of the woofer. An enlarged passive radiator piston can more easily provide the volume velocity necessary to effectively load the woofer.

Driver parameters.

Some people have objected that normal production variations in drivers preclude such precise calculations in box design. This has been answered in studies by Keele and Snyder.

One driver parameter that is difficult for manufacturers to control precisely is compliance. In fact, in some kinds of suspension systems, the compliance changes with temperature or humidity. Fortunately, compliance variations are usually cancelled by compensating changes in other parameters.

For example, if the compliance of a driver is reduced, the frequency of resonance will be raised, but the Q is also raised to a similar degree. Thus, the ratio of resonance to Q, a really important factor, is hardly affected. If the mass of the moving system is constant and the magnetic field around the voice coil unimpaired, the speaker will perform according to design specifications.

Finally we come to another aspect of the bass-reflex problem that has often plagued hobbyists, the information dam. Several years ago I wrote to a company and asked for specifications on its woofers. The reply suggested that I rely on the reputation of the brand rather than upon specifications!

In the past there was an excuse for such reticence, in the unreliability of acoustical measurements made under differing conditions. In fact, most measurements were useful only to experienced engineers who could interpret them correctly.

But most of the required measurements for Thiele data can be made by tests that are fairly simple and easily reproducible. There is no longer any reason for the attitude shown in the letter mentioned above. Several companies now offer complete Thiele data for their speakers. Table III shows some representative drivers with a summary of the Thiele data for each.

While the closed-box loudspeaker – which Small has shown to be analogous to a second-order filter network – still offers the ultimate in design simplicity, its overwhelming advantage has been reduced by the Thiele approach to vented-system design. It looks as if the bass reflex, having fallen into virtual oblivion, has been reborn, Phoenix-like, from its own ashes.

FORUM

Conducted by Neville Williams

THE KEY TO BETTER BASS? TURN THE CLOCK BACK THIRTY YEARS!

A reply to a query in our May issue about poor bass response (P.M., Altona, Vic, page 122) prompted a letter from a NSW reader, who felt that he had encountered a similar problem with entirely different equipment. His letter raises a number of questions about bass response in general — an evergreen subject in the world of hifi.

Before taking up these matters, however, we should mention another letter from R.B. of Belgrave Heights, Victoria, who reacted quite differently to our reply to P.M. In fact, he didn't like it at all and felt that we had been haughty, unhelpful and a few other things into the bargain.

And he didn't like our rather flippant put-down of loudness controls, which he obviously considers to be a worthwhile inclusion in a modern amplifier.

In retrospect, I agree that the reply could have been better phrased – less concerned with defence of the 40-40 amplifier, and more analytical of the reader's stated problem.

In fact, the 40-40 scarcely needs defending, as one of the notably successful designs in the realm of do-it-yourself hifi. It certainly does not suffer any intrinsic lack of bass response and, with full bass boost in operation, would be a potential thunder machine. Hence our question about whether P.M. had checked it in any way by instruments or by comparison.

If subsequent checking did, indeed, reveal a fault, then rectifying that fault should overcome the problem. On the other hand, if the amplifier was shown to be normal, with normal bass boost available, then the trouble must surely be elsewhere.

There could be a problem with the pickup but it would more likely have to do with the loudspeaker system. It might even be that the stereo pair are operating out of phase, in which case reversing the connections to either loudspeaker might effect a noticeable improvement.

It may have been helpful to P.M. had we added a paragraph to this effect. Point taken, R.B.!

As for loudness controls, one can start an argument at any time in hifi circles by merely mentioning the term. If one elects to compensate for the classical Fletcher-Munson curves – and this is part of the argument – then at least it should be done accurately. This would involve some method of assessing the sound pressure level at the listening situation in order to determine how the loudness control should operate.

Much more commonly, the loudness function ends up as a fairly arbitrary preset bass and (sometimes) treble boost, which the listener switches in when he feels so inclined, and which is switched out again when he happens to remember. In these circumstances, it really isn't surprising that a loudness control is so frequently dismissed as a "gimmick".

More than this I need not say here. Leo Simpson has already said it in "Audio Talk" in the July '79 issue.

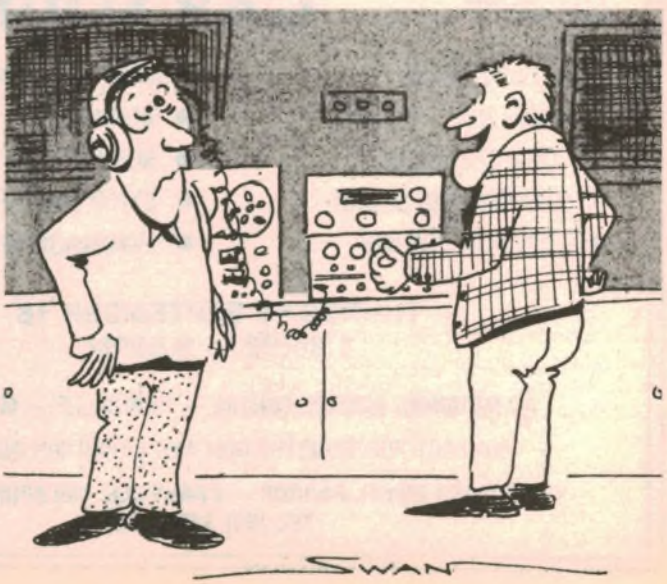
In fact, we did not debate the matter too seriously when planning the original 25+25 and 40+40 watt amplifiers. We were responding to approaches from electronic parts dealers who sensed a need – at that time – for a couple of basic, high-performance amplifiers, which would be no more costly and no more difficult to build than strictly necessary. Whatever they might say now, their plea at the time was "no frills".

In 1980 it might be quite different and, for compelling commercial reasons, Leo Simpson might have to abandon his pride and eat his words – lumps and all!

However, to take up the original theme, R.B. of Turramurra, NSW, writes as follows (the identical initials are a coincidence):

Dear Sir

The comments of P.M. (Altona, Vic) concerning the lack of bass in a Playmaster 40+40 amplifier were of interest to me because of a similar experience. However, I suspect he will find his trouble in the speaker boxes rather than in the amplifier.



"But for really solid bass, there's no substitute for a pair of top quality phones and a hundred watt amplifier!" (Adapted from "Audio" magazine)

I should explain that I have a strong interest in pipe organ music and in Bach in particular. My equipment is conventional – a 45 watts/channel commercial receiver/amplifier and a pair of commercial three-way speakers, with a good quality turntable and magnetic cartridge.

To say this set-up, worth about $800, was disappointing for pipe organ music would be very much an understatement. I tolerated the situation until Ron de Jong's article on a super bass filter appeared in your February 1980 issue. I made up the filter using only the components for position 4, cutting off at 100Hz. (I cannot imagine any use for the other three positions). This done, I returned to service a Playmaster 136 amplifier to drive the central bass speakers.

There was an immediate and distinct improvement but an even better result was obtained by abandoning the filter altogether. Instead, I fed the signal from the existing speakers and was content with the bass boost and treble cut available on the amplifier itself. In my case, the outstanding success of the final result lay in the use of a pair of Rola 12UX hifi speakers some 30 or so years old.

R.B. goes on to emphasise the high flux density in the air gap of these classic hifi speakers, and their resulting sensitivity, concluding that modern drivers lack the ability to produce equivalent bass at low listening levels on the domestic scene. He then continues:

It is all very well to talk about amplifiers with 45 watts/channel ouput. In the home, we are much more interested in levels up to 1W per channel. In my set-up that gives a sound pressure level reading, six metres away from the speakers, of 85dB on the fast A scale of a sound level meter (pressure). If anyone wants more noise than this, they are welcome to it – and my ears are nearly 70 years old!

This is the nub of the argument because, at voltage input levels equivalent to one watt (2.83V into 8 ohms) modern ceramic magnet speakers are apparently just too insensitive to produce a reasonable level of bass air pressure, hence the absence of bass response.

Not everyone will be fortunate enough to possess a pair of 30-year-old speakers, as I do, but you may be able to make some alternative suggestions.

It is fortuitous that, elsewhere in this issue, you will find an authorative article on driver and enclosure design, which will help shed light on matters raised by R.B.

In the heydey of the Rola 12UX, and contemporary models by Goodmans, Wharfedale and others, most systems were mono and most hifi enthusiasts managed to find a spot in the listening room for a single large enclosure; or maybe a closet door or wall or fireplace in which a big driver could be mounted.

As R.B. observes, all those heavy duty speakers were very sensitive and could make a lot of noise with the 10 to 30 watts of drive that was commonly available from contemporary valve amplifiers.

But the sensitivity had another significant implication: electrical damping on the cone movement was very high and it was often difficult to judge where the cone resonance was by simply listening as you ran over the range with an audio generator.

How far down the bass response extended still depended on the acoustic laws of baffling but, with a smooth (if tapering) response, a firmly suspended cone and sensitivity to spare, those classical old drivers were amenable to generous bass boost.

Given a spare wall, a fireplace, Briggs-style sand-filled baffle, or a big enough enclosure, the speakers worked fine by the standards of the period. According to R.B., they still work fine by the standards of 1980!

THEN CAME STEREO . . .

As pointed out in the article by David Weems, elsewhere in this issue, the arrival of stereo spelt the end of the big driver/big enclosure approach and the search began for smaller enclosures which would still produce a satisfying bass response.

This search had a fairly unfortunate beginning, when the major loudspeaker manufacturers tried simply to reduce the size of the enclosures around their otherwise conventional drivers. They fiddled with filling materials, internal baffles, vents, ports, acoustic filters, and so on – ending up with only partial solutions.

It was left to those mentioned in Weems' article, plus the odd unsung pioneer, to rationalise what was going on. Out of all this came the modern sealed "acoustic suspension" enclosure and the modern vented system.

Without repeating the contents of Weems' article, it turns out that practical drivers for both types of enclosure end up with a lower acoustic efficiency than the classical hifi drivers of the 12UX variety. Indeed, the more a system is scaled down, in a search for compactness, the lower the driver efficiency is likely to be. It will need more electrical power to produce a given sound level.

Fortunately this is not, in itself, too much of a problem, nowadays. One can get up to 100 watts from a solid-state amplifier with no more hassle than once went into winning 25 watts from valves. And a 12dB increase in power level is sufficient to offset that kind of loss in driver sensitivity.

Superficially, R.B. of Turramurra is in error when he implies that lower driver sensitivity has something to do with bass

response at low listening levels. A properly designed modern system will have a flat response down to some stated corner frequency (-3dB) and this response will be evident from low listening levels through to the upper limit of power handling.

At the heart of the matter – and of R.B's problem – lies the question: "What is the corner frequency of any given system?" Forget the superlatives and the glamour settings in which somebody's loudspeaker system is depicted. How far down does the bass response really go?

In fact, it is quite interesting to look at the response curves published by overseas reviewers for dozens of widely publicised loudspeaker systems. In a surprising number, the response is on its way down at 50Hz!

THE KIND OF MUSIC

For many listeners, whose interest centres on vocal, instrumental and orchestral recordings, a system of this nature can be quite satisfactory, particularly if it is agreeably compact and capable of being played at loud room volume.

It is organ buffs like R.B. who listen for – and miss – those 32ft pedals. It is they who are likely to be disappointed in otherwise acceptable modern systems – just as they might have been disappointed, in other days, in anything less than a fireplace enclosure, a corner horn or a huge sand-filled baffle.

Nor is bass boost the answer to an organ buff's deprivation, with a modern over-compact system. One can nudge up the response around the corner frequency by a few dB but any attempt to recover response in the "cut-off" region is likely to find the amplifier running out of power, and/or the driver(s) running out of travel.

If one is going to demand sustained response around 35-40Hz, one has to shop for a system which has been designed to this sort of specification. And, having found it, there is every chance that it will turn out to be larger and more expensive than you had hoped.

Maybe as much or more for a pair of speakers than R.B. quoted for his entire system!

It was to help out in this area that we published Ron de Jong's article on the Super Bass Filter in the February 1980 issue. As R.B. rightly concluded, the basic intention was to reinforce the sound level below 100Hz and particularly in the region below 50Hz, where the average enclosure system tends to roll off.

To complete the job, one needs a powerful amplifier, preferably comparable with the total power rating of the existing stereo system.

One also needs an appropriately rated woofer mounted in a way which will allow it to propagate adequately frequencies in the region of 30-40Hz.

A favourite trick of hifi specialists overseas is to mount a downward facing 15in or 18in woofer in a heavy box, styled to look like a period or oriental chest. It rests innocently in a convenient spot, supporting ornaments of coffee cups, without anybody being immediately conscious of where the deep rumbles are coming from!

R.B. was able to get away with a relatively modest super bass amplifier because of the high acoustic efficiency of his Rola 12UX speakers. But I'm not convinced that he experienced the full and originally intended benefit of the system.

Unless the 12UX's were unusually well baffled, their effective acoustic output at 30Hz would be way below that at 60Hz and above. That could still make the big pipes sound impressive but their loudness would be coming more from their partials than from the foundational 32ft tone.

What supports this reservation is his further statement that the system sounds even better with the super bass filter switched right out of circuit. That "even better" can only mean that he is responding also to frequencies well above 100Hz. In effect, R.B. is saying: I like a lot of weight in the pedals and maybe the left hand – from 200Hz down!

That would not be at all unusual for a pipe organ fan, particularly one who is apparently discreet in his use of the volume control.

CAUSE TO THINK

Be that as it may, R.B's statements hit me at a time when I had just got through commenting on the smoothness of the bass in the Technics SX-7700G organ, reviewed in our June issue. No enclosure; just three speakers on the fascia board and good, fundamental sounding pedals.

Talking the matter over with engineer Nick Kay of Etone, the local speaker manufacturer, Nick suggested that the explanation would probably be in the use of sensitive, highly damped drivers, with possibly some shaping in the amplifier curve to flatten the overall response.

I'm currently thinking about that one, because one of the things it's difficult to fit into an organ console is an adequate enclosure!

And that leads us to some "wouldn't-it-be-funny-if" speculation flowing from R.B's letter:

Wouldn't it be funny if an attractive proposition for good bass turned out to be one of Etone's highly-damped big-magnet woofers, mounted in a semi-open cabinet and driven by a husky bass-compensated solid-state amplifier?

AUDIO ELECTRONICS

HIFI • PROFESSIONAL AUDIO • ENTERTAINMENT

THE CHICAGO CES: $20,000 for loudspeakers; $3000 for a turntable; $500 for a cartridge!

While manufacturers, on the one hand, struggle to remain competitive in budget-level consumer items, no such restraint is evident, in either technology or price, at the other end of the spectrum. In this specially written article, our US correspondent, George Tillett, looks at some of the products unveiled at the recent Chicago Consumer Electronics Show.

Attendance at the Chicago Summer CES was about 55,000, some 15% lower than last year, in spite of the fact that the advance bookings were at a record high. The reason may have had to do with the poor economic situation, but the growing popularity of the January Las Vegas Show might also be a factor.

Exhibitors numbered 946 and more than 75,000 square feet of extra space was needed to accommodate them. Total area was 550,000 square feet at the Exhibition Centre and two hotels.

If there is a recession, many exhibitors seemed to be unaware of it, at least judging by the number of new luxury items with astronomical prices. Infinity were demonstrating a $20,000 loudspeaker and Lux had a $3,000 turntable!

There was a proliferation of phono cartridges costing over $250 – including one at $500, while one company, Fulton offered a precision tonearm for a mere $1250.

If you are tired of watching ordinary TV, you could spend $16,500 to $30,000 for a dish antenna system to watch satellite transmissions!

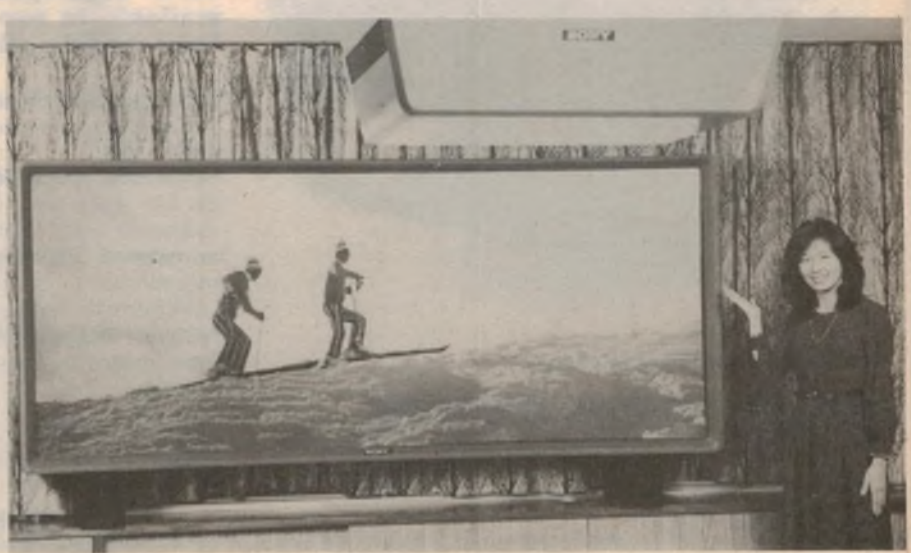
As at Las Vegas, video systems of one kind or another were well to the fore. Both Pioneer and Magnavox were demonstrating laser video discs while RCA gave a private showing outside. Agreements have been made with Zenith and this, plus the enormous RCA-CBS repetoire of programs, make the Selectavision disc player a potent competitor. Selectavision is still the cheapest system and RCA state that random access has been added recently – a significant move.

There are quite a number of 6-hour VCR's to be seen. In the long playing mode, there is inevitably a loss in definition, especially with models that reduce track width as well. Ordinary track width in VHS machines is 58 microns but, when the same heads are used to scan the 19.3 micron width employed in the 6-hour mode, the tracks overlap, causing picture degradation. (Adjacent tracks are out-of-phase). Now, JVC have come up with a simple solution: two extra narrow field heads are switched in for the long playing mode.

Sony's AG-300 features a cassette autochanger, permitting 20 hours of recording time and the program unit allows the user to record separate programs on separate cassettes. Other Sony models use Beta-Scan which lets the user to search backwards or forwards at any desired speed (up to 20 times normal) with a remote control unit. Toshiba has a similar fast scan system but theirs can flip the tape at 40 times normal speed!

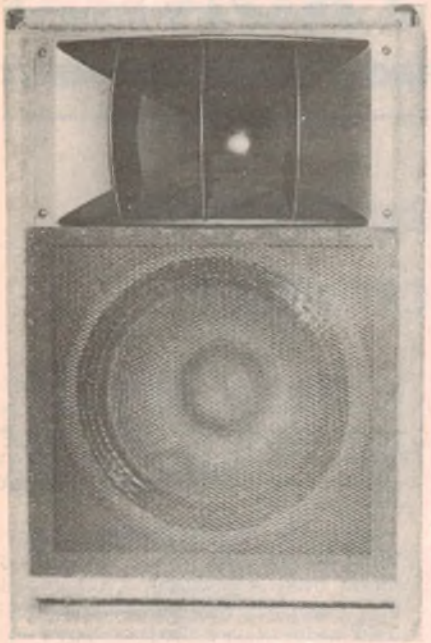
Turning to ordinary TV, there seems to be a trend towards better sound

Walking, riding or skating, you simply drop this new "Bone Fone" around your neck and hear high quality stereo through speakers nestling near your ears. A miniature AM/FM-stereo receiver system is built into the two ends.



Sony's new VPK-723W projection TV system can show either standard format TV pictures, or cinemascope shape pictures, as shown. The slightly concave screens range in size from 2ft x 5ft to 5ft x 11½ft. The projector uses three special tubes and three lenses and can either be suspended from the ceiling as shown, or located close to floor level.

ROLMONT AUDIO & RECORDING PTY LTD



announce our new range of professional sound reinforcement speakers. Suitable for P.A., theatre, studio, club, disco and general sound reinforcement use.

In fact any application where high quality, wide range, low colouration, high S.P.L.'s are needed or desired.

Models available include studio monitors, compact bins and our dB series.

AVAILABLE FROM:

ROLMONT AUDIO AND RECORDING PTY LTD
PO Box 154 Balgowlah, NSW 2093
Ph: (02) 938 5597

DISCO CITY
141 York St, Sydney 2000
Ph: (02) 29 6492

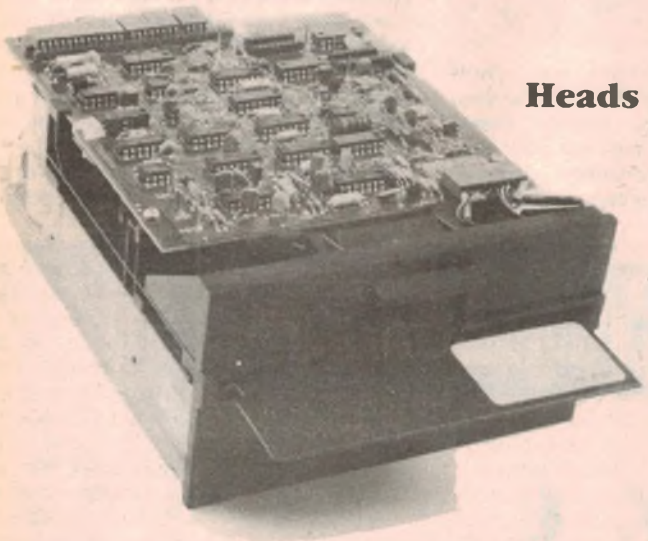
CASH-MORE ENTERPRISES
356 Liverpool Road, Ashfield 2131
Ph: (02) 798 6782

AUDITEC AUST PTY LTD
10 Waitara Ave, Waitara 2077
Ph: (02) 48 5116

For information call **Rolmont Audio & Recording 938 5597**

Dealer & Trade inquiries welcome.

Tandon Model TM-100 Mini-Floppy Disk Drives



Heads above the rest in disk technology.

Tandon's TM-100 family of mini-floppies offer the absolute highest storage capabilities of any 51/4" high-speed, random access disk drive available in two single head and two double head models, all double density.

Unsurpassed Storage Capacity - Up to an incredible 1000K bytes information on 160 tracks. Recording density is 5877 BPI.
Advanced Dual-Head Design - Tandom Magnetics has for years been the leading designer and supplier of read/write heads to most major disk drive manufacturers.
Increased Throughput - Tandon's TM-100 have a track-to-track access time of only 5 milliseconds (an incredible 3 milliseconds double track density.)
Proven Reliability - Designed for total reliability, as demonstrated by more than 50,000 production models in operation.

TM100 SS -48.P.I.
TM100 DS -48 T.P.I.
TM100 SS -96T.P.I.
TM100 4 DS - 96T.P.I.
TM100-3M SS - 100T.P.I.
TM100-4M ds - 100T.P.I.

FROM $325.00

Australian Representative

AE ADAPTIVE ELECTRONICS P/L
77 Beach Road, Sandringham, Vic. 3191
Ph (03) 598 4422

reproduction from the higher priced models. One set from GE has a 10-watt amplifier with four loudspeakers, separate bass and treble controls plus a voice-music switch. Sanyo uses two speakers in a new 19" portable and the power is rated at 7- watts. Separate tone controls are employed and other features include a LED bar graph for audio level, digital display for channel and time.

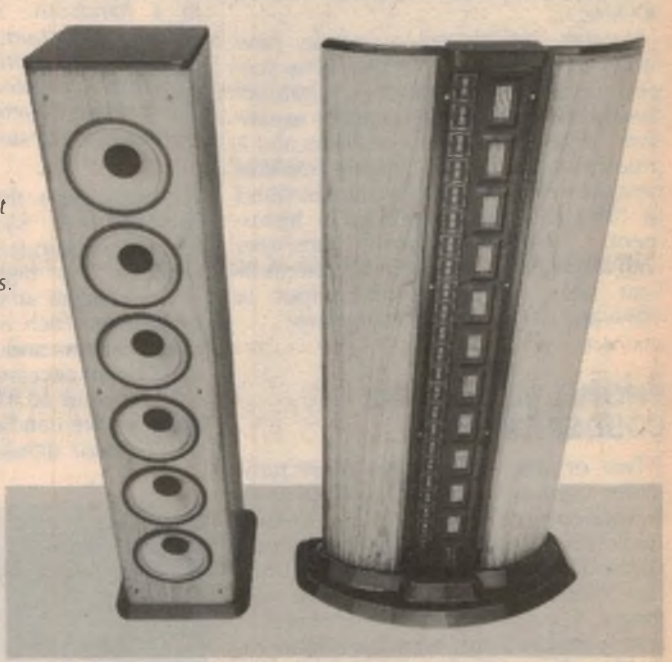
Sony's top model offers 10-key express tuning with or without remote control, while the audio section uses two separate built-in enclosures for the speakers. A time-delay system simulates stereo sound.

Sanyo has what they call an "Electronic Color Picture Processor", which consists of an ordinary-looking 26" TV set with a "light Pen" or magic wand. You can draw pictures on the screen in any colour combination and various kaleidoscope effects can be achieved at a touch of a switch. For example, you might make a circle in one corner, which would be repeated automatically in all four segments – just the thing for wallpaper designers!

Sony's latest projection TV uses a ceiling mounted projector to produce a cinema size picture 11½ feet long by 5 feet high and the screen size can be altered at a touch of a switch. Like other Sony systems, three separate picture tubes are employed.

A new company, Electronic Systems Products were demonstrating a projection TV which could do even better than the Sony as it could produce pictures up to 20 foot wide! The extra brightness is achieved by using liquid-coupled lens and tubes to enable the output to be increased up to 4 times.

Fred Hopengarten, President of Channel One Inc. poses in a 16.4ft diameter dish designed to receive television signals direct from a satellite in stationary orbit at a height of 22,300 miles.



These two modules comprise one channel only of the Infinity Reference Standard speaker system. The units stand 7½ft high and house a 1.5kW amplifier for each channel.

CASSETTE DECKS, RECEIVERS, AMPLIFIERS

Cassette decks seem to be cheaper than ever and they certainly offer better value than those made only 3 years ago. For example, there were a number of nicely styled, good performance decks priced at well under $US160 and they all offered metal tape capability, large VU meters, a Dolby system, provision for 3 or 4 different kinds of tape and so on.

In the high priced bracket, most models boasted automatic program selection, digital displays, fluorescent bar-graphs and mic-line mixing. At least three companies were showing two-speed models: Marantz, BIC and Fisher, while there were 12 decks with Dolby HX. This ingenious circuit varies the bias and equalisation to improve signal handling capacity (headroom) at the higher frequencies where the tape tends to saturate.

Two or three years ago, makers of receivers were engaged in a "Power Race" to see who could design the best 250-watt-plus models with the lowest distortion. These days, the accent is on features and convenience, with readout displays, automatic scanning, DC circuitry and preset station selection. Onkyo beat its competitors with a built-in "snap, crackle and pop" noise remover that works like the SAE and Garrard units. It reverses the phase of the signal to remove narrow-pulse transients.

A number of receivers and amplifiers now use a modified class-A output circuit although a few true class-A models were to be seen. The big disadvantage of conventional class-A is the high idling current necessitating massive heat sinks and possibly a built-in fan! On the other hand, unless a class-B stage is very carefully designed, it can suffer from crossover distortion as one half of the stage is alternately biased to cut-off, leading to a possible switching discontinuity. What several manufacturers have come up with is a class-A circuit which is effectively biased by the signal so the output current varies. Efficiency is claimed to be comparable with class-B but there are no crossover problems. There are a number of circuit variations. For example, Technics "Synchrobias" is different from Kenwood's "Zero Switching" but the end result is similar. Fisher prefer the term "Class A-II" while JVC use the designation "Super A".

Hitachi's receivers and amplifiers use the exclusive class-G arrangement which is now called "Turbo Power". This kind of circuit provides a reserve of power to handle peaks so that the maximum output is effectively doubled.

It is now well recognised that too much negative feedback can produce a kind of subtle distortion known as Transient Inter Modulation, or TIM. So many engineers now design an amplifier to have very low distortion before the application of feedback; thus the loop can

be as low as 15 to 20dB, instead of 40 to 50dB used in "brute-force" designs. Harman-Kardon, Revox, Cerwin-Vega, Phase-Linear and many others use this approach but a radically different method will, I believe, become more popular – at least for the state-of-the-art designs.

I refer to the "feed-forward" circuit which involves the use of a separate amplifier to balance out the inherent distortion in the main amplifier. Threshold were the first to use it in their Stasis model; Sansui have now developed a similar circuit and they introduced the first model at the Show. The Model number is the AU-D11, rated at 120-watts per channel with a distortion below 0.004%. Direct coupling is used throughout and the frequency response is within +0 and −3dB to 200kHz.

Marantz introduced a whole new range called "Esotec". As the name suggests, this line is designed as a state-of-the-art offering and will be rather expensive. There are 3 power amplifiers and 2 preamps in the line, the largest amplifier being the SM-1000, modestly described as "The Ultimate Amplification Instrument. . ." It boasts 18 power transistors with the patented wind tunnel system of heat sinks. Rated power output is 400-watts per channel into 8 ohms.

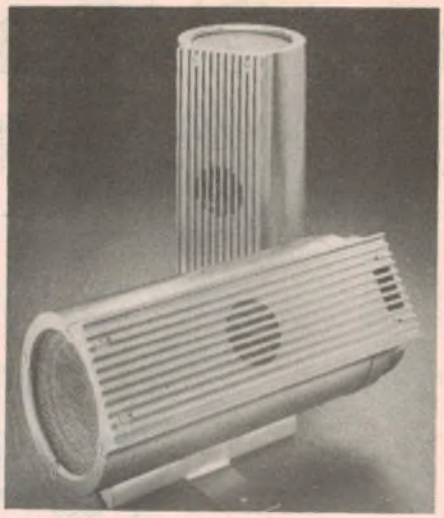
PHONO DECKS AND LOUDSPEAKERS

Two or three years ago, most turntables used an S-shaped arm but now straight arms are the rule (sorry!). United Audio (Dual) attracted a lot of attention with a demonstration of their ULM (Ultra Low Mass) tonearm and Ortofon cartridge. It was mounted on a turntable with a standard arm having a total mass of 18 grams – 10 grams higher than the ULM combination. A special record modulated with a 300Hz signal was used and it was twisted into 8 uniformly spaced warps. Well of course, the ULM arm played it with no trouble but the severe distortion caused by the other arm (11.5% against 0.01% IM) could easily be heard.

Like cassette decks, present day turntables offer better value than ever and a great number of direct-drive models with prices in the $150 range were to be seen. There is also a revival of interest in straight-line, or linear tracking designs and among the examples were models from Revox, Technics, Harman-Kardon, Mitsubishi, Dennesen and Phase-Linear.

The $3000 Lux turntable uses an air pump – not to provide a cushion for the record but to hold it down flat on the platter – which seems an expensive way of doing things!

One of the most interesting items at the Show was the Infinity $US20,000 loudspeaker system called The Reference Standard. It consists of 4 modules, 7' 6" high, which house a pair of 1.5 kilowatt amplifiers as well as the drive units. Each bass column contains six 12" drivers and servo feedback is applied by an accelerometer.



In a handsome bronze finish, these Jensen J.2000 loudspeakers measure 10" long by 5" diameter and each contain a long-throw woofer, a passive radiator and a dome tweeter. They are intended high quality car stereo systems.

Crossover is at 70Hz and midrange frequencies are handled by a vertical stack of 12 planar dipole electormagnetic induction units; the high frequencies are fed to 36 more. The cabinets are 1" thick and some sections are sand-filled (who remembers the Wharfedale systems?). Rosewood veneers are used and the total weight of the systems is 1200lbs.

How did it sound? Well, it was unquestionally very, very good: the program sources included a Soundstream recorder (digital) and the low frequencies were particularly impressive. After all, those 12" drivers fed by 3 kilowatts can move a lot of air! Although the system is not a true line source, the stereo image was outstanding but it must be said that the net gain over a pair of really good $US1000 systems is quite small – at least at lower listening levels. It's the law of diminishing returns.

Cerwin-Vega were demonstrating a new model "specially designed to handle the wide dynamic range of the new digital super-discs". It is a 3-way system using an 18" woofer and a 12" coaxial unit which has a compression tweeter. The bass compartment is effectively increased in volume by the use of an inert gas contained in plastic pouches. The system stands 52" high and it can handle a continuous power of 1000 (yes, one thousand) watts!

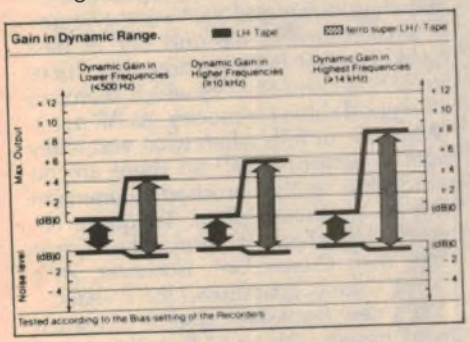
Sony were showing an unusual floor-standing system which employed 4 drivers, all with flat diaphragms. The base speaker has 4 voice coils strategically placed to inhibit flexing and the honeycomb carbon fiber – aluminium diaphragm is some 13" square. The other diaphragms measure about 4½, 2 and 1" square. Total weight of the system is over 220lbs.

Going right to the other extreme, there was the J.2000 from Jensen, a bronze

Sony's XF-3000 "Freedom III" is a kind of carry-it-with-you hifi system. It can operate from a battery pack or via cords from the mains or car electrical system. It has an in-built AM/FM tuner, a metal-compatible cassette deck with Dolby NR, and inputs for microphone and turntable. Plug in available stereo speakers and the XF-3000 is ready to entertain. The price is quoted as $US795.00.

The new BASF high precision cassette. An unbeatable case for buying The Green One.

Dubbed The Green One for ease of identification, the new BASF ferro super LH I displays high precision and performance throughout.



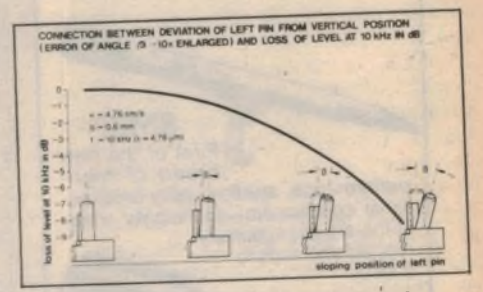
In the mechanics of the cassette, BASF has achieved new standards of azimuth precision, taking full advantage of the outstanding LH I quality.

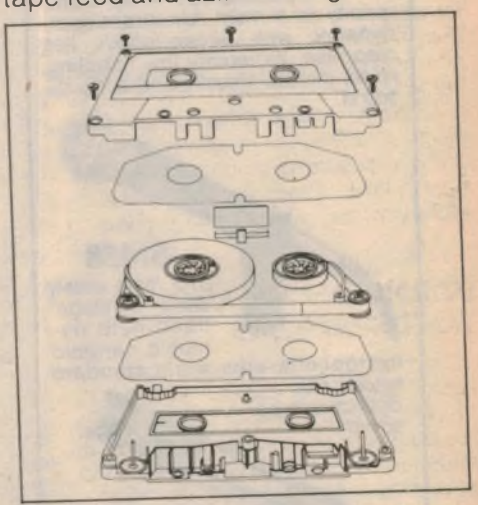
A dense coating of super-fine ferric oxide particles has produced a mirror-finish tape with extremely strong magnetic direction preference.

The end result – true Hi-Fi in the normal bias position I (Ironoxide or Fe 120 μs EQ). Plus higher volume levels with minimised distortion.

One common cassette fault. Deviation in vertical position of the pins diminishes high-frequency output, which results in loss of sound brilliancy. Minimum tolerances ensure that no fault can occur with the new BASF ferro super LH I.

In the tough, screw-together polystyrene, precision moulded shell, slip sheets eliminate tape edge damage. A mu-metal shield blocks stray magnetic fields. A felt pressure pad on a phosphor bronze spring ensures precise head contact on any deck. Flanged roller guides on lubricated stainless steel pins provide precise tape feed and azimuth alignment.





The patented BASF Security Mechanism (SM) prevents scrambling of tape and guides the tape smoothly within the cassette. A large strong window gives clear visibility to the best BASF ferro super I tape yet.

So spend a little more, and get more for your money.

Go for The Green One. Step up to Hi-Fi precision.

BASF

Quality across the range.

FCB/SPASM/BAS/40R

Also on show at the Chicago CE S Casio model M-10 electronic keyboard instrument, which is small enough to fit into a briefcase. It is battery powered and can simulate piano, organ, flute and violin.

cylinder some 10" long by 5½" in diameter. A 4½" long-throw bass driver is mounted at one end and a passive radiator is at the other end. It's diaphragm is made from compressed hollow glass spheres which are very rigid. In between the two ends is a high frequency dome radiator which "fires" through an acoustic lens. A 20-ounce ferrite magnet with a special high temperature voice coil permit a power handling capacity of 55-watts. As you have probably guessed, this novel unit was designed for auto use but it could have domestic applications.

A new company, Snell Acoustics, were demonstrating a system which broke all the rules by having the tweeter – a small dome – mounted at the floor level. A plastic reflector deflected the radiation upwards, a feature that gave the systems a bizarre appearance.

The Canadian Jumetite system that uses a large horn-loaded ribbon unit from 600Hz up has been re-designed and the bass enclosure increased in size. It was responsible for some of the best sound heard at the Show.

Acoustic Research (AR) introduced two new models, the High-Tech AR-93 and 94, both 3-way floor-standing systems. The former has 4 drivers: two 8" bass speakers mounted at the sides, one 8" midrange driver and 1¼" cone tweeter. Its smaller brother has only one 8" bass speaker and it is front mounted. Prices are $US249 and $US199 which seems to offer good value for money. As AR put it: "Why pay for frills when what you really want is performance?" So there are no removable grills, brushed aluminium trim or chromium plate. To quote AR again, "High-Tech is more like Carrot Cake than Cream Pie". However, AR's Carrot Cake is guaranteed for 5 years.

KEF's new bookshelf system is a small 2-way design with an 8" bass driver and a 1" dome tweeter. Both use plastic diaphragms and a special feature is an automatic overload protective circuit called "S-Stop". It functions on any continuous or intermittent signal greater than 60V peak from DC to 50kHz.

The use of lasers in cone design has resulted in the appearance of many new materials: Wharfdale employ a plastic homopolymer in their laser range, KLH use polypropylene. So do Infinity, while Hitachi's new 3-way system has all the diaphragms made from "porous metal".

The Ionophone, which enjoyed a certain popularity back in the 1960s, is with

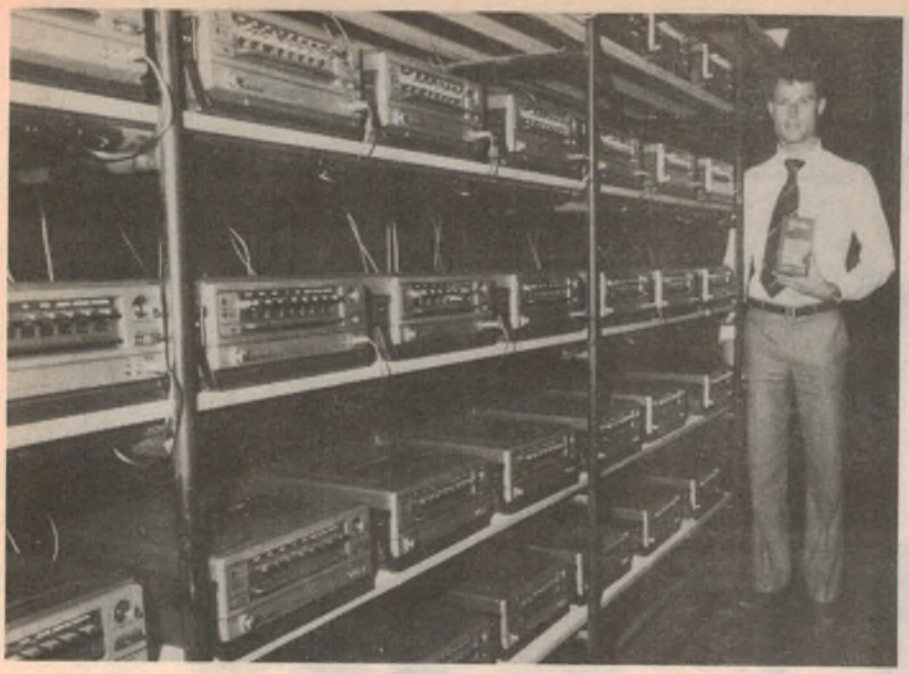
New Australian-made cassettes

A new range of Australian-made compact cassettes has just been released by the Master Tape Company Pty Ltd, of Castle Hill, NSW. The initial release includes standard and special grade ferric cassettes, chromium dioxide cassettes and a head cleaner cassette.

The Ferric tapes are marketed with the prefix "UD" signifying "Ultimate Detail". Master Tape say that their attention to detail includes the use of top quality tape, a heat resistant housing moulded from ICI's lupilon polycarbonate, roller type tape transport, low friction pressure pad, 2½ minutes per side extra recording time and head cleaning leaders. In addition, each cassette contains a rub-on lettering sheet as an aid to neat titling.

"UD" is the standard ferric tape and is priced at $1.79 for a C-65. "UDX" is the prestige ferric tape at $2.49 (C-65) while Chrome Master CRX (C-65) is slightly dearer again at $2.99. Price of the head cleaner is $1.49.

We understand that Master tapes will be sold through retail outlets but further information can be obtained from Mr David Donkin via PO Box 302, Castle Hill, NSW 2154. Phone (02) 634 2565. (Mr Donkin, founder and Chief Executive of Master Tape, was formerly General Manager of Edels Music Stores and Goldring Audio Industries, and Executive Director of Bintang Ltd.)



A software duplication centre concerned primarily with video cassettes had been set up in Sydney by AVID Publishers, under the guidance of Dr Antek Skotnicki as Chief Executive. With the co-operation of National Panasonic Aust Pty Ltd, the company will be concentrating mainly on the VHS format, but they are in a position to transfer to VHS from a full range of other tape formats or from film. Pictured is Graeme Noble of National, alongside 40 rack-mounted National VHS machines, having a potential output of 300 video tapes per day. The AVID Videotape Duplication Centre can be contacted via Box 248, Paddington 2021 or by telephone: Marketing (02) 436 2210 or Production (02) 33 6900.

us once more. As many readers know, it works by modulating an RF corona discharge, so there are no moving parts. The model at the Show was made in W. Germany and its new name is "Ionovac". Crossover frequency has been moved up an octave to 6kHz. My old original model used to radiate on all TV channels for a considerable distance – which caused some friction with the neighbours – but it is claimed that this and other drawbacks have been overcome.

IN BRIEF . . .

One company was showing an AM-FM sun-powered radio set – just the thing for the beach.

The 3M company demonstrated a remarkably efficient anti-static treatment for records: it comes complete with a novel applicator. A sophisticated electrostatic meter with a digital readout (named "Herman") proved that potentials in excess of 5kV were present on brand-new records. A quick application of the solution, and "Herman" indicated voltages of less than 100!

Several talking calculators were to be heard: one from Panasonic had a splendid female voice with an impeccable British accent.

The Variable Speech Control company introduced a new cassette deck using a "bucket-brigade" IC to produce high speed audio playback at speeds up to 3 times normal while maintaining intelligibility.

Quadraphonic sound may be dead but the interest in multi-channel is still there and a number of rear-channel delay systems were to be seen – including one from Koss. Ambisonics were demonstrating their surround system which involves the use of a special quad co-incident microphone and decoder.

Casio had a small calculator which contains a clock, date memories, a calendar and 12 pre-recorded melodies. The user can program the unit to play a tune on special occasions – like "Happy Birthday" or the "Wedding March". But one tune is locked in: "Jingle Bells" which is played automatically every Christmas!

FM POLARISATION

A press release to hand from the Postal and Telecommunications Department indicates that, in future, the use of mixed polarisation will be normal for all classes of VHF FM sound broadcasting stations. "Mixed" polarisation is a collective term covering elliptical, slant, dual and circular, the last-named being the preferred form of mixed polarisation. The release indicates, however, that where circumstances preclude the use of mixed polarisation, horizontal or vertical polarisation will be authorised, as appropriate. The reference for ERP measurement is also covered in the P & T Dept. statement.

Audiosound AM101 Wideband AM Tuner

For the second month in a row, we review a rare product indeed; a wideband, high performance AM tuner which is made in Australia. It is the Audiosound AM101 which can give sound reproduction rivalling the quality of the best FM stations.

It has been interesting to compare the newest wideband tuner from the Audiosound stable with its predecessors. The earliest was reviewed as far back as May, 1971 and a modified version in September, 1974. Whereas these earlier tuners were designed around valves, the AM101 is a completely new design using solid state devices and a completely new cabinet.

The cabinet is fabricated with a solid steel chassis base and formed solid end plates and a louvred metal cover. The front panel is black brushed and anodised aluminium, supported by two "T" sections of natural coloured anodised aluminium. Two chipboard ends covered with imitation wood grain complete the cabinet assembly. The dimensions of the cabinet are 358mm x 105mm x 282mm (W x H x D) including the rubber feet and knobs.

While the Audiosound tuner is reasonably well finished considering the price, the styling is uninspired to say the least. This flows partly from the use of a simple dial mechanism but even so, a reasonably competent commercial artist or industrial designer could do wonders for the presentation while still keeping tooling costs to a minimum.

The dial drive incorporates a smooth vernier action with calibrations in kHz. Frequency coverage is quoted as 560-1750kHz which includes the University of NSW radio VL2UV. (The range 530-1600kHz is also available to order).

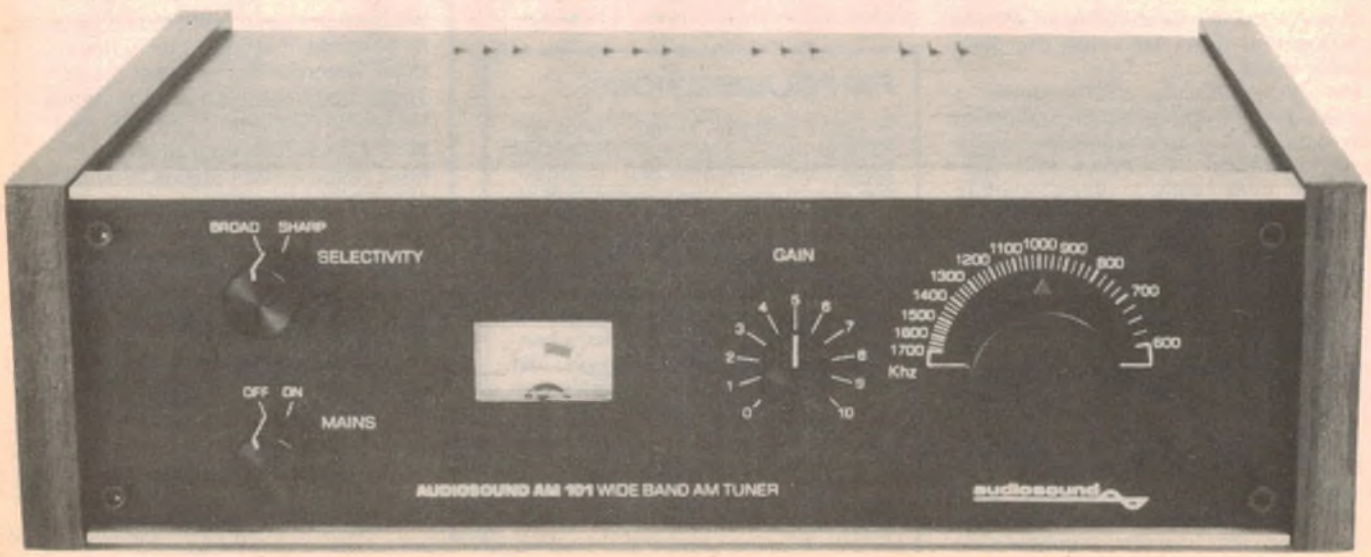
In addition to the tuning knob, there are three other knobs on the front panel: the mains on/off switch, the broad/sharp selectivity switch and the manual gain control. An odd feature of the manual gain control is that the knob has a rotation of 1¼ turns, which makes the panel calibrations, 0 to 10, over about 270° inappropriate.

The two switches leave something to be desired, both in their action and appearance. The mains switch is the type used on the back of potentiometers, with the potentiometer section unused, while the selectivity switch is a 3-pole 4-position rotary, used only as a single pole 2-position. Perhaps it would have been better to use two miniature toggles, or possibly pushbutton types, for these controls.

The three knobs just mentioned are not a good match for the tuning knob – a better choice here could improve the overall appearance. A brightly lit tuning meter completes the front panel.

On the back panel is a socket for the balanced antenna input, a fuse and a shielded audio cable fitted with RCA phono plugs.

Removing the top cover reveals a relatively large printed circuit board with the components well spread out over the available area. External to the board are the power transformer and its terminating strip. Also external to the board, is the two-gang variable capacitor, which is mounted on a solid aluminium angle bracket just behind the tuning dial. The manual gain control is a dual gang potentiometer mounted on an aluminium bracket fixed to the back of the circuit board. There is also a pulley arrangement fixed to the same bracket and driven via a long shaft from the front panel knob. The pulley ratio accounts for



the discrepancy in knob rotation mentioned earlier.

There are two IF trap coils mounted right at the antenna input socket. These look very much like an afterthought and while they will do the job where they are, no doubt on future versions they would be included on the board.

Most of the circuitry is included on the PCB and discrete components are used throughout. The first IF transformer is heavily damped and between the two FET IF amplifiers are two IF transformers, bottom capacitively coupled. This coupling is switched to give sharp and broad selectivity modes. The detector is a modified version of the voltage doubler type, using negative feedback to keep distortion to a minimum.

No AGC is used in the circuit which means that the manual gain control has to be used virtually every time a different station is tuned. Just why this should be necessary is certainly not obvious to us. While some designers claim that the use of AGC can cause distortion, the method of gain control used here (variable degeneration in the source circuit of the two FET IF amplifiers) would appear to have the same potential drawback.

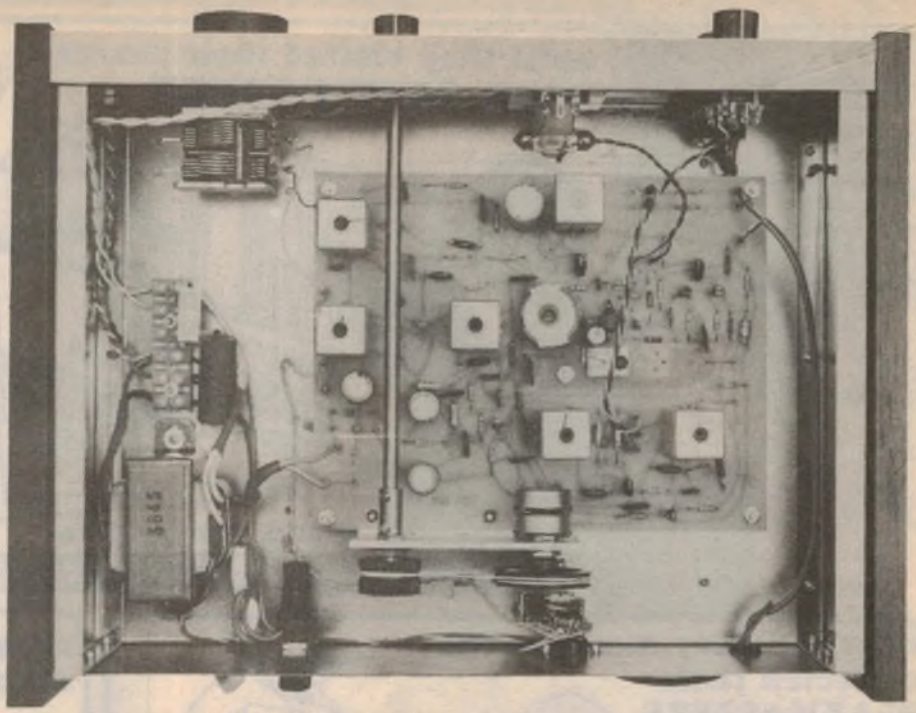
A whistle filter is included, which is essential in a wideband tuner. This filter has a switch provided on the PCB which selects 9kHz, 10kHz, or switches it out of circuit.

Perhaps the most worthwhile feature of the new Audiosound tuner is the noise-reducing loop antenna system which has been available with the previous Audiosound tuners. This really does work well and gives remarkably noise-free AM reception, except, of course, during thunderstorms.

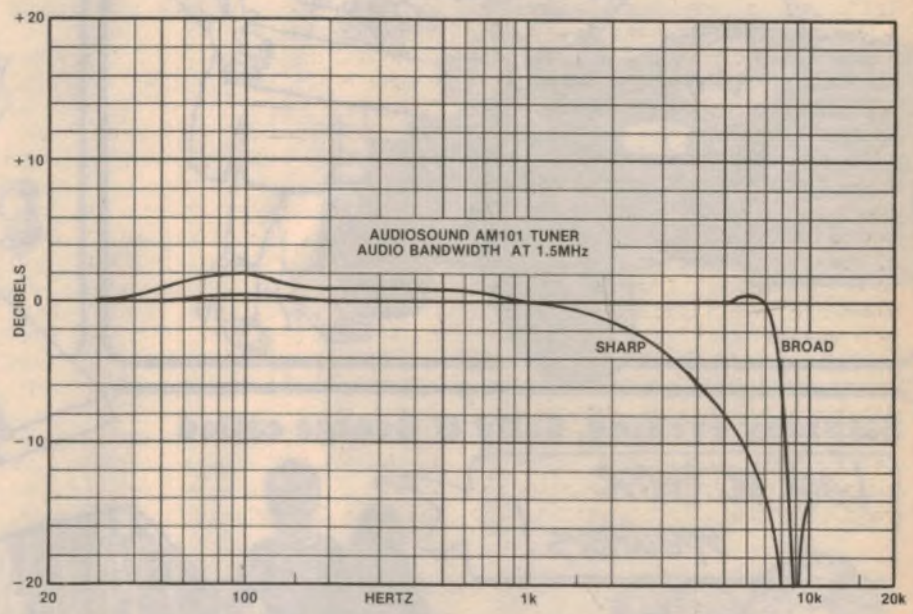
We set up the tuner in our laboratory in the city area, where radio reception is normally very noisy. The loop antenna was attached to one of the walls, after experimenting to find which orientation gave the best results from the local stations. That done, all the local stations were tuned in and the more powerful ones were virtually noise free, even in the wideband mode. The ethnic station, 2EA, is currently only running a power of 500 watts and even this was quite acceptable in the wideband mode, with just a gentle "sizzle" in the background.

By comparison, when the loop antenna was exchanged for a random length of wire, the noise became obtrusive on all but the most powerful signals. And 2EA was so noisy as to be unlistenable.

Another feature on the Audiosound tuner is a simulated AM stereo circuit. This facility incorporates 90° all-pass phase-shift networks at the output of the tuner, giving two pseudo-stereo outputs which provide a special effect. There is no doubt that the scheme works out as claimed, giving a sense of the sound coming from an area rather than from a point source. However, I found that in the case of voice announcements, or where a single instrument was involved, the effect was less than natural.



Above is the internal layout of the Audiosound AM101 while below are the audio response curves.



Most wideband tuners need more care in tuning stations than the more conventional tuners that most people are used to and the Audiosound tuner is no exception. When tuning in a particular station, it is necessary to set the selectivity switch to "sharp", (narrow mode) peak the signal on the tuning meter and then switch over to "broad" (wideband mode). Because this tuner is fitted with a manual gain control, it is also necessary to adjust it so that the tuning meter reads within a marked area on the scale.

While some of the signals from the local stations are quite strong in our test location, it cannot be said that they are overwhelming. (This is more likely to be the case in some of the western suburbs of Sydney, where they are close to many of the transmitter sites). So the tuner cannot be said to have sensitivity to spare. On the positive side, our listening tests did not reveal any signs of cross-modulation.

Having made the above observations, it was a surprise to learn that sensitivity is well up on the earlier models. With a signal modulated 30%, these are the results which we obtained: at 700kHz, 20uV and 30uV for sharp and broad, respectively; at 1500kHz, 10uV and 15uV for sharp and broad, respectively. These figures are for an audio output of 25mV RMS at each of the stereo simulator outputs. With a strong signal, which enables the tuning meter to be set

(Continued on page 44)

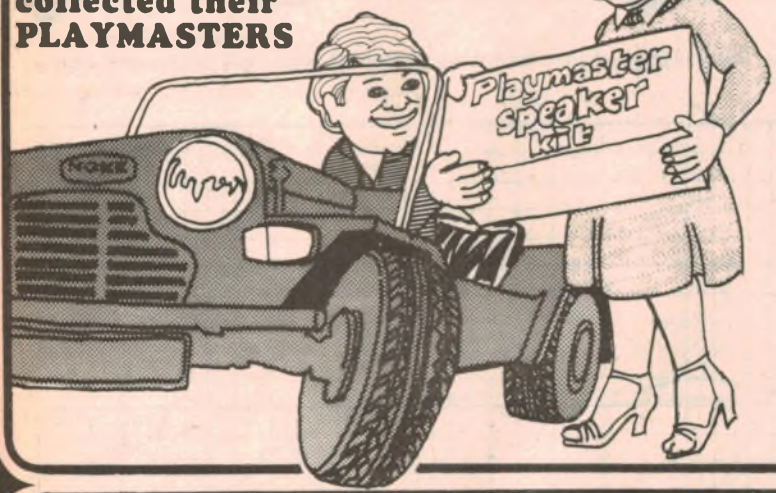
Ross and Sandra were feeling down. They wanted a good sound system but thought they couldn't afford one . . .

until they visited their nearest DICK SMITH STORE

& saw the fabulous PLAYMASTER SPEAKERS

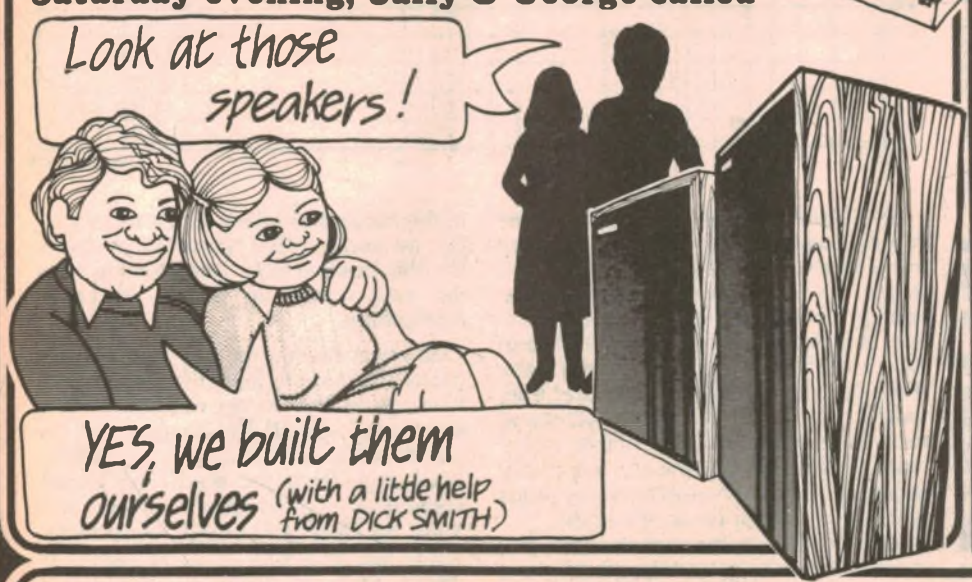
Ross worked out how much they would save and decided Playmasters were for them.

next saturday morning they collected their PLAYMASTERS



assembly was a cinch.

Saturday evening, Sally & George called



PLAYMASTERS ARE RIGHT FOR YOU!

8" SYSTEM
26 litre infinite baffle system with 8 ohms impedance and 40 watts max. power handling.
SAVE $101* **$159.50** pair

10" SYSTEM
53 litre infinite baffle system with 8 ohms impedance and 60 watts max. power handling.
SAVE $101* **$248.00** pair

12" SYSTEM
75 litre infinite baffle system with 8 ohms impedance and 80 watts max. power handling. Also has mid-range and tweeter control networks.
$298.00 pair

*Saving based on the same speakers in made up form (also available from Dick Smith).

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

Marantz SD8000 Compudeck

Two speeds, two motors, two heads

The recently introduced SD8000 cassette deck from Marantz has features such as a digital clock and tape counter plus programmable timer and program sequencing. In addition it has metal tape and double tape speed capability.

Since we first reviewed a microprocessor-controlled cassette deck earlier this year, more computer decks have appeared on the market with features ranging from optimisation of bias and equalisation to others with extensive control of tape motion, like the Marantz SD8000.

Dimensions of the unit are 416 x 146 x 295mm (W x H x D) and net weight is 10kg. The front panel is heavy gauge aluminium and features a large four-digit LED display, 24-button keyboard and a 12-segment LED peak level meter plus the more usual tape selector, line level, output level and microphone level controls. Additional controls include a bias fine adjust, tape speed selector (standard or double), function selector, program mode, counter memory, rec mute, timer and a Dolby/MPX filter selector.

Following current trends, the tape mechanism is not recessed into the front panel but protrudes from it, providing easy access to the heads for cleaning and degaussing. In place of the usual cassette loading door, Marantz have used a swing-up plastic dust cover which can also be removed if desired.

This open mechanism arrangement also has the advantage that the head azimuth can be readily adjusted for optimum high frequency response.

The SD8000 has solenoid control of the transport mechanism, ie instead of the usual piano key controls for play, record, fast forward, reverse and pause it has individual microswitches.

In place of the tactile feedback provided by mechanical controls, LED displays directly above the play, pause and record switches provide a visual indication that the switch has been pressed – this is also useful if the remote control option is used.

The four digit LED display directly above the LED peak level meters shows either the tape counter, time of day, program track or programming data according to the selector switch. The five positions on the function selector switch (underneath the keyboard) are timer set, counter, program, clock and clock set. Most of these functions are fairly self explanatory. In the clock position the display just shows the time of day with a flashing colon indicating seconds, while in the count position the four-digit tape counter is displayed.

The other displays are used in conjunction with the programming keyboard. In the clock set position the time of day can be set by entering "CE/RESET" followed by the time, eg 3.30 is set by entering the digits 3, 3, 0, and then the "MEMORY" key. With the selector switch set to timer, pressing either the "timer on" or "timer off" keys followed by the time and then the memory key will set the times at which the deck will turn itself on and off.

The timer is used in conjunction with the timer switch to the right of the Dolby/MPX switch and can be set to either play or record. When the timer key is pressed and the power switch off, the deck will display the time of day and wait until the preset time is reached and then start either to play or record. This is accomplished by using a relay to connect power to the mains transformer – naturally all the timer circuitry is powered from a second smaller transformer.

Well the functions we have mentioned so far are certainly useful but the program position on the function selector is really versatile. Up to 19 musical tracks can be played in any desired order. First switch the program mode switch to "single" then enter the number of each track followed by the memory key on the keyboard. Then by pressing the start key the deck will play the tracks in the

MARANTZ SD8000 CASSETTE DECK

order specified. There are also "skip" and "pgm pause" keys which can be used during playback; "skip" instructs the microprocessor to skip the current track and play the next song on the menu, while "pgm pause" will halt the deck momentarily and if the key is then pressed again the program continues normally.

This track search capability is also provided on some other decks though not with this flexibility. The way it works is first to rewind the tape to the beginning, then move the heads up into the pause position (ie with the heads just in contact with the tape) and then press fast forward and count the blank portions in between musical tracks until the first track numbered in the program is reached. From then on, after each track is finished, it either rewinds or fast forwards to find the next track in the program. If, for example, you entered the sequence 4, 3, 1 it would skip the first three tracks play the fourth, then rewind back to the third, play it and rewind again to play the first track.

That just about covers all the programming facilities of the SD8000 though it should be said that there are some other features we have not mentioned such as memory call for reviewing programs.

Looking now at the audio facilities, we find much the same effort has been made towards providing a host of useful features such as dual speeds and metal capability, MPX filter and LED peak level displays.

The 12-segment LED peak level displays are more in keeping with the advanced computerised image of this deck than conventional mechanical meters, but there are also some practical advantages. Clearly the response of these electronic meters is faster, which means that it allows more accurate setting of recording levels. It is also easier to read then a conventional meter; the segments above 0VU are red LEDs while segments below 0VU are green. Incidentally, we found that the scale which is calibrated from −30VU to +6VU is also very accurate – far more so than mechanical meters which can be as much as 10dB off on a −20dB reading!

Some of the other controls on the deck are also well thought out. The "rec mute" switch, for example, is useful for temporarily muting the input signal when, say, an announcer interrupts music on FM radio. An output level control is also included and this can be used to adjust the output level of the deck to that of the other components.

Internally, the SD8000 is quite complex though not as closely packed as some decks. The microprocessor responsible for most of the deck's functions is located close to the four-digit LED display. Like most of the microprocessors used in similar dedicated applications it is a proprietary design with an internal mask-programmed ROM and with dedicated output lines rather than the more familiar data and address busses.

The tape transport mechanism uses two separate motors. One DC servo-controlled motor constantly drives the flywheel and capstan while a second smaller motor is used to drive the tape reels. A rather cunning mechanical arrangement permits the one reel motor to drive either reel for rewind, fast forward and play just by reversing the motor.

Frequency response of the unit is quite creditable at both standard and double tape speeds. The high frequency response with TDK-SA tape at double speed is actually better than at normal speed: within ±2dB from 20Hz to 20kHz without Dolby at double speed and within ±2.5dB from 20Hz to 20kHz at normal speed.

The only disappointing result in the frequency tests was the response of the metal tape at −10dB at 15kHz and −15dB at 20kHz. Note also that the response of the metal tape was actually worse at the −20VU recording level than at the 0VU level which suggests that the Technics RT-MX46 metal tape we used for the tests was not compatible with the SD8000.

Signal to noise ratio referred to a 0dB recording level was 47dB for TDK-SA tape at normal speed with Dolby and was substantially the same at double speed and with metal tape. Most of this noise though is at low frequencies and is therefore not very audible – a point which is brought out in the DIN and CCIR weighted S/N figures which were 57dB and 54dB respectively. At double speed for the TDK-SA with Dolby the figures were DIN 56dB and CCIR 53dB.

Wow and flutter was quite good, being .06% at normal speed and .04% at double speed according to the DIN 45507 measurement. Distortion is about average with 0.7% at 0VU and 1kHz for a TDK-SA tape at normal speed with Dolby. This rose to 2.6% at 10kHz while the figures without Dolby were 1.0% and 1.8% at 1kHz and 10kHz respectively. The figures with metal tape were: with Dolby, 0.8% at 1kHz and 2% at 10kHz; without Dolby, 1% at 1kHz and 2% at 10kHz. At double speed, the figures at 10kHz dropped significantly, being 1.4% for the TDK-SA and the metal tapes, with Dolby.

From these test results it is clear that the SD8000 does offer a good audio performance at normal speed and excellent performance at double speed.

Considering all the programmable functions of the deck as well, it should be an attractive proposition to enthusiasts. Recommended retail price is $589.

Further information on Marantz equipment can be obtained from high fidelity retailers or from Marantz (Aust) Pty Ltd, 32 Cross Street, Brookvale, NSW 2064. (RdeJ).

AUDIOSOUND AM101 TUNER . . . from p41

in the middle of the recommended region of the scale, the audio output rises to a little more than 50mV RMS. At the absolute maximum, a 100% modulated signal would result in an audio output of about 150mV RMS which is enough to drive most stereo amplifiers to full power (via the AUX inputs).

Audio bandwidth at 1500kHz is shown in the graph. In the "sharp mode", it is 3dB down at 3kHz and 8dB at 5kHz. In the "broad" mode it is 6dB down at 8kHz and 14dB at 10kHz. These figures are influenced by the presence of the whistle filter which adds a notch at 9kHz. The notch was down 34dB and it has a significant bandwidth as claimed by the manufacturers, in order to cope with slight off-frequency adjacent signals, which can produce a beat note just a little above or below 9kHz.

Harmonic distortion in the narrow and wideband modes was 0.38% at 1kHz and 30% modulation. This distortion was mainly second harmonic and the above figure was only achieved after we filtered out power supply hum. Audio signal-to-noise ratio was measured at −40dB with the power supply hum, increasing to an excellent 65dB when the hum was removed. In view of this excellent potential result and the fact that hum is audible on good signals, the power supply filtering should be increased above the present bare minimum.

In spite of the rather critical nature of this review we must declare that the Audiosound does give a very good account of itself in listening tests. It clearly gives reception and sound reproduction which is far beyond that achieved by the mediocre AM sections in the vast majority of FM/AM receivers and tuners. So at the reasonable price set for what is virtually a custom-made product, it is a good buy.

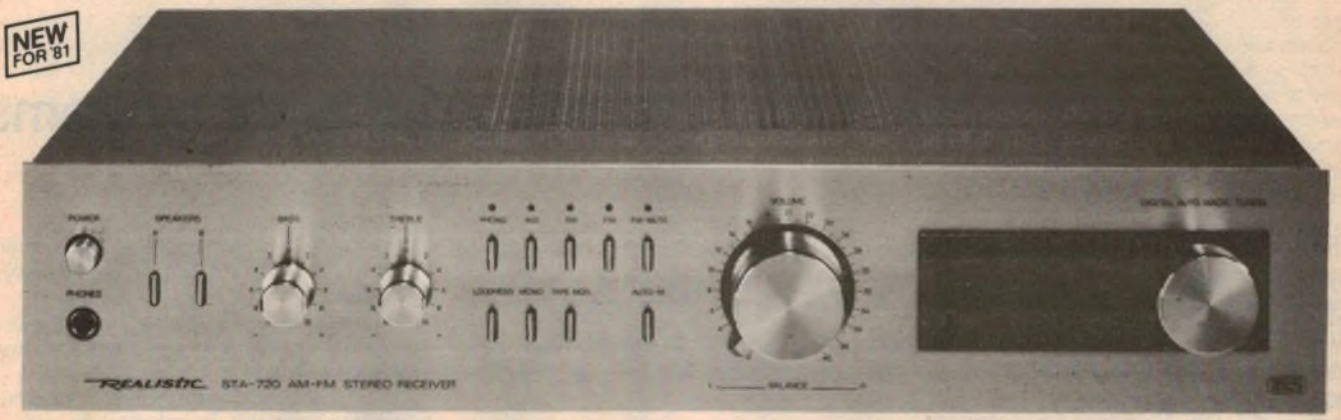
Recommended retail price of the Audiosound AM101 is $249 including tax, plus $38 for the stereo simulator which is a "delete option".

For further information and demonstration of the comprehensive range of Audiosound products, contact Audiosound Electronic Services, 148 Pitt Road, North Curl Curl, NSW 2099. Telephone (02) 938 2068 (I.L.P.)

REALISTIC®

Has Two New Stereo Receivers: Sleek & Sophisticated For the 80's

NEW FOR '81



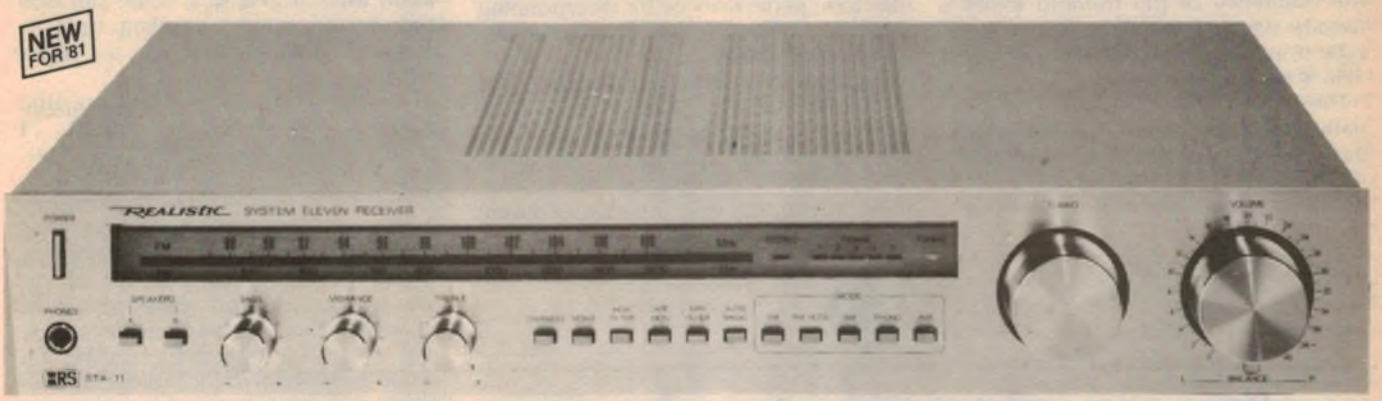
Realistic STA-720 : The Low Profile Receiver with Digital Frequency Display

449.95

25 watts per channel minimum RMS at 0.05% T.H.D.

We've replaced the mechanical tuning dial with an LED display and an accurate electronic counter. Exclusive Auto-Magic fine tunes FM stations and locks them on frequency. Phase-locked loop multiplex assures full FM stereo channel separation. The phono preamp features a new IC that lowers distortion while maintaining proper RIAA equalization. High level audio stages are direct coupled for clean and powerful bass. 10 thin-line push-button controls, 5 LED mode indicators, full tape monitoring circuitry, detented bass and treble controls and a 40-detent volume control : all luxury features, designed to make the STA-720 a unique receiver. 31-1997

NEW FOR '81



Realistic STA-11: Promising Ample Power for Clean Sound at High Levels

469.95

30 watts per channel minimim RMS at 0.02% T.H.D.

The Realistic STA-11 has the power and specs once found only in components twice the size! The features include phase-locked loop FM multiplex for wide stereo separation, FM muting, high MPX filter, detented bass, treble and midrange controls, 40-detent volume control with concentric balance control, tape monitoring facilities, 5-level AM/FM LED signal strength indicators and more. Features a circuit that tailors its response to small speakers giving uniform output at all frequencies, controlled by rear panel EQ switch. The STA-11 — Precision and power. Sound promising? 31-1999

REALISTIC® by TANDY ELECTRONICS

Available at all Tandy Stores and Participating Dealers Around Australia or Mail Order Department, P.O. Box 229, Rydalmere, N.S.W. 2116

Twin tremolo for organs/stage amps

an alternative to rotating speaker systems

This new twin tremolo unit should be of considerable interest to anyone wishing to expand the facilities on an existing electronic music system. As applied to an organ, it could provide simple tremolo for the respective manuals, or it could process the total signal as an alternative to — or substitute for — a rotating loudspeaker system.

by IAN POGSON AND NEVILLE WILLIAMS

To forestall any possible confusion in the meaning of terms, we use the word "tremolo", to signify a periodic variation in the level or loudness of the sound. For popular or "theatre" style organ music, the frequency of the tremolo effect is usually set at about 7Hz. For "church" type organ sound, a frequency of about 1Hz is more appropriate.

The tremolo effect was widely used in early electronic organs but it gradually gave place to "vibrato" – a periodic variation in the pitch or frequency of the notes. In fact, vibrato does produce a subjective variation in loudness, as well because of the changing pattern of echoes or "standing waves" in the listening room. It can be achieved by modulating the operating conditions of the tone generators or by incorporating a phase modulating system in the subsequent signal path.

Rotating loudspeaker systems, of which the "Leslie" is the best known example, also tend to produce a mix of loudness and frequency variation because of the changing pattern of standing waves, and also because of phase or "Doppler" modulation as the sound source moves in relation to the listening position.

By comparison to these effects, pure tremolo is commonly regarded as being somewhat bland.

Vibrato, as effected in the generator or amplifier circuits, is subjectively more complex and more "interesting". However, too much vibrato can also have the subjective effect of changing the overall pitch of the melody – distressing to pitch-sensitive listeners.

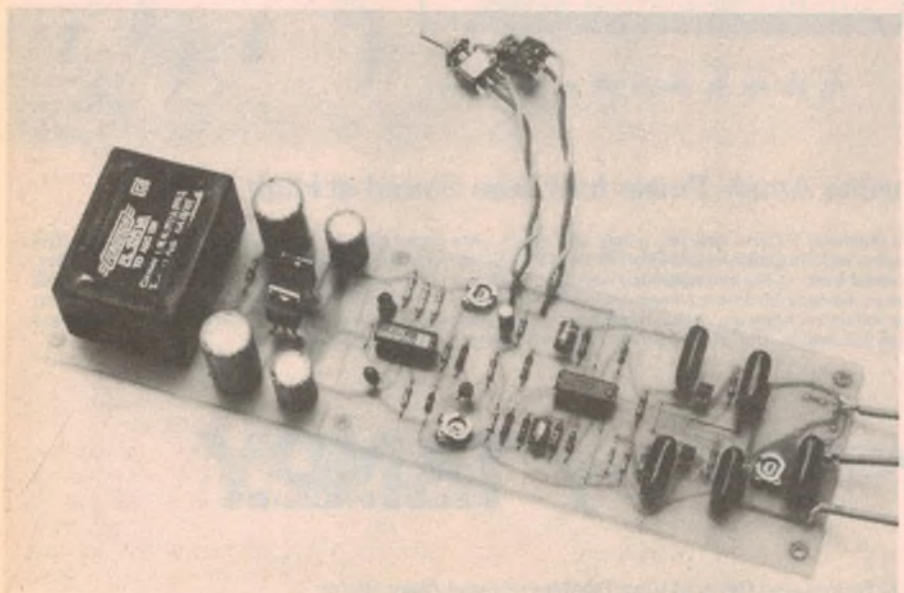
Rotating loudspeakers are effective musically – but they also have their problems: mechanical noise, especially when used at 7Hz in a home situation, and limited power handling capacity. Periodic maintenance is a further liability.

Our attention was focussed on other possible approaches by recent experience with the Technics SX-7700G organ, reviewed in the June 1980 issue. While it included vibrato as a normal facility, it also closely simulated a fast and slow mode rotating loudspeaker, without actually using one. We did not see a circuit or block diagram but we reckoned that Technics achieved the end result by effectively cycling the sound between two (or more) channels. There may have been more to it than this but it was certainly very effective.

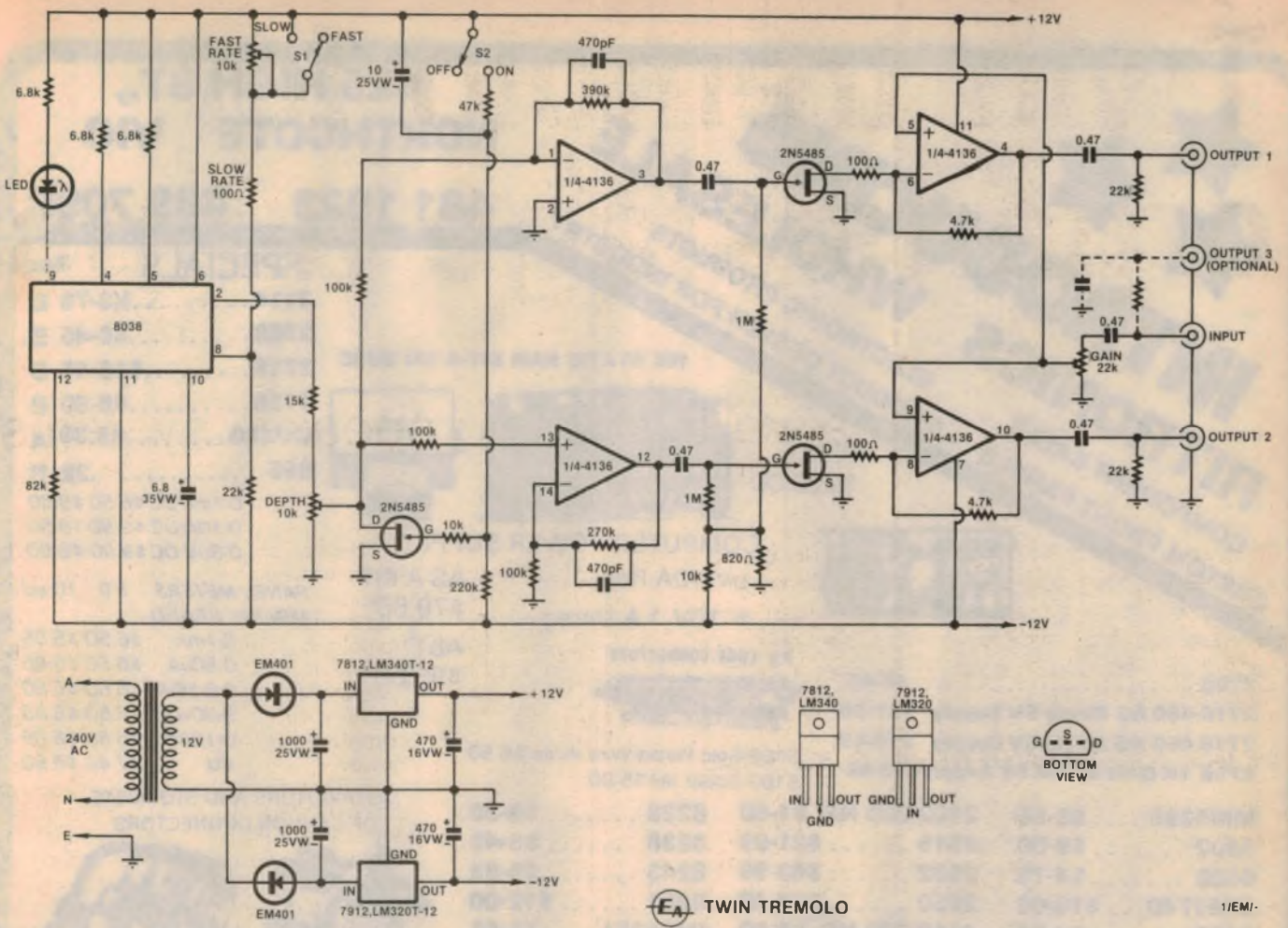
About the same time, we noticed a circuit for a "Split-Phase Tremolo" unit in the May 1980 issue of the English magazine "Practical Electronics". While they saw it as an adjunct to any stage music system – even a vocal channel – it had obvious potential for an electronic organ. It, too, served to quicken our interest.

Thinking back over add-on units that we have described previously, there was the "Phase-shift Vibrato Unit for Electronic Organs" featured in the October '74 issue. It offered the interesting potential of being "fiddled" to produce a mix of vibrato and tremolo but, by present day standards, its use of LDR technology is somewhat "old hat".

More recently, in the November '77



A single PC board accommodates all components, including the power supply. Signal pick-up for the unit can take place after the volume or "Expression" control.



An 8038 waveform generator, a 4136 quad op-amp and three junction FETs form the basis of the circuit (see text re dotted components).

issue, we described an "Electronic Scanner for Organs" – a potential substitute for a rotating loudspeaker system but assuming the use of three separate channels.

Looking afresh at the proposition, we reckoned that it should now be possible to come up with a unit, much simpler than the above-mentioned scanner, using two channels and hopefully showing the way to a smooth, non-mechanical 'Leslie" effect.

The basic idea would be to break into the signal path of an existing organ – or other stage music system – at a point where the level is being controlled by the volume or "expression" pedal. The controlled signal would then be fed into the proposed add-on unit, split into two channels and fed thence into two separate power amplifiers and two separate loudspeakers. This would involve the provision of an extra single-channel amplifier, or the use of an entirely separate stereo power amplifier.

If nothing else were to happen, the organ (or other instrument) would behave much as before, except for the doubling up of the power amplifier system. However, the proposed add-on unit would include provision whereby the sound would effectively be cycled from one amplifier to the other, as the tremolo circuitry smoothly increased and decreased the relative gains of the two channels.

Subjectively, and as far as standing waves were concerned, the sound would appear to oscillate smoothly from one speaker to the other, thereby creating an effect not unlike that of a physically moving sound source. A slow movement (eg 1Hz) would produce a "church" or "celeste" effect; faster movement (eg 7Hz) would produce "theatre" sound.

The "Practical Electronics" unit used a function generator chip to produce the slow or fast modulating frequency and a FET to provide "soft" electronic on-off switching; so far so good. However, they then used a separate transistor as a tremolo phase splitter, a couple of 741 ICs as tremolo amplifiers and a 3340 IC in each channel to effect amplitude modulation of the music signals. A point was made about the modulation being desirably logarithmic.

We opted for a completely different approach in this area, using a single 4136 quad op-amp and a couple of JFETs, with the aim of achieving as close as possible to a classical linear modulation envelope. And we produced an appropriate PC board pattern.

Let's look in more detail at our suggested circuit:

The modulating signal is derived from an 8038 waveform generator, which is capable of operating over a very wide frequency range and which gives separate sine wave, square wave and triangular wave outputs. The sine wave is used for modulation and the square wave is used to drive a LED, which serves to indicate the mode of operation. The LED current is limited by the 6.8k series resistor.

The rate of oscillation is determined by the 6.8uF capacitor and the resistor chain associated with pin 8. The fast rate is adjustable and preset by the 10k trimpot. The slow rate is set by the 100 ohm resistor and this may be altered to suit individual tastes. (The more resistance between pin 8 and the +12V rail, the faster the rate of oscillation.)

The sine wave output from pin 2 is taken via a 15k resistor in series with a 10k trimpot which functions as a modulation depth control. Output from the rotor of the trimpot is fed via two 100k resistors to two sections of a 4136 quad op amp. The op amps are connected such that one is non-inverting and the other inverting, thus obviating

INTRODUCING RITRONICS WHOLESALE

COMPONENT SALES
CUSTOM FRONT PANELS
ELECTRONIC PRODUCTS
PRODUCT DESIGN FOR INDUSTRY

425 HIGH ST., NORTHCOTE VIC

481 1923 489 7099

SPECIALS

	Tax
2114 ..... ¼3-78	B
2708 ..... $6-45	B.
2716 ..... $18-45	B
4116 ..... $6-50	B
BUX80 ..... $5.30	A
555 ..... .22	B

0-1mA DC $6.50 $8.50
0-10A DC $9.90 $8.50
0-30V DC $9.90 $8.50

PANEL METERS "MINIPA" BRAND	1-9	10-up
0-1mA	$6.50	$5.85
0-50uA	$6.50	$5.85
0-0-50ua	$6.50	$5.80
0-30vDC	$6.50	$5.85
0-10ADc	$6.50	$5.85
VU	$7.40	$6.60

16K STATIC RAM KIT-S 100 BUSS

PRICE $229.00

COMPUTER POWER SUPPLY
5V 10A Reg.
± 16V 1 A Unreg.

AS A KIT $79.50

A&T $95.00

P.C. EDGE CONNECTORS

S100 Gold Plated Wire Wrap $6.50
S100 Solder tail $5.90

2708 ..... $6-45
2716 450 NS Single 5V Supply $21-99
2716 450 NS Single 5V Supply $16-49
2758 1K 8-bit PROM 5V Supply $12-49

MM5395	$5-55	2102 200 NS	$1-50	8228	$8-20
6502	$9-00	2516	$21-99	8238	$6-49
6508	$4-70	2532	$63-99	8243	$6-85
MM5740	$10-00	2650	$23-40	8251	$12-00
6520	$4-75	4116 200 NS	$6-90	INS8251	$5-55
6522	$8-49	5101	$7-49	8253	$16-85
6532	$14-65	S5101	$4-49	8255A	$7-20
6551	$14-65	MM5203	$12-49	8295	$21-45
IM6561	$3-89	MM5204	$10-49	MM5104N	$9-65
MCM6574	$9-60	MM5220	$5-49	MM5106N	$8-49
MCM6575	$7-89	MM5303N	$3-49	MM55106N	$6-49
MC6800P	$7-49	MM5307	$15-49	MM57160	$6-49
MC6802	$11-79	MM5309	$5-60	Z80 CTC	$9-45
MC6808	$10-49	MM5312	$7-80	Z80 CPU	$14-80
6810A	$4-20	MM5369	$1-89		
		5387	$7-25		

DISTRIBUTORS AND STOCKISTS OF CANNON CONNECTORS

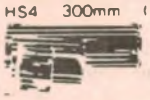
XLP-3-11C	$3.32	XLR-LNE-11C	$4.47
XLP-3-12C	$2.43	XLR-LNE-12C	$4.16
XLP-3-31	$5.08	XLR-LNE-31	$4.25
XLP-3-32	$2.61	XLR-LNE-32	$3.14.

MINIMUM ORDER VALUE $10.00
MIN. PACK & POST $1.00

AUSTRALIAN MADE HEATSINK

Higher thermal capacity than comparable types as well as being 100% Australian made !

			14	59	10+
HS1	38mm	(1.5")	$1.85	$1.65	$1.45
HS2	75mm	(3.0")	$3.00	$2.80	$2.50
HS3	150mm	(6.0")	$5.80	$5.40	$4.90
HS4	300mm	(12")	$8.90	$8.40	$7.90



(All above heatsinks are black anodised. Unanodised sizes are listed below

HS11	38mm		$1.50	$1.30	$1.00
HS12	75mm		$2.50	$2.20	$1.90
HS13	150mm		$4.90	$4.50	$4.00
HS14	300mm		$6.50	$5.90	$5.30
HS15	600mm		$12.00	$10.00	$9.00
HS16	1200mm	(4")	$20.00	$18.00	$16.00

Further quantity breaks and prices are available from Rod Irving, by phoning RITRONICS WHOLESALE PTY LTD (03) 489 7099

Please note we are in the process of designing further products to be made in Australia

GENUINE WHOLESALE PRICING FOR TAX EXEMPT CUSTOMERS. SCHOOLS, GOVERNMENT DEPTS, BUSINESS ETC. TRY US FOR THAT NEXT QUOTE. CORRESPONDENCE TO P.O. BOX 235, NORTHCOTE

PRICES SHOWN DO NOT INCLUDE SALES TAX. NON EXEMPT CUSTOMERS ADD TAX AS APPLICABLE. TAX A 27, TAX B 15, TAX C 2. PRICES SUBJECT TO CHANGE WITHOUT NOTICE

"For reliable data storage, you can't beat Shugart's

Verbatim

SHUGART SA 400

CHECK THESE PRICES

SA400 ..... $330.00
SA800 ..... $550.00
SA801 ..... $550.00

5 INCH $3-69

8 INCH $3-90

Part No.	Sectoring	Application
MD 525-01	Soft Sector	TRS-80 Apple
MD 525-10	Hard 10 Sector	North Star
MD 525-16	Hard 16 Sector	Micropolis
FD32-1000	Hard Sector	Shugart 801R
FD34-1000	Soft Sector	IBM 3740

Bankcard Mail Orders Welcome

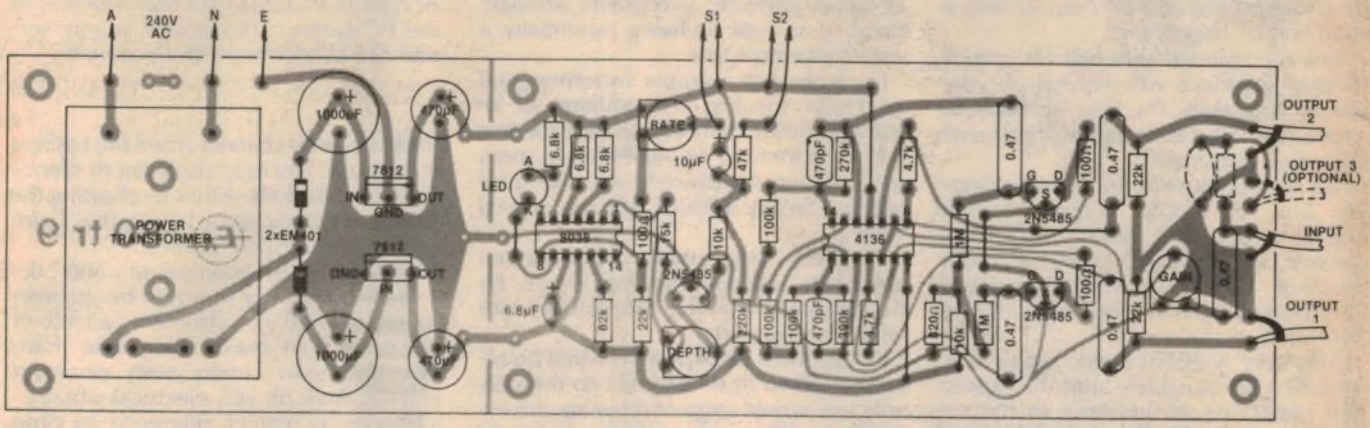
Please debit my Bankcard

Bankcard No .....

Expiry Date .....

Name .....

Signature .....



The component overlay. Note that the two ICs are oriented in opposite directions.

the need for a separate phase inversion stage.

The modulation process is achieved with two 2N5485 junction FETs in the negative feedback networks associated with the other two sections of the 4136 quad op amp.

Modulating drive from the first two op amps is fed to the gates of the two JFETs and the variation in the effective resistance of the JFETs, in turn, varies the gain of the op amps.

The signal to be modulated is fed into the board via a 22k trimpot; it is then split and the two signals are fed through the modulating op amps. The resulting modulated signals emerge from the op amp outputs, modulated in opposite phase – one passing through a peak as the other passes through a trough.

In order to get proper modulating action of the op amps, it is necessary to set them up with a reasonable amount of gain. When actually coupled into an amplifier chain, the tremolo device is most likely to be operated under unity gain conditions and the 22k input trimpot can be used to set the overall gain accordingly.

Fixed negative bias for the two modulating JFETs is obtained by a voltage divider consisting of a 10k resistor from the −12V rail and an 820 ohm resistor to the 0V line.

Fast/Slow switching is done by a simple toggle switch across the 10k fast rate trimpot.

On/Off switching is rather more involved. A similar toggle switch is used to switch bias to a JFET via a voltage divider consisting of a 47k and a 220k resistor across the +12 and −12V rails. A 10uF electrolyic capacitor is also connected between the +12V rail and the junction of the voltage divider.

With the switch in the open circuit position, a negative bias of several volts is applied to the gate of the JFET, cutting it off; it looks like a very high resistance and so allows the modulating signal to pass, to the two op amps.

When the toggle switch is closed, a positive bias is applied to the gate of the JFET. This has the effect of making it look like a very low resistance, thereby short circuiting the modulating signal and preventing it from being passed on to the two op amps. The 10uF capacitor acts as a time constant, making the switching between on and off a gradual rather than a sudden transition.

The power supply consists of a Ferguson PL12/5VA transformer in a centre-tapped voltage doubler arangement. The DC output is split and feeds two 3-terminal regulators, to give plus and minus 12V output, referred to a 0V line.

With the exception of the two toggle switches, all of the components are mounted on a PCB, measuring 254mm x 72mm and coded 80tr9. The board should be available from the usual places by the time this appears in print.

While most will probably prefer to incorporate the power supply as shown, there may be situations in which the requisite source voltages would be available from the associated amplifier, either directly or in association with 12V regulators. With this possibility in mind, the PC board has been designed so that the power supply section can be sliced off, to conserve space.

The remainder of the components should be readily available. However, if any problem should arise in obtaining the 8038 or the 4136 ICs, we suggest that you try Radio Despatch Service, 869 George Street, Sydney 2000, for the former and any Dick Smith Store for the latter.

Because of the nature of the tremolo unit and the varied applications for it, we have not fitted it to a box of any sort. Where it is likely to be used in conjunction with an electronic organ, more than likely it will be fitted inside the cabinet and so it would not need a box. This matter is left to the builder to decide for himself.

It is usually best to start the board assembly by first fixing the smallest components. There are five jumpers on the board and they should be fitted using tinned copper wire. These may be followed by the resistors, small capacitors, diodes, ICs or sockets, checking carefully for dry joints. Care should be taken to observe the polarity of components where this applies.

More than that need hardly be said as far as the actual construction is concerned.

We do, however, need to add something about possible uses for the twin tremolo unit and your expectations of it, especially in relation to electronic organs.

First off, if you can gain access to a CRO and any kind of an audio source, set the unit up for unity gain and for full modulation, with the envelope just tipping the zero line, without obvious flattening.

Without a CRO, turn the modulation right off and adjust the input pot so that the unit does not add or detract noticeably from the natural gain through the organ amplifier. Then turn the modulation up until further rotation yields no obvious benefit. Do not turn up the modulation to the point where the modulation sounds rough or seems to

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

$40

This includes sales tax.

be chopping the sound. That, in fact, is what will be happening!

How the twin tremolo unit fits into individual situations will depend on your needs, your skills, the time available to experiment, and the adaptabiity of each individual instrument.

Our own tests were done with an ageing but reasonably complex spinet organ, with in-built vibrato and Leslie speaker, and a single channel amplifier feeding three parallel-connected loudspeakers across the front of the instrument.

Consistent with our earlier suggestion, we broke the signal line after the expression pedal and at the input to the existing amplifier. We coupled in the twin-tremolo unit and fed it to the AUX terminals of an external stereo amplifier and thence to a pair of stereo loudspeakers. (Since they were wide-range units, we turned the stereo amp treble control down to simulate the limited top response of the average organ console speaker.)

It was immediately apparent that the twin tremolo did provide the kind of result that we had been seeking – a well modulated, spacious kind of sound. It was far more satisfying than simple tremolo, which could be achieved simply by turning off either channel by means of the amplifier balance control.

As a matter of interest, we tried moving the stereo loudspeakers well apart but, overall, the result seemed unpromising. The dominant effect seemed to be of simple tremolo via the speaker that happened to be the closer of the two. In fact, we finished up wiring the stereo amplifier to the two outermost speakers in the console and that seemed to be a perfectly acceptable arrangement – as well as being potentially a very convenient one.

For those with a simple instrument and no Leslie speaker, the addition of an extra amplifier channel and loudspeaker with twin tremolo would therefore seem to be a very worthwhile exercise, providing a facility additional to the normal vibrato.

However, with more complex instruments, careful planning would be necessary to blend the new facilities with what already exists.

Where three loudspeakers could be accommodated in or adjacent to the console, we would suggest retaining the existing amplifier and a centre speaker to carry the lower frequencies and particularly the pedals. This could be done by taking the signal into the tremolo unit and then out again via output 3. There is space on the board to allow for a series resistor and a bypass, which could be chosen to roll off the response through the main amplifier above about 200Hz. By limiting the output of the main amplifier in the melody area, the tremolo effect would from the additional speakers would not be swamped.

We would also suggest reducing from 0.47 to about 0.1uF the capacitors to do with the tremolo unit "Input" and "Output" 1 & 2. This will keep the lower frequency signals out of the modulated amplifiers and also make it practical to get by with a less powerful stereo amplifier and smaller speakers.

If the organ already includes a Leslie system, and you logically want to retain it, the same general course could be followed but with provision to switch out the high frequency bypass on the main amplifier channel when the Leslie is to be used. You may also want to silence the trem channels, either by shorting the input or outputs, or by having the "Gain" pot as an accessible control.

At right is an actual size reproduction of the PC pattern. The power supply section can be deleted if not required.

Indeed, with appropriate and accessable switching, it would be possible to end up with an instrument capable of operating solo main, solo Leslie, trem fast and slow, multi trem or multi celeste. And, oh yes, electrical vibrato!

Hence our earlier reference to time and initiative.

To go beyond that would be to provide separate twin tremolo on the two manuals and we have thought of that possibility by providing holes whereby you can piggy-back two trem units with spacers. But, be warned:

The output from each manual would automatically become 2-channel rather than 1-channel (virtual stereo), requiring a ganged inter-manual balance pot and an expression pedal with two symmetrical signal circuits. It's possible, it's rewarding and Technics did something like this (and more) in their 7700-G, mentioned earlier. But you have to be prepared to dive in with iron smoking!

One final suggestion, which may not be quite so daunting: In many spinets, there is no way of doing different things with the two manuals. Vibrato and Leslie affect both and there is no way of splitting them.

It would be possible to wire one channel of the twin tremolo unit into the signal line for the lower manual and at least have simple trem available to accompany a straight upper manual instrumental sound.

You could go one step further and, by cutting the copper track, wire the other channel into the upper manual. Duplicate the switching circuit on a scrap of tag and you can have simple trem separately available on the upper manual. With both manuals on simple trem and operating out of phase, the result could be sonically quite interesting.

You try it: we didn't have time to experiment with everything!

One final point: when you are interconnecting amplifiers and speakers to operate side by side, keep in mind the matter of loudspeaker phasing. If introduction of the extra amplifier(s) appears to diminish the bass in particular, try reversing the connections to the extra speaker(s). If you are not able to precheck the phasing in the amplifier chains, there is a 50/50 chance that it will be wrong.

PARTS LIST:

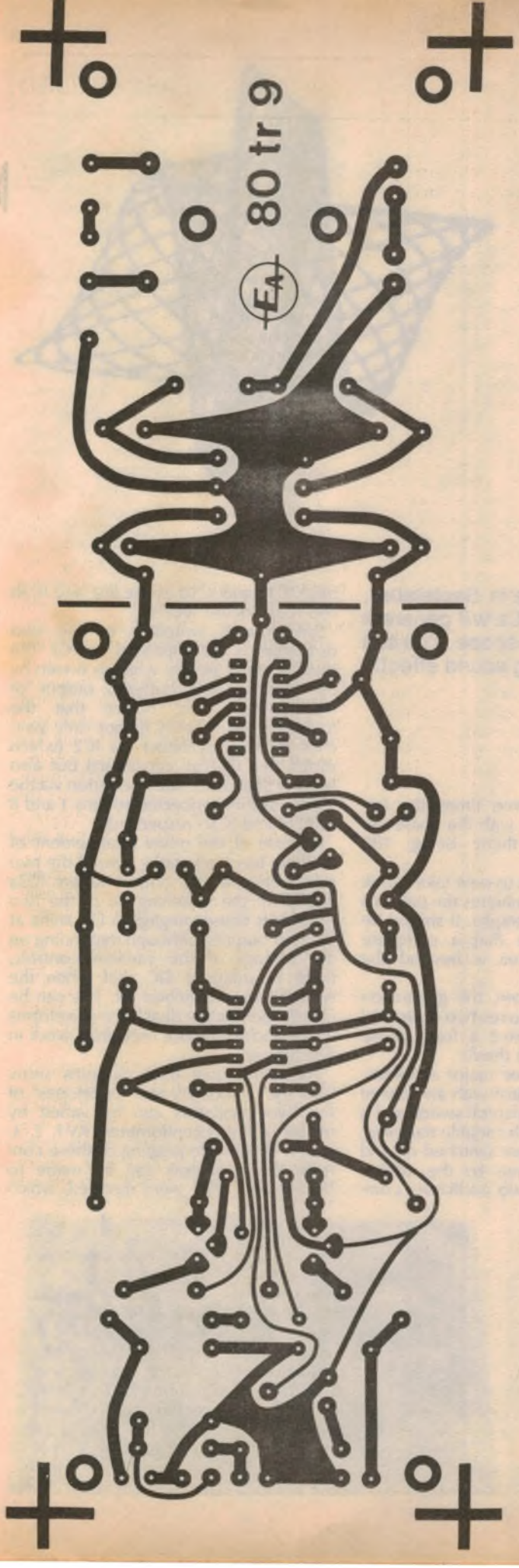
1 PC board 254mm x 72mm code 80tr9
1 Ferguson transformer PL12/5VA
2 10k miniature horizontal trimpots
1 22k miniature horizontal trimpot
2 14-pin DIL sockets
2 miniature toggle switches SPDT
2 EM401 or similar rectifier diodes
1 red LED
1 LM340-12, uA7812 12V 3-terminal regulator
1 LM320T-12, uA7912 –12V 3-terminal regulator
3 2N5485 JFETs
1 8038 waveform generator
1 4136 quad op amp

RESISTORS
(5% tolerance, ¼ or ½W rating)
3 x 100 ohms, 1 x 820 ohms, 2 x 4.7k, 3 x 6.8k, 2 x 10k, 1 x 15k, 3 x 22k, 1 47k, 1 82k, 3 100k, 1 220k, 1 270k, 1 390k, 2 1M.

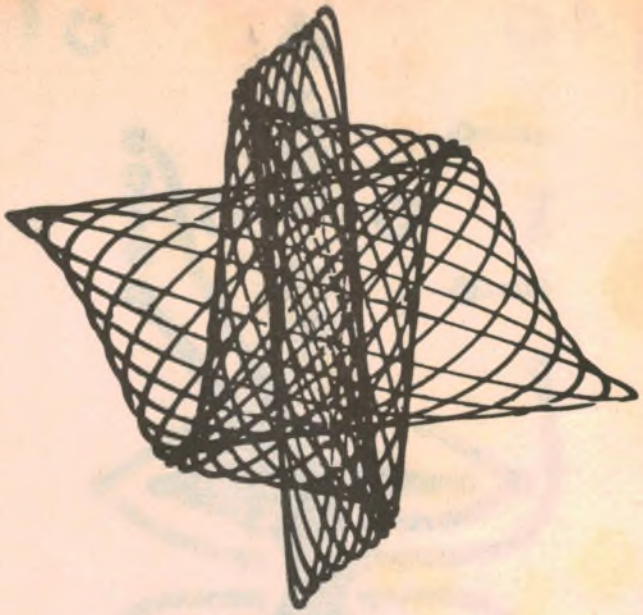
CAPACITORS
2 470pF polystyrene
5 0.47uF/250V metallised polycarbonate (greencap)
1 6.8uF/35VW tantalum electrolytic
1 10uF/25VW electrolytic
2 470uF/16VW electrolytics
2 1000uF/25VW electrolytics

MISCELLANEOUS
Hookup wire, shielded audio cable, 3-core power flex, 3-pin plug, solder, hookup wire.

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible.



LISSAJOUS PATTERN GENERATOR



For Fun with an Oscilloscope

Based on a design published in "Elektor" magazine in September, 1978, this clever circuit using just three economy ICs will generate an endless variety of Lissajous figures on your oscilloscope. You can also use the circuit to produce some very interesting sound effects. Why not build it up just for fun?

by GERALD COHN

A great many of our readers have an oscilloscope and although it is an extremely useful instrument, it spends most of its time displaying a horizontal line, or even a blank screen. The circuit presented here can remedy this situation in that it produces a multitude of fascinating and attractive geometrical patterns on the screen of the scope.

The patterns are actually so-called "Lissajous" figures which are generated by two resonant circuits which are triggered at regular intervals, producing two damped sinusoidal outputs. By feeding these to the X and Y-inputs of the oscilloscope and disabling the internal timebase, we can modulate the position of the trace in a variety of patterns.

Perhaps the simplest possible example of a Lissajous figure is the case where we have two sine wave signals of exactly the same amplitude and frequency, but 180 degrees out of phase. The resulting pattern will be a perfect circle. If we were to now change the phase relationship between the two signals, say decrease the difference from 180 degrees to 90 degrees, the pattern will change from a circle to an elipse inclined at a 45 degree angle. Decreasing the phase difference even further, to zero degrees will result in a straight line at a 45 degree inclination.

One of the most familiar examples of a Lissajous figure is the pattern used by the ABC television network as its logo. This is generated using two sinewave signals, one of which is three times the frequency of the other, with the phase difference between them being 180 degrees.

Having said that, let us now take a look at how our circuit generates the patterns shown in the photographs. It should be noted at this stage that a complete analysis of the circuit is beyond the scope of this article.

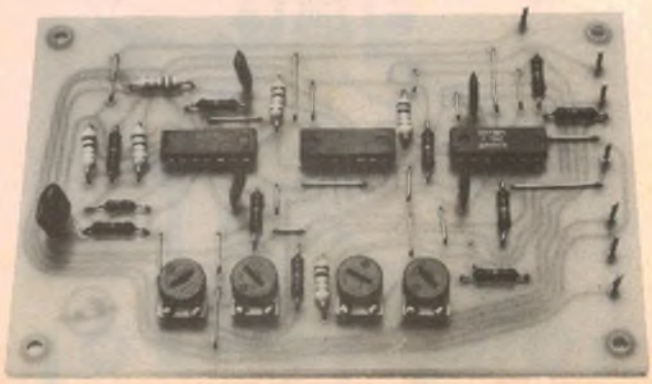
As mentioned before, the generation of these patterns requires two sinusoidal waveforms which have a fixed phase relationship between them.

The circuit has three major elements: an astable multivibrator with an uneven duty cycle, a quad bilateral switch and a pair of oscillators with variable damping. The two oscillators are switched on and off at regular intervals by the astable multivibrator. The two oscillators comprise IC1c and IC1d as the first and IC3b and IC3c, as the second.

Synchronous switching of the two oscillators is accomplished by IC2, the quad bilateral switch, which is driven by the inverted and buffered output of multivibrator IC1a. Notice that the multivibrator buffer IC1b not only switches off the oscillators via IC2 (which shorts the .0047uF capacitors) but also triggers them back into oscillation via the 100k resistors connected to pins 1 and 8 of IC1c and IC3b respectively.

Because of the novel arrangement of multiple feedback paths around the two oscillators and their output buffers, IC3a and IC3d, the switching on of the two oscillators causes negligible DC shifts at the two outputs, although depending on the settings of the variable controls, there is usually a DC shift when the oscillators are switched off. This can be clearly seen on the dual trace waveforms which show how the oscillators work in synchronism.

The same dual trace patterns show how the frequency and "envelopes" of the two oscillators can be varied by means of the potentiometers RV1, 2, 3, and 4. By suitable juggling of these controls, the oscillators can be made to behave as if they were damped, which



A single PC board accommodates all of the circuitry. Note that a few detail changes were made to the board pattern after this photograph was taken.

CANBERRA TELEVISION INTRODUCE THE TI-99/4 HOME COMPUTER.

The first home computer designed for beginners or skilled computer users.

WE'VE ENTERED A NEW AND EXCITING ERA – the age of the home computer. Maybe you're already quite knowledgeable about computers and are looking for the most programming power and versatility for your money. Maybe you've just read about it and want to learn more. Either way you need to look closely at Texas Instruments TI-99/4 Home Computer.

If you're new to computers, the TI-99/4 is for you.

You can begin using the TI Home Computer literally minutes after you unpack it. Without any previous computer experience or programming knowledge. Just touch a few keys and step by step instructions are displayed on the screen to tell you what you're doing, what to do next and if you happen to make a mistake how to fix it.

If you know computers, you'll quickly see the difference in the TI-99/4.

Texas Instruments has taken those features you've been wanting – plus some you may not have heard about yet – and included them in one incredible affordable computer system. The TI-99/4 gives you an unmatched combination of features and combinations including:

* Powerful TI-Basic: Built-in 13 digit, floating point Basic language with special features and extensions for colour, sound and graphics.

* Solid State Speech™ Synthesizer (optional) provides verbal prompts and special messages to the user.

* Solid State Software™ Command Modules with programmes for Home Management/Personal Finance, Education and Entertainment.

* Built-in equation calculator – unique convenience feature helps you find quick solutions to everyday math problems, as well as complex scientific calculations.

* High quality 34 cm colour TV – specially matched for use with the TI-99/4 computer console. Simple sure hookup.

A world of genuine, practical applications exist for the TI Home Computer right now.

The world of things you can do with the TI Home Computer is varied and exciting: personal finance, home management, educational and entertainment uses. A world that will grow at exactly the pace you choose. As your children advance in education. As your family explores the computer. As, and if, you want to do your own programming.

If you'd like to find out more about the TI-99/4, the best way is to try it out for yourself.

The Texas Instruments Home Computer is now available from Canberra Television.

For more information and a free demonstration just mail the coupon below to Canberra Television.

P.O. Box 98, Camberwell, Vic. 3124.

I'd like more information and/or a free demonstration of the TI-99/4 Home Computer.

Name

Address

Postcode

Phone

CANBERRA TELEVISION

Australia's No 1 Television Specialists.

TEX0009

When the TV action's too good to miss, tape it.*

It always happens. You're going out and there's a great sporting programme, movie or special on TV. Next time, instead of hearing how good it was, tape it with a National VHS Video Cassette Recorder.

Simply set the date and time on the 7-day timer, select the desired station and the National NV-8610A VHS will do the rest automatically.

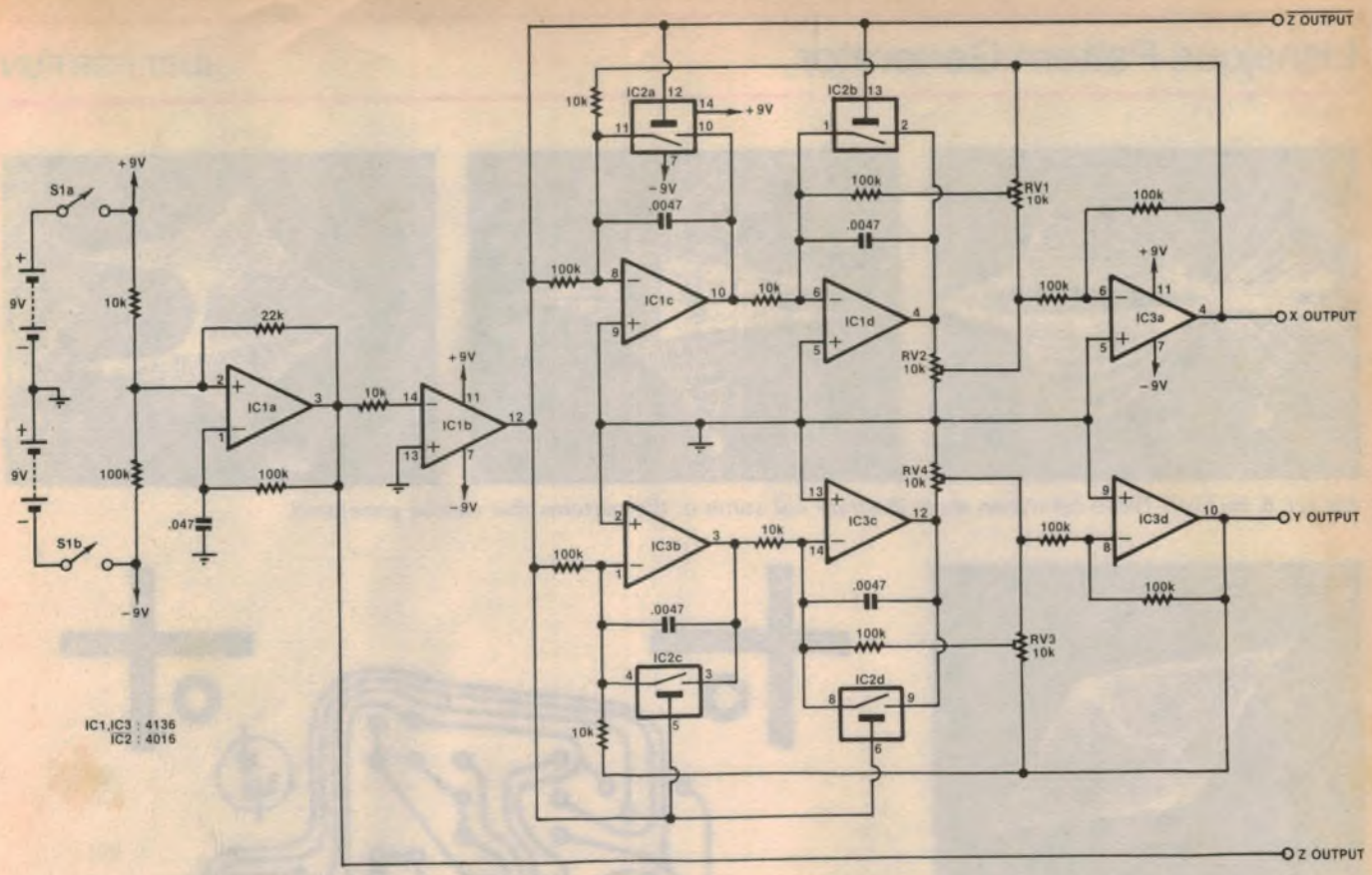
Even recording full length movies up to 3-hours.

*Caution: Unauthorised recording of TV programmes and other materials may infringe the rights of others.

Because time doesn't stand still...

VHS National National Instant Home Video

D624



LISSAJOUS PATTERN GENERATOR

3/MSF

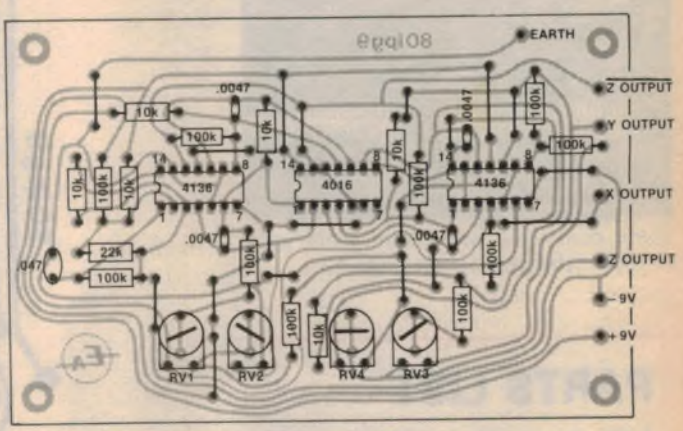
The circuit can be divided into three sections: an astable multivibrator (IC1a), a quad bilateral switch (IC2), and two oscillators (IC1c & IC1d; IC3b & IC3c).

gives rise to a large oscillation amplitude at first and then tapering off. Alternatively, the oscillators may appear undamped, in which case, the oscillation amplitude starts off relatively small and gradually builds up to a high level before being switched off.

Apart from the X and Y-outputs from the circuit, we have also provided trace modulation outputs, Z and Z-bar (the opposite polarity). If your oscilloscope has a Z-modulation input (generally found on the rear of the instrument), one or other of these outputs may be suitable for trace blanking during the periods in which the oscillators are switched. The circuit did not provide sufficient blanking voltage for the oscilloscope used for our photography, which is why there is a bright spot in each Lissajous figure.

The circuit may be powered from balanced supply rails of ±5V up to a maximum of ±9V. This upper limit is set by the maximum voltage rating of the 4016 quad bilateral switch. At ±9V, the current drain is typically 12 milliamps.

We have designed a printed circuit board for the unit, coded 80lpg9 and measuring 81 x 124mm. All the components are mounted on the board, including the four trimpots that are used to vary the patterns. Conventional potentiometers may be substituted for the trimpots if so desired.

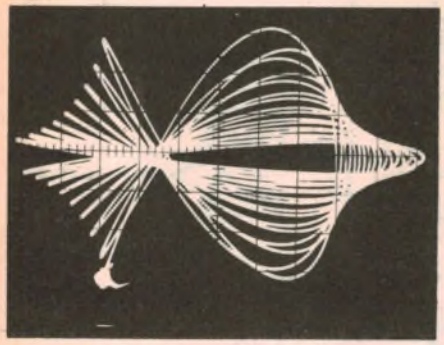


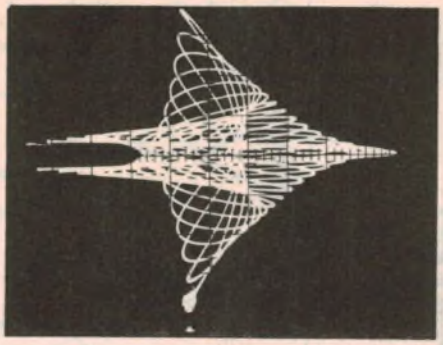
Follow this component overlay diagram when wiring up the unit. Use PC stakes to terminate external connections to the CRO and power supply rails.

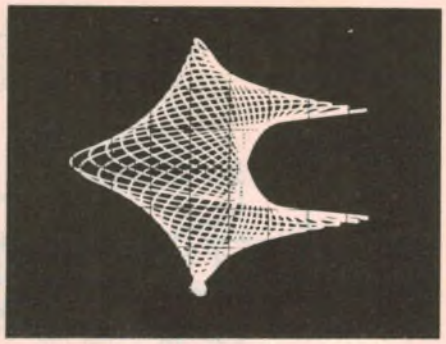
Construction is a simple matter, taking only about three quarters of an hour or so. The first thing to do is to place the links on the board and solder these in place. Follow these up with the resistors and the capacitors, and then finally the ICs. Note that the 4016 is a CMOS IC and that the usual precautions pertaining to the handling of CMOS should be taken: use a soldering iron with the barrel connected by a clip lead to either supply rail; solder the supply pins, 14 and 7, first and then solder the others.

The connections to the board are few but we suggest the use of PC stakes for this since they are so much more convenient when it comes to testing and terminating the board.

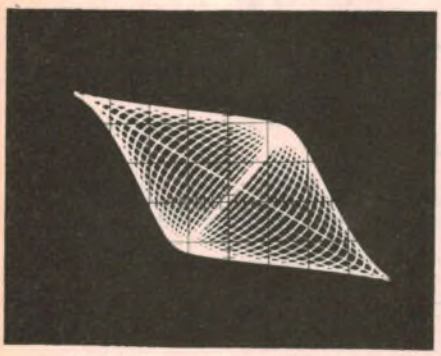
Assuming that you have checked the assembly of the board, apply power to it and then with a CRO, check the outputs of the two channels. If you have a dual trace CRO you can check both channels at the same time. The things to look for when checking the outputs are a decaying waveform whose frequency will vary in sympathy with one of the pots, and the rate of decay varying with adjustment of the other pot.

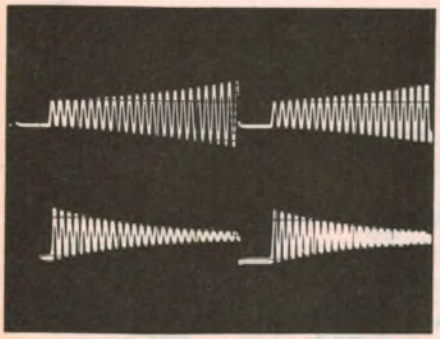




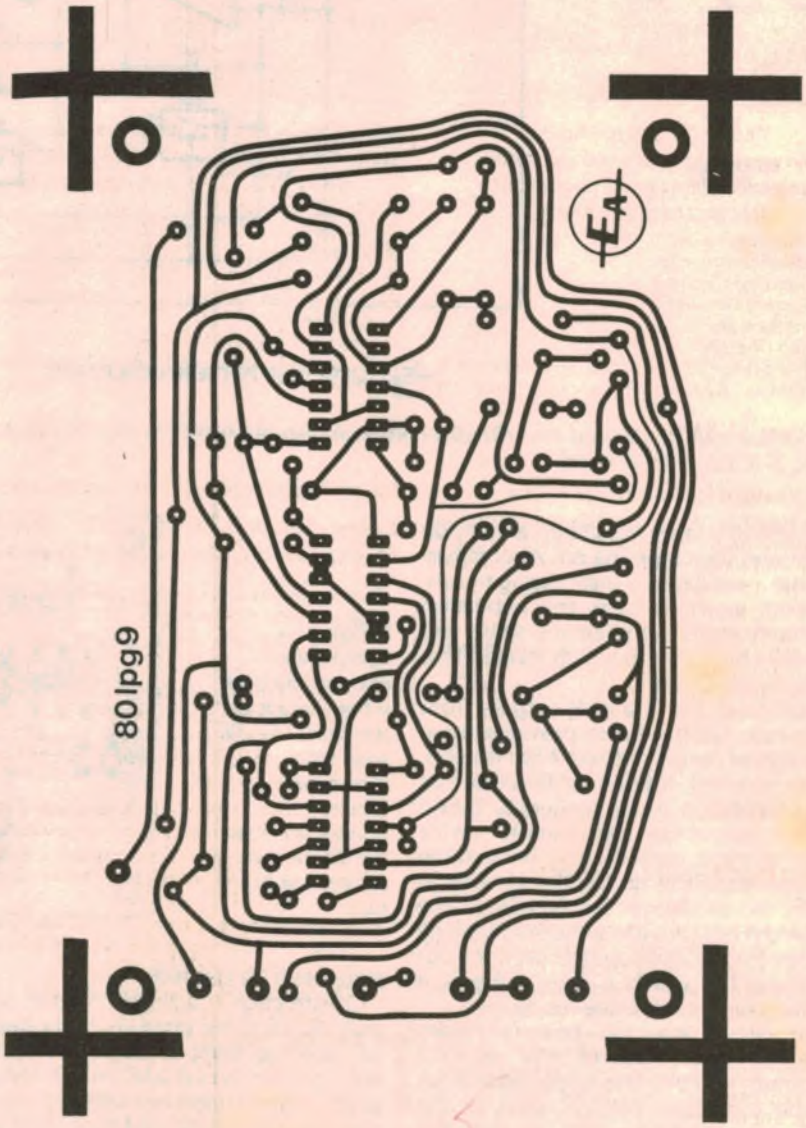


ABOVE & BELOW: These off-screen shots illustrate just some of the patterns that can be generated.





These dual trace waveforms were used to create the pattern on page 52.



PARTS LIST

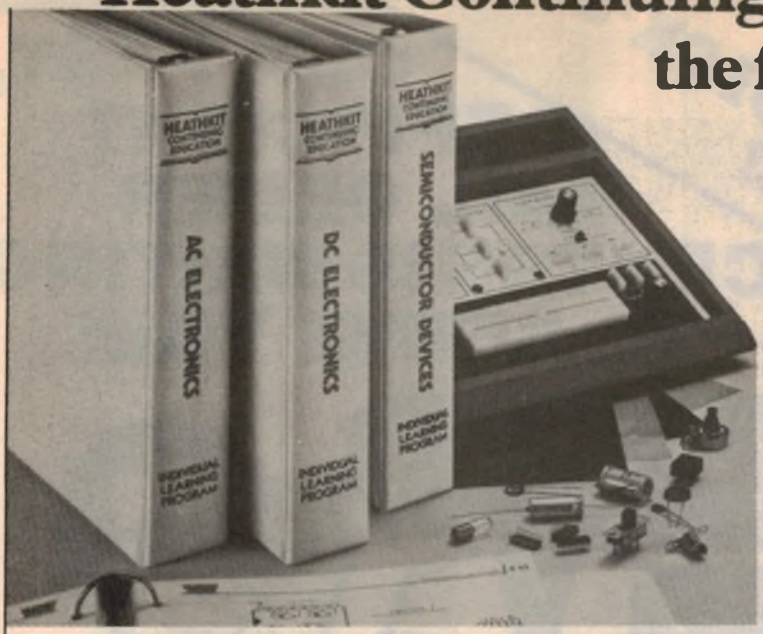
1 PC board 81 x 124mm, code 801pg9
2 4136 ICs (quad op-amps)
1 4016 IC (quad bilateral switch)
4 10k miniature trimpots (see text)
1 double-pole, double-throw miniature toggle switch
2 9-volt batteries (type 216 or similar)
2 clips to suit batteries
7 PC stakes
RESISTORS (¼ or ½ wat, 5%)
10 x 100k, 1 x 22k, 6 x 10k
CAPACITORS
4 .0047uF metallized polyester
1 .047uF metallized polyester

When you are satisfied that the two oscillators are working properly, connect the CRO up for modulated XY operation and try setting up some patterns. You will find out with a little patience that the number of patterns that you can generate is almost infinite.

For those readers who may like to take this a little further, another thought might be to build a second trigger circuit, and trigger the two oscillators independently. This provides even more variety in the patterns since there is no fixed phase relationship between the two oscillators; ie the patterns will shift around continuously.

Heathkit Continuing Education Series—

the fast, easy, low-cost way to learn electronics!



These four basic programmes provide an excellent overview of contemporary electronics—they'll provide you with the fundamentals you need to follow your interests wherever they may lead you. The programmed learning text is clearly written, with technical material fully explained as it is introduced. Built-in quizzes let you test your knowledge at each step. The records give you a "personal" outline of text material and additional information, and electronic parts are included for use in the experiments. Each course leads logically into the next, and when you complete all four, you'll have a thorough knowledge of basic electronics.

Part 1: DC Electronics—
electrical fundamentals, theory and practice—

1. *Electron Theory*
2. *Voltage*
3. *Resistance*
4. *Ohm's Law*
5. *Magnetism*
6. *Electrical Measurements*
7. *Network Theorems*
8. *Inductance and Capacitance*

Includes all texts, records, 56 parts for 20 experiments. Average completion time, 20 hours.

Programme EE-3101 **$76.00**

Part 2: AC Electronics—
sine waves, inductive and capacitive reactance, impedance, phase shift, transformers and filters

1. *AC Fundamentals*
2. *AC Measurements*
3. *Capacitive Circuits*
4. *Inductive Circuits*
5. *Transformers*
6. *Tuned Circuits*

Includes all texts, records, 16 parts for 8 experiments. Average completion time, 15 hours.

Programme EE-3102 **$76.00**

Part 3: Semiconductor Devices—
transistors, zeners, SCR's, FET's, digital and linear IC's, LED's, opto-electronics

1. *Fundamentals*
2. *Diodes*
3. *Zener Diodes*
4. *Special Diodes*
5. *Bipolar Transistor Operation*
6. *Bipolar Characteristics*
7. *FET's*
8. *Thyristors*
9. *IC's*
10. *Opto-electronic Devices*

Includes all texts, records and 27 parts for 11 experiments. Average completion time, 30 hours.

Programme EE-3103 **$76.00**

Part 4: Electronic Circuits Learning Program

Brings the knowledge you've gained in the first three programs to bear on the latest circuits used in solid-state electronics. This program covers the operation of common solid-state electronic circuits. It shows you how to analyse and design simple amplifiers and oscillators. You learn about pulse circuits, multivibrators, SSB and how to use a voltmeter and oscilloscope to analyse the operation of electronic circuits. Included are texts, records, and 110 electronic components for 18 different experiments.

Programme EE-3104 **$95.00**

Heathkit Experimenter/Trainer

For the Heathkit DC, AC and Semiconductor programs—helps you perform each project quickly and easily. And after you finish the programs, it's ideal for "breadboarding" your own design projects. Has solderless breadboarding sockets, 2-range variable sine and square wave signal source, dual-variable power supplies for positive and negative voltages (both variable over 1.2 to 16 volts, 120 mA, both regulated and short-circuit protected). Built-in 1k and 100k linear potentiometers. Center tapped power transformer secondary provides 30 V rms, 50 Hz for line experiments.

Kit ET-3100 **$131.00**

Heathkit Digital Design Experimenter/Trainer

Use it to perform all the experiments in the Heathkit Digital Techniques Programme, also to develop projects, build and test prototypes, verify circuit operation, check digital IC's. Has solderless breadboard sockets, four binary data switches, 2 "no-bounce" switches to pulse logic circuits, 3-frequency pulse clock generator, 4 LED's for visual indication of logic states. Three regulated power supplies: +12V, 100 mA current limited; −12 V, 100 mA current limited; +5 V, 500 mA, overload protected. Accommodates up to eight, 14 or 16-pin dual-in-line IC's, also 24, 28 and 40-pin DIP's.

Kit ET-3200 **$157.00**

HEATH
Schlumberger

Digital Techniques Program—For the advanced experimenter, technician, hobbyist or engineer.

Learn digital fundamentals, circuit design, TTL, ECL, CMOS, PMOS, NMOS integrated circuits; SSI, MSI and LSI; ROM's, PLA's; microprocessor theory

1. *Introduction: techniques and uses, binary numbers, digital codes.*
2. *Semiconductor Devices for Digital Circuits.*
3. *Digital Logic Circuits: AND gates, OR gates, NAND/NOR logic, etc.*
4. *Digital Integrated Circuits: TTL, ECL, CMOS, nMOS, pMOS, how to choose.*
5. *Boolean Algebra.*
6. *Flip-Flops and Registers: latches, D & JK flip-flops, storage registers, applications.*
7. *Sequential Logic Circuits: binary, BCD, modulo N, up/down counters, dividers, shift registers.*
8. *Combinational Logic Circuits: encoders, decoders, exclusive OR, comparators, multiplexers, ROM's, PLA's.*
9. *Digital Design: combinational and sequential circuits, procedures.*
10. *Digital Applications: counters, computers, microprocessors.*

Update your knowledge of electronics with this program in digital fundamentals. Provides a solid background with particular emphasis on circuit design. Covers the latest integrated circuits; ROM's and PLA's; even microprocessors. Helps you learn to design digital circuits for virtually any application.

The program assumes a prior knowledge of electronics fundamentals, either completion of the Heathkit basic electronics programs or equivalent knowledge. It can be successfully completed by technically-oriented people with a math or science background.

The program includes all texts, records and 44 parts for 24 experiments. Av. completion time: 40 hours.

Programme EE-3201 **$119.00**

ORDER BY COUPON NOW OR COME TO OUR SHOWROOM

EA 9/80

Please rush me the programme of my choice. My cheque for $ is enclosed plus $7.00 for package & post.

- ☐ *Programme EE-3101*
- ☐ *Programme EE-3102*
- ☐ *Programme EE-3103*
- ☐ *Programme EE-3104*
- ☐ *Kit ET-3100*
- ☐ *Kit ET-3200*
- ☐ *Programme EE-3201*

Name .....

Address .....

..... **P/Code** .....

Send to: W. F. Heathkit Centre,
220 Park St., South Melb. 3205. Phone: 699-4999

YOU DON'T HAVE TO LIVE IN A CITY TO BENEFIT FROM DICK'S LOW PRICES!

OUR FAST, EFFICIENT MAIL ORDER CENTRE IS WAITING TO SERVE YOU!

'looking forward to some more of your first class service.'
J E Pike, Papua New Guinea

I am pleasantly impressed at the efficiency in which you attended to my first order, and hope you keep up the good work.
R B Dufty, Grafton

Let me congratulate you on an efficient mail order system
N Booker, Mount Isa

Thank you very much for the quick delivery
Martin Long, Perth

I am extremely happy over my last order. It is a far cry from others I have had the misfortune of dealing with.
M. Williamson. Wyndham

Thank you for the action you took in expediting the delivery of my order.
W J Little, Daylesford

Thank you for the swift and efficient attention my mail order received.
Chris Farrelly, Redcliffs

These unsolicited letters speak for themselves

Write or phone your order – (Bankcard also accepted by phone)

Choose from over 3000 top products in our latest catalogue – 43,500 satisfied customers can't be wrong!

DICK SMITH ELECTRONICS

Mail Order Centre: PO Box 321 North Ryde; NSW 2113. PH (02)888 3200

Beat frequency oscillator for shortwave receivers

Build it & resolve SSB & Morse code signals

Want to receive Morse code and SSB signals, but can't afford to outlay the cash for one of those classy communications receivers? You can alleviate the problem by building this simple beat frequency oscillator, or BFO. Fitted to a portable AM shortwave receiver, it may enable you to resolve both SSB and Morse, with a modicum of operating skill.

by IAN POGSON

There are quite a number of shortwave receivers on the market capable of resolving both Morse code and SSB signals, in addition to AM transmissions. While such receivers may represent good value for money, when their various features are considered, the fact remains that not everybody can afford to outlay several hundred dollars cash to acquire one.

So, for many enthusiasts, the reality is a modest multiband receiver capable of resolving AM transmissions only, and usually costing less than $100. Of course, these receivers are no match for the expensive communications receivers - far from it. But they can still log a good many shortwave stations and offer the listener a great deal of enjoyment.

That's where this simple project comes in. It's a device called a beat frequency oscillator, or BFO for short. Added to your AM shortwave receiver, it will enable you to resolve SSB and Morse code stations as well. All you need is $15 worth of parts and a little operating skill.

But enough of the sales talk! What exactly is a BFO and does it work? Let's find out.

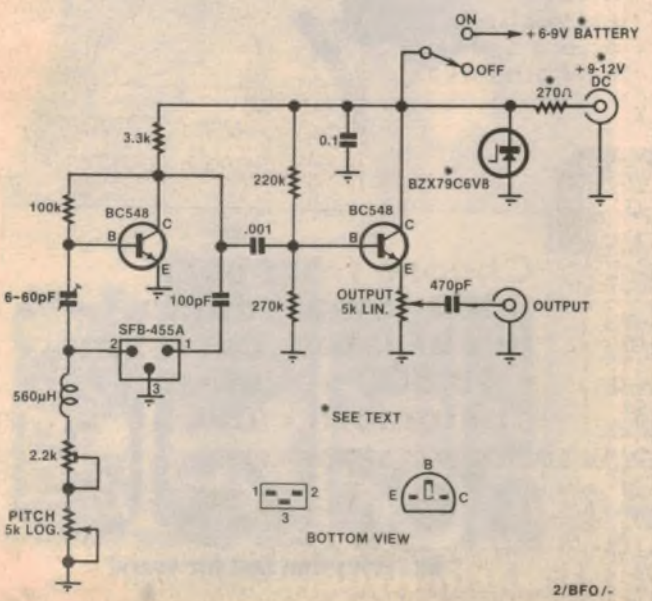
Basically, a BFO is an oscillator with a stable output frequency that can be adjusted over a very small range. The BFO signal is generated at the intermediate frequency (IF) of the receiver and is injected into the system at some convenient point in the IF chain up to or at the detector. The design presented here has a nominal output frequency of 455kHz, and can only be used with receivers with a 455kHz IF.

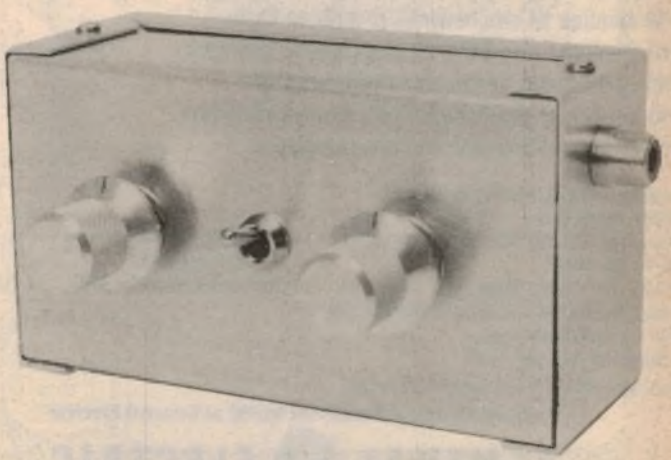
Fortunately, the majority of receivers come into this category.

As we've already indicated, the main purpose of fitting a BFO is to enable you to make sense of Morse code and SSB signals. Morse code, for example, is still used by many radio amateurs and in some commercial applications. Without a BFO, the received Morse signal will be heard as a series of "thumps", or it may not be audible at all. To resolve Morse signals, it is necessary to "beat" the received signal against a locally generated signal (the BFO signal), suitably offset in frequency so that the difference between the two is heard as an audio tone or "beat" note.

The function of a BFO is rather different for SSB reception. In contrast to a normal AM signal, an SSB signal has one of its sidebands and the carrier suppressed at the transmitter, leaving only one sideband. There are many advantages to SSB transmission, but it does require special facilities in the receiver. In particular, a signal equivalent to the missing carrier must be re-inserted at the receiver, and this is the purpose of the BFO.

Without a BFO, SSB signals are quite unintelligible and are often aptly described as "duck talk". Those expensive com-





We housed the prototype in a small aluminium case. Controls from left to right are: pitch, on/off and output level.

Left: the complete circuit diagram for the BFO. It consists of Pierce oscillator feeding an emitter-follower stage.

Don't throw away batteries ...& money Use GE Rechargeables

From the frontiers of space to the products in your home.

When reliable batteries were needed for missions to the Moon and Mars, General Electric was a leading supplier. Now GE's Nickel Cadmium battery leadership has pioneered a low cost system for you that can recharge all of GE's popular battery sizes (AA, C, D and 9 volt) up to 1000 times, with a single low-cost charger.

If you're tired of buying batteries, it's time for GE Rechargeables.

Rechargeable batteries make sense in today's value-conscious market. GE's proven efficiency and dependable system is rapidly attracting more and more consumers to the advantages of GE Rechargeables.

Convenience: Charge overnight or keep extra batteries charging, fresh and ready to use.

Longlife: GE Batteries are rechargeable up to 1000 times and they will last for years.

Performance: GE Rechargeables maintain voltage for the life of the charge to keep your products operating with steady performance.

Warranty: Guaranteed not to leak, with resultant damage to your product, plus all GE battery products have a full one year warranty.

Economy: One GE Rechargeable outlives 100 or more throwaways — even the long-life alkaline kind.

Tests show that one GE Rechargeable Battery outlasts:

350 Alkaline AA size batteries in a photo flash.
140 Alkaline C size batteries in a cassette recorder.
250 Carbon-Zinc D size batteries in a torch.
100 Alkaline D size batteries in a motor-driven toy.
150 Alkaline 9-Volt batteries in a calculator.

Batteries that last for years!

Available from leading retailers.
Trade enquiries:

Australian General Electric (Sales) Limited,
86-90 Bay Street,
Ultimo, New South Wales 2007.

C. G. E Marketing Services,
117 Burnley Street,
Richmond, Victoria. 3121.

Rank-General Electric Housewares Pty. Ltd.
296 Ferntree Gully Road,
Notting Hill, Victoria 3168.
plus regional offices in Capital City areas.

Products from the Wonderful World of General Electric

GENERAL ELECTRIC*

*Trademark General Electric Company U.S.A. World's Largest Electrical Enterprise

munications receivers we referred to earlier incorporate a BFO as standard. The BFO is automatically switched in whenever the operator selects the appropriate receiving mode.

THE CIRCUIT

Let's now have a look at the circuit diagram. It's really very simple, and uses just two transistors, a ceramic filter, and a handful of other parts.

Basically, the circuit is similar to the familiar Pierce crystal oscillator, but with a ceramic filter used instead of a quartz crystal. The main advantage of a ceramic filter in this application is that it can be shifted in frequency by a significant amount, whereas a crystal cannot. Other advantages of a ceramic filter type BFO include low cost and adequate frequency stability.

To be used as a BFO, the circuit needs to be variable over a limited range. The 60pF trimmer capacitor connected in series with the ceramic filter provides the lower frequency limit, while the upper limit is set by the 560uH choke and the 2.2k preset pot. Tuning between the two limits is accomplished by the 5k (log) pot which becomes the pitch control.

We have used an emitter-follower stage to provide isolation between the oscillator and the output – a provision which reduces frequency variation due to loading. A 5k output level control varies the signal injection into the receiver.

The 270 ohm resistor and the zener diode are required only if the circuit is to be powered from a plugpack supply. Alternatively, the unit may be powered from a 9V battery, as was the prototype.

CONSTRUCTION

Construction of the BFO is straightforward, with most components mounted on a small PC board measuring 68 x 50 mm and coded 80B7. All components, with the exception of the ceramic filter, should be readily available from components stores. The ceramic filter used in the prototype came from Radio Despatch Service (869 George St, Sydney 2000).

Commence construction by wiring the PC board according to the circuit and component overlay diagrams. Make sure that the transistors and the ceramic filter are correctly oriented, and don't forget to add the 270 ohm resistor and the 6.8V zener diode if you intend powering the unit from a plugpack supply.

This done, the various external items can be mounted on the aluminium case and the wiring completed. The PC board is then fixed to the bottom of the case using machine nuts and screws, with additional nuts used as standoff spacers between the board and the case.

The 9V battery (if used) is mounted at one end of the case, and can be held in position using double-sided adhesive tape. Current drain is just 3mA at 9V and 2mA at 6V, which should result in long battery life.

The final job of assembly is the setting-up procedure. If you have access to a frequency meter, we suggest that you use it to set the upper and lower frequency limits to 457kHz and 453kHz respectively. The procedure is as follows:

- connect the meter to the BFO output, switch-on, and set the 2.2k trimpot and pitch control to maximum resistance;
- adjust the 60pF trimmer capacitor to give 453kHz;
- reset the pitch control to minimum resistance and adjust the 2.2k trimpot to give 457kHz;
- repeat the above procedure as many times as necessary to get the correct readings at the two extremes of the pitch control.

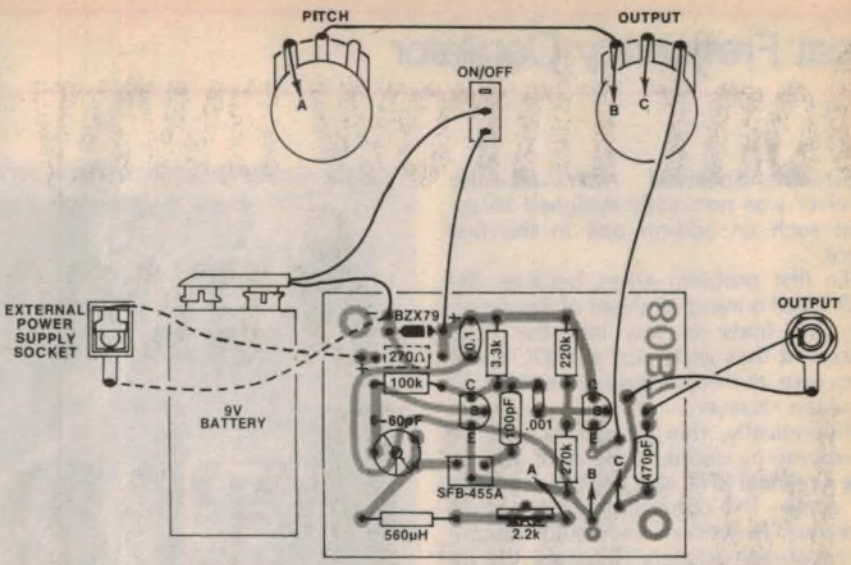
For those without access to a frequency meter, the setting up procedure is carried out using the all-wave receiver itself. The idea is to mix the BFO output with the receiver IF and adjust the BFO to obtain a steady tone. This tone will be heard along with the normal program.

First, tune the receiver to a local broadcast station and inject a suitable signal from the BFO into the receiver IF. Now, with the 2.2k trimpot and the pitch control set to maximum, adjust the trimmer until a high-pitched tone is heard. Finally, reset the pitch control to minimum resistance and adjust the trimpot until a similar tone is heard.

Note that as the pitch control is rotated from one extremity to the other, the tone should lower in frequency until, at about the centre of rotation, no audible tone will be heard; ie, BFO frequency = IF (intermediate frequency). The tone frequency should then increase as the other extremity is approached.

USING THE BFO

As can be expected, there are a few problems in adding a BFO to an AM



Follow this diagram in conjunction with the circuit when wiring up the BFO. The wiring shown dotted is required only if an external power supply is used.

PARTS LIST

1 aluminium box 102mm × 54mm × 42mm
4 rubber feet for box
1 RCA socket, single hole mounting
1 3.5mm jack socket (see text)
1 5k linear potentiometer
1 5k log potentiometer
1 2.2k mini vertical trimpot
2 knobs
1 SPDT miniature toggle switch
1 9V battery, No 216
1 PC board, 68mm × 50mm, code 80B7
1 Murata ceramic filter SFB-455A
1 560uH RF choke
1 6-60pF Philips trimmer
2 BC548 transistors
1 BZX79C6V8 zener diode (see text)

RESISTORS (½ watt, 5%)
1 × 270k, 1 × 220k, 1 × 100k, 1 × 3.3k, 1 × 270 ohm (see text).

CAPACITORS
1 0.1uF metallised polyester
1 .001uF metallised polyester
1 470pF polystyrene or ceramic
1 100pF polystyrene

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible.

shortwave receiver. After all, the receiver was not really designed to accept such an add-on unit in the first place.

The first problem arises because the BFO signal is injected ahead of the detector, and finds its way into the AGC system. It thus generates an AGC signal of its own, thereby reducing the sensitivity of the receiver.

Theoretically, this problem could be overcome by disabling the AGC and fitting a manual RF/IF gain control, much as is done in communications style receivers. However, we would hesitate to encourage readers to attack the innards of their commercial receiver.

But don't worry too much about this. Even with the set in its original form, it should be possible to get acceptable results.

Getting the BFO to "inject" the right amount of signal into the receiver's IF is quite important. Too much BFO signal swamps or even blocks out incoming signals, while too little BFO signal will not do the job either.

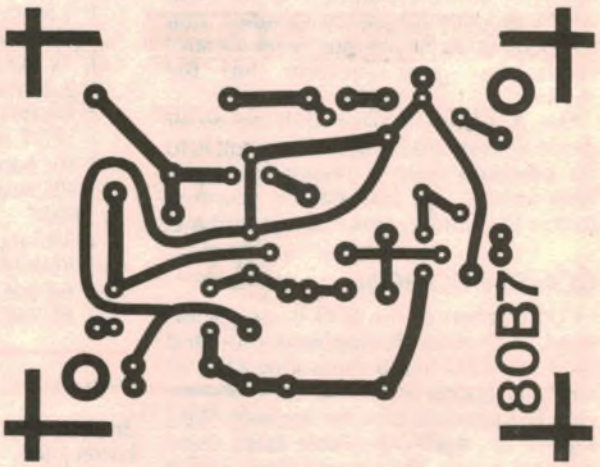
Note that although the RCA output socket provides for an earth lead, this should not be required. A length of insulated hookup wire connected to the centre pin of the plug should be quite sufficient, the actual length of the wire depending upon your experiments.

Above: view inside the prototype. Note that this unit is powered from its own 9V battery and has not been wired to accept an external plugpack supply.

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

$15

This includes sales tax and the battery but does not include the optional plugpack power supply.



Right: actual size reproduction of the PC artwork.

The simplest method involves connecting the lead from the BFO directly to the antenna terminal of the receiver. Alternatively, you could try wrapping the insulated lead from the BFO around the base of the telescopic antenna, or even winding a complete loop of wire around the receiver itself. In the latter case, the position of the loop should be adjusted for optimum results.

The best results are usually obtained by gaining access to the inside of the receiver. Without making electrical contact between the receiver and the lead from the BFO, try pushing the lead into the "works" near one of the IF transformers. Suitably adjusted, this method should give sufficient injection by radiation into the IF stages.

As already implied, the amount of injection can be controlled somewhat by varying the position of the output lead with respect to the relevant components of the receiver. We suggest that you arrange for sufficient injection for the strongest signals with the output level control at maximum. Then, for weaker signals, the output level can be easily reduced.

It should not be necessary to make a direct electrical connection to the detector circuit.

It should also be possible to use this unit to resolve SSB signals on many AM CB transceivers. On one unit we tested, all that was necessary was to tape the lead from the BFO to the copper side of the transceiver board, adjacent to the IF stage. SSB signals could then be resolved by careful adjustment of the output level and pitch controls.

Our observations indicate that the BFO signal should make the "S" meter read just over half scale for a satisfactory level of signal injection. Note also that the "delta tune" control, where fitted, can often be used to advantage in resolving SSB signals in conjunction with the BFO.

Finally, some readers may find that a ±2kHz BFO range is inadequate for resolving all SSB signals. If so, the range can be increased by suitable adjustment of the trimmer and the 2.2k trimpot. Depending on the receiver, it may also be necesary to increase or decrease the nominal output frequency. This can be done by respectively increasing or decreasing the value of the inductor.

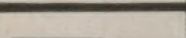
JUST WRAP™ WIRE WRAPPING TOOL

WHY CUT? WHY STRIP? WHY SLIT? WHY NOT JUST WRAP?

JW-1-B	BLUE WIRE
JW-1-W	WHITE WIRE
JW-1-Y	YELLOW WIRE
JW-1-R	RED WIRE

JUST WRAP REPLACEMENT ROLLS

R-JW-B	BLUE WIRE	50 ft. Roll
R-JW-W	WHITE WIRE	50 ft. Roll
R-JW-Y	YELLOW WIRE	50 ft. Roll
R-JW-R	RED WIRE	50 ft. Roll



UNWRAP TOOL FOR JUST WRAP

JUW-1	UNWRAPPING TOOL

JUST WRAP KIT

JWK-6	JUST WRAP KIT

"HOBBY" WIRE WRAPPING TOOL BATTERY POWERED

BW-2630	FOR AWG 26-30

Use "C" size NICAD Batteries, not included. Bits not included.

BT-30	BIT FOR AWG 30
BT-2628	BIT FOR AWG 26-28

HOBBY WRAP TOOLS

WSU-30	REGULAR WRAP
WSU-30M	MODIFIED WRAP

XURON CORP.

NEW

Cutters have a new patented shearing action

- Very thin profile
- Low operator fatigue
- Low cost
- Long life

TRI-COLOR DISPENSER

WD-30-TRI	TRI-COLOR DISPENSER
R-30-TRI	REPLACEMENT ROLLS

WIRE DISPENSER

WD-30-B	BLUE WIRE
WD-30-Y	YELLOW WIRE
WD-30-W	WHITE WIRE
WD-30-R	RED WIRE

DISPENSER REPLACEMENT ROLLS

R-30B-0050	30-AWG BLUE 50 FT. ROLL
R-30Y-0050	30-AWG YELLOW 50 FT. ROLL
R-30W-0050	30-AWG WHITE 50 FT. ROLL
R-30R-0050	30-AWG RED 50 FT. ROLL

*KYNAR-FENWALT

HOOK-UP WIRE

HK-18	18 AWG	25 FT.	SOLID CONDUCTOR
HK-20	20 AWG	25 FT.	SOLID CONDUCTOR
HK-22	22 AWG	50 FT.	SOLID CONDUCTOR
HK-24	24 AWG	50 FT.	SOLID CONDUCTOR
HK-26	26 AWG	50 FT.	SOLID CONDUCTOR
SHK-18	18 AWG	25 FT.	STRANDED CONDUCTOR
SHK-20	20 AWG	25 FT.	STRANDED CONDUCTOR
SHK-22	22 AWG	50 FT.	STRANDED CONDUCTOR
SHK-24	24 AWG	50 FT.	STRANDED CONDUCTOR
SHK-26	26 AWG	50 FT.	STRANDED CONDUCTOR

PRB-1 DIGITAL LOGIC PROBE

- DC to > 50 MHZ
- 10 Nsec. pulse response
- 120 K Ω impedance
- Automatic pulse stretching to 50 Msec.
- Automatic resetting memory
- Open circuit detection
- Automatic threshold resetting
- Compatible with all logic families 4-15 VDC
- Range extended to 15-25 VDC with optional PA-1 adapter
- Supply O.V.P. to + 70 VDC
- No switches/no calibration

PRB-1	DIGITAL LOGIC PROBE

PROTOTYPE BOARD CM-100

TERMINALS: 1,020 TEST POINTS. 188 separate 5 point terminals, plus 2 horizontal bus lines of 40 common test points each.

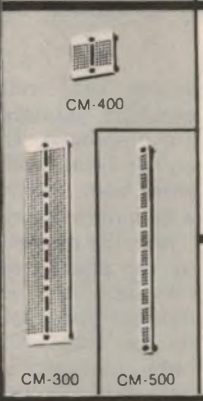
SIZE: 6½" Wide 5" Long.

CM-100	MODULAR PROTOTYPE BOARD

PROTOTYPE BOARD CM-200

TERMINALS: 630 TEST POINTS. 94 separate 5 point terminals, plus 4 bus lines of 40 common test points each. SIZE: 6" Wide, 3½" Long.

CM-200	MODULAR PROTOTYPE BOARD



PROTOTYPE BOARD CM-300, CM-400

CM-300 and CM-400 have two separated rows of five interconnected contacts each. Each pin of a DIP inserted in the strip will have four additional tie-points per pin to insert connecting wires. They accept leads and components up to .032 in. diameter. Interconnections are readily made with RW-50 Jumper Wire. All contact sockets are on a .100 in. square grid (1⅜ in. wide).

CM-300	MODULAR PROTOTYPE BOARD
CM-400	MODULAR PROTOTYPE BOARD

MODULAR BUS STRIP

CM-500 is a bus strip to be used in conjunction with CM-300 and CM-400 for distribution of power and common signed lines. Two separate rows of common terminals, grouped into clusters of five. All contact sockets are on a .100 in. square grid.

CM-500	MODULAR BUS STRIP

DIP IC INSERTION TOOLS WITH PIN STRAIGHTNER

Narrow profile. Pin straightener built into tool. Automatic ejector.

INS-1416	14-16 PIN DIP/IC INSERTER

MOS, CMOS-SAFE

GROUND STRAP NOT INCLUDED

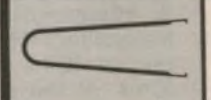
MOS-1416	14-16 PIN. MOS CMOS SAFE INSERTER
MOS-2428	24-28 PIN. MOS CMOS SAFE INSERTER

36-40 PIN CMOS-SAFE IC INSERTION TOOL

Aligns bent out pins. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

MOS-40	36-40 PIN CMOS SAFE INSERTION TOOL



DIP IC EXTRACTOR TOOL

Extracts all LSI, MSI and SSI devices of from 8 to 24 pins.

EX-1	EXTRACTOR TOOL

24-40 CMOS-SAFE EXTRACTOR TOOL

Removes 24-40 pin IC's, .600" centers. C-MOS safe. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

EX-2	CMOS SAFE EXTRACTOR TOOL

AMPEC ELECTRONICS PTY. LTD. 1 Wellington Street, Rozelle, 2039. Tel: (02) 818-1166

Available from: NSW David Reid Electronics, 29-6601. Radio Despatch Service, 211-0191. Martin De Launay, 29-5834. Applied Technology, 487-2711. **VIC.** Stewart Electronics, 534-3733. Ellistronics, 602-3282. **S. Aust.** Protronics, 212-3111. **W. Aust.** Reserve Electronics, 328-3116. Taimac Electronics, 328-1988 **QLD.** N.S. Electronics, 36-5061.

An acoustically-coupled modem for computers

One of the most satisfying aspects of personal computing is writing your own programs and exchanging these programs with other computing enthusiasts. Now we have made it easier to communicate: you can send your programs over telephone lines with our acoustically-coupled modem. It is simple to build and uses just a handful of readily available economical ICs.

by JOHN CLARKE

What is a "modem"? Modem is a contraction of the two words modulator demodulator. This describes the purpose of a modem. It is used to encode information in a format suitable for transmission over telephone lines and to decode incoming information.

Strictly speaking, the cassette interface found in most personal computers is also a type of modem. It also encodes and decodes information, in this case in a format suitable for storage on cassette tape.

Some modems are permanently connected to telephone lines. This is certainly the case for Telex (teletype) and document facsimile services. Large computer data networks also employ directly connected modems.

In less demanding applications or where only one telephone line is available, acoustically coupled modems are employed. These enable a user to communicate with a computer data network from anywhere, providing there is a telephone handy!

Now the modem has become available to personal computer users. Anyone may purchase a "Telecom approved" modem (more about this aspect later) for use with his or her personal computer. In operation, you dial your friend who must also have a modem and computer, and after some discussion (unintelligible to the computers) you each place your telephone handsets into the modems. The computers then begin to communicate. From this point, the operation is as simple as saving or loading a program from a cassette.

As with the cassette interface in most personal computers, all modems use a system of FSK, "frequency shift keying". But whereas the two frequencies used on cassette interfaces which conform to the "Kansas City Standard" are 2400Hz and 1200Hz (where a "1" is equivalent to 2400Hz and "0" is equivalent to 1200Hz), modems in Australia conform to the CCITT standard. This standard embraces so-called "full duplex" modems which can transmit and receive simultaneously.

The new "Electronics Australia" acoustically coupled modem can be described as "half-duplex" which means that it can either transmit or receive data and it can be switched from one mode to the other. But it cannot perform the

HOW THE CIRCUIT WORKS

The circuit of our modem can be broken down into four major sections: transmitter, receiver, interfaces and power supply. Perhaps it is easiest to understand if we begin by describing the transmitter section.

Five integrated circuits and three transistors make up the transmitter circuit and the heart is IC4 and IC5, two 555 timer ICs connected as monostables. When used as a monstable, the 555, upon being triggered, delivers a positive pulse from its output which lasts for a time determined by the resistance and capacitance associated with its threshold control, pin 6. After this time, the output stays low until the 555 is triggered once again.

In this circuit, both monostable timers are reset and triggered simultaneously. Why? Well, the idea is that one monostable, IC5, is the source of the high tones (1850Hz) while the other, IC4, is the source of the low tones (1650Hz). By having the monostables reset and triggered simultaneously, the two tones will be locked together and thus be easier to decode by the receiver circuits.

IC1 and transistor Q3 accomplish the resetting and triggering of IC4 and IC5 in a circuit arrangement which looks a little complex but is really fairly simple, as can be demonstrated by reference to Fig. 1: Waveform A is the data being transmitted; when A is high, the output of IC1a goes low, disabling IC1d. At the same time, IC1b and IC1c are enabled, so that they pass output signals from IC4 (waveform B) through a 180pF capacitor (waveform E) to transistor Q3. When the base of Q3 is pulled negative by waveform E, pins 5 of both monostables are pulled briefly low, which causes them to reset.

Shortly after resetting has occurred, pin 2 of both monostables also goes low. This triggers both monostables for a new cycle and the output of both (pin 3) reverts to the high state. So whenever waveform A is high, IC4 actually controls the resetting and triggering of both monostables and the resultant waveform B is fed through flipflop IC3a to become the transmitter waveform.

A similar process occurs when waveform A is low: IC1d and IC1c are now enabled so that the output from pin 3 of IC5 is coupled through to Q3 and pin 2 of both monostables. So when waveform A is low, IC5 controls the resetting and triggering of both monostables (waveform C). And when IC5 is in control, waveform B and C are identical; this means that even though waveform C is the desired frequency in the latter case, waveform B, fed to flipflop IC3a, gives the correct transmitter frequency (waveform D).

IC2d gates the transmitter signal through when the transmit switch is

This photograph shows the modem working in conjunction with a typical personal computer system.

on and IC2c, Q1 and Q2 buffer the signal to drive the loudspeaker. Flipflop IC3b and a LED give visual indication that the transmitter is working.

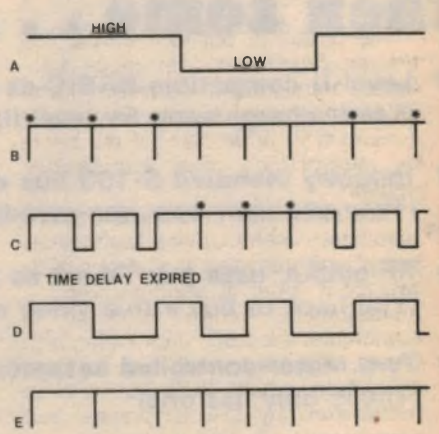
The receiver circuitry consists of a 4136 quad operational amplifier package, a 565 phase-locked loop and a 741 op. amp. A small loudspeaker is used as a microphone connected to a non-inverting amplifier, IC6c, with a gain of 101. The amplified signal from IC6c is filtered with a bandpass filter made up of two third-order Butterworth filters — a low-pass filter IC6b and high pass filter, IC6a. These filters provide minimum phase distortion.

Further amplification is provided by IC6d and the output from this is capacitively coupled to the phase-locked loop (PLL), IC7. The free-running frequency of the PLL is set to 1750Hz by the .033uF capacitor at pin 9 and the 4.7k trimpot and 1k resistor connected to pin 8.

The error voltage from the phase-locked loop is smoothed by a three-stage filter connected to pin 7 and then fed to a comparator, the 741 op amp, IC8.

When a logic "0" signal is received at pin 2 of IC7, the PLL will lock onto this causing the voltage-controlled oscillator of the PLL to suddenly shift from 1750Hz to 1850Hz. As this happens, the output signal from the phase comparator, pin 7 of IC7, becomes negative with respect to the reference voltage at pin 6 of the PLL. This potential difference will force the DC comparator, IC8, to swing negative and this output signal will be clamped at approximately −0.6V by D4 when the "0" is received.

Similarly, if a logic "1" signal is now received at pin 2 of IC7, the PLL will lock to 1650Hz, resulting in the phase comparator output becoming greater than the DC reference at pin 6 of IC7. So the voltage comparator, IC8 responds with a positive-going output voltage clamped at about +5V. Thus the IC8 output is compatible with TTL levels.



*TIMER CAUSING RESET AND TRIGGER WAVEFORM 'E'

FIG. 1

(continued on p69)

WHY IS THIS AUSTRALIA'S FASTEST SELLING COMPUTER?

SIMPLE:
IT IS FAR AND AWAY THE BEST VALUE COMPUTER IN AUSTRALIA

It has everything the TRS-80 has, and then some . . .

- **Level II compatible BASIC as standard**
  (Tandy charge extra for level II)
- **Industry standard S-100 bus expansion**
  (They use their own non-standard system)
- **RF output: uses any TV set as a monitor**
  (You have to buy a true video monitor)
- **Two motor-controlled cassette interfaces**
  (Theirs only has one)
- **Inbuilt cassette deck (no inter-connections)**
  (Their cassette is completely separate)
- **Inbuilt power supply (no inter-connections)**
  (Tandy power supply has to be connected up).
- **AND THE BEST PART OF ALL: IT IS MUCH CHEAPER THAN THE TANDY EQUIVALENT**

DICK SMITH

SYSTEM 80

Not only the best value, but the lowest price!!!

ONLY $670.00

4k RAM MODEL, CAT X-4003

WITH LEVEL II BASIC

Compare the System 80 with the TRS-80. Notice the additional features. Then notice the lower price. Which would you choose?

	PARAMETER	SYSTEM-80	TRS-80 (level I)	TRS-80 (level II)
1	CPU type	Z-80	Z-80	Z-80
2	Speed	1.7MHz	1.7MHz	1.7MHz
3	Amount of RAM	16K	16K	16K
4	Built-in cassette recorder	Yes	No	No
5	Built-in video modulator	Yes	No	No
6	Capacity of BASIC ROM	12K	4K	12K
7	Type of BASIC supplied	Microsoft 12K Floating point	Floating point	Microsoft 12K Floating point
8	RAM expansion on-board to:	16K	16K	16K
9	Machine language programs accessible from executing BASIC programs	Yes	No	Yes
10	Full ASCII characters	Upper case only	Upper case only	Upper case only
11	Programmable graphics characters	No	No	No
12	Graphics resolution (dots)	8192	8192	8192
13	Mixed graphics/text – any format	Yes	Yes	Yes
14	Text format	16 lines x 64 or 32	16 lines x 64	16 lines x 64 or 32
15	Number of cassette interfaces	2	1	1
16	Baud rate	500	250	500
17	Time to load 8k program	2 min 30 sec	4 min 50 sec	2 min 30 sec
18	Cassette file names	Yes	No	Yes
19	Number of cassette recorders	2	1	1
20	Motor control for cassette recorders	Yes (2)	Yes (1)	Yes (1)
21	Number of string variables	930	2	930
22	Maximum length of string variables	255	16	255
23	S-100 compatible (with expansion unit)	Yes	No	No
24	Supports disc drive system	Yes	Yes	Yes
25	**Cost of basic unit with 16K RAM including monitor and cassette recorder**	**$899.50***	**$989.00**	**$1169.00**

* This price includes the monitor shown above. However, as the System 80 does not need a video monitor, if you have a surplus B&W TV set you can save another $149.50 – making the savings over the Tandy system even more dramatic!

TAX SAVINGS:

If you're buying your System 80 for business usage, you're probably eligible for the 20% investment allowance and generous depreciation allowances – making the System 80 even cheaper in the long run!

TERMS:

To approved personal applicants, we offer terms from a low 10% deposit and less than $25 per month (over 48 months). We also accept Bankcard, Mastercharge and Visa credit cards.

MAIL ORDER CUSTOMERS:

We'll send your System 80 anywhere in Australia for just $6.00 extra by road freight: that's less than what it costs us! And yes, you can order by phone: quote your Bankcard No.

DICK SMITH

SYSTEM 80

16K MODEL

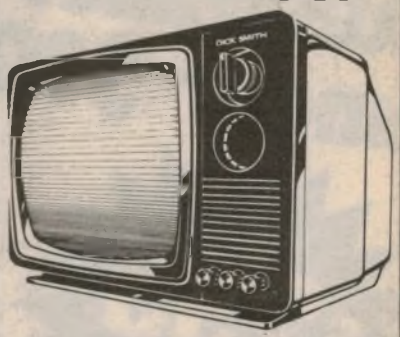
ONLY $750

(WITH LEVEL II BASIC)

Cat X-4005

SEE US AT THE MELBOURNE HOME COMPUTER SHOW (16 – 19 OCTOBER)

DICK SMITH MONITOR



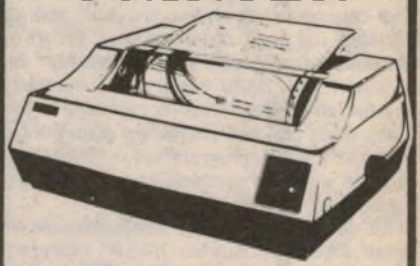
Haven't got an old TV? This 30cm monitor will give you clear, jitter-free viewing at a modest price. **And it works with all micro-computers available!**

Don't pay high prices for 'brand name' monitors when they'll perform no better! 240V AC or 12V DC operated, single 'RCA' type connection to your computer video output. And look at the price:

$149.50!

Cat X-1196

DICK SMITH PRINTER



Compare the features: and the price. 9x7 dot matrix with 240mm print, at 125cps! For the best in low cost printers, you can't go past the Itoh 8300P™. Cat X-3255

$970.00!

NOTE: This printer does NOT need an expansion interface; however you will need an X-4012 printer cable (@$89.50) to connect to the computer.

DICK SMITH ELECTRONICS

NSW	125 York Street,	SYDNEY	Ph 290 3377
	147 Hume Highway,	CHULLORA	Ph 642 8922
	162 Pacific Highway,	GORE HILL	Ph 439 5311
	30 Grose Street,	PARRAMATTA	Ph 683 1133
	613 Princes Highway,	BLAKEHURST	Ph 546 7744
	263 Keira Street,	WOLLONGONG	Ph 28 3800
VIC	399 Lonsdale Street,	MELBOURNE	Ph 67 9834
	656 Bridge Road,	RICHMOND	Ph 428 1614
QLD	166 Logan Road,	BURANDA	Ph 391 6233
	842 Gympie Road,	CHERMSIDE	Ph 59 6255
ACT	96 Gladstone Street,	FYSHWICK	Ph 80 4944
SA	60 Wright Street,	ADELAIDE	Ph 212 1962
WA	414 William Street,	PERTH	Ph 328 6944

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113 Ph 888 3200 PACK & POST EXTRA

SHOPS OPEN 9AM to 5.30PM (Saturday: 9am till 12 noon) BRISBANE: Half hour earlier.
ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY
RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA

Australia's first under $300 COMPUTER...

$295 INCL. ZX80 BASIC MANUAL

Remember — *all prices shown include sales tax, postage and packing.*
N.B. Your Sinclair ZX80 may qualify as a business expense.

sinclair ZX80 -British made.

Until now, building your own computer could cost you around $600 — and still leave you with only a bare board for your trouble. The Sinclair ZX80 changes all that. For just $295 you get **everything** you need including leads for direct connection to your own cassette recorder and television. The ZX80 really is a complete, powerful full-facility computer matching or surpassing other personal computers costing much more. The ZX80 is programmed in BASIC and you could use it for anything from chess to running a power station.

Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. **The unique Sinclair BASIC interpreter:** offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

Excellent string handling capability — takes up to 26 string variables of any length. All strings can undergo all rational tests (e.g. comparison). The ZX80 also has string input to request a line of text; strings do **not** need to be dimensioned. Up to 26 single dimension arrays. FOR/NEXT loops nested up to 26. **Variable names** of any length. BASIC language also handles full Boolean arithmatic, conditional expressions, etc.

Exceptionally powerful edit facilities, allows modification of existing program lines. **Randomise function,** useful for games and secret codes. **Timer under program control.** PEEK and POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine. **High resolution graphics** with 22 standard graphic symbols. **The Sinclair teach-yourself-BASIC manual** 96 page book **free** with every kit.

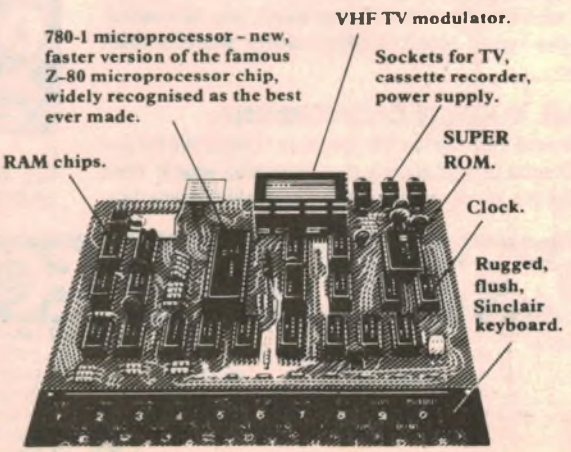
Fewer chips, compact design, volume production means MORE POWER FOR YOUR DOLLAR! The ZX80 owes its low price to its remarkable design: the whole system is packed onto fewer, newer more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system and monitor. And the ZX80's 1K byte RAM is roughly equivalent to 4K bytes in a conventional computer because the ZX80's brilliant design packs the RAM so much more tightly. (Key words occupy just a single byte). You can add to the memory via the expansion port, giving a maximum potential of 16K.

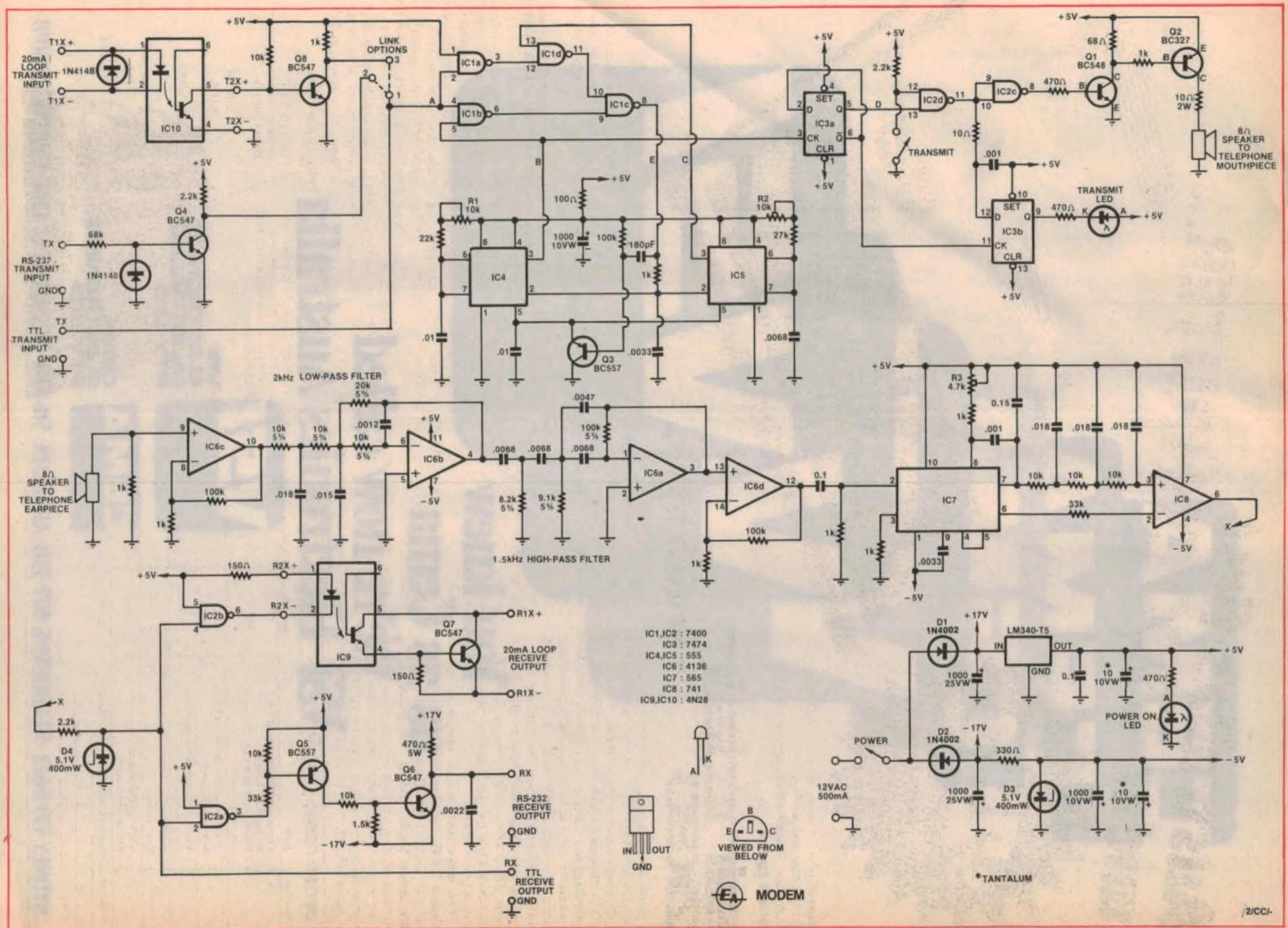
ORDER FORM: SINCLAIR EQUIPMENT (AUSTRALASIA) PTY. LTD.
308 High St., Kew 3101. Vic. Tel. 861 6224.

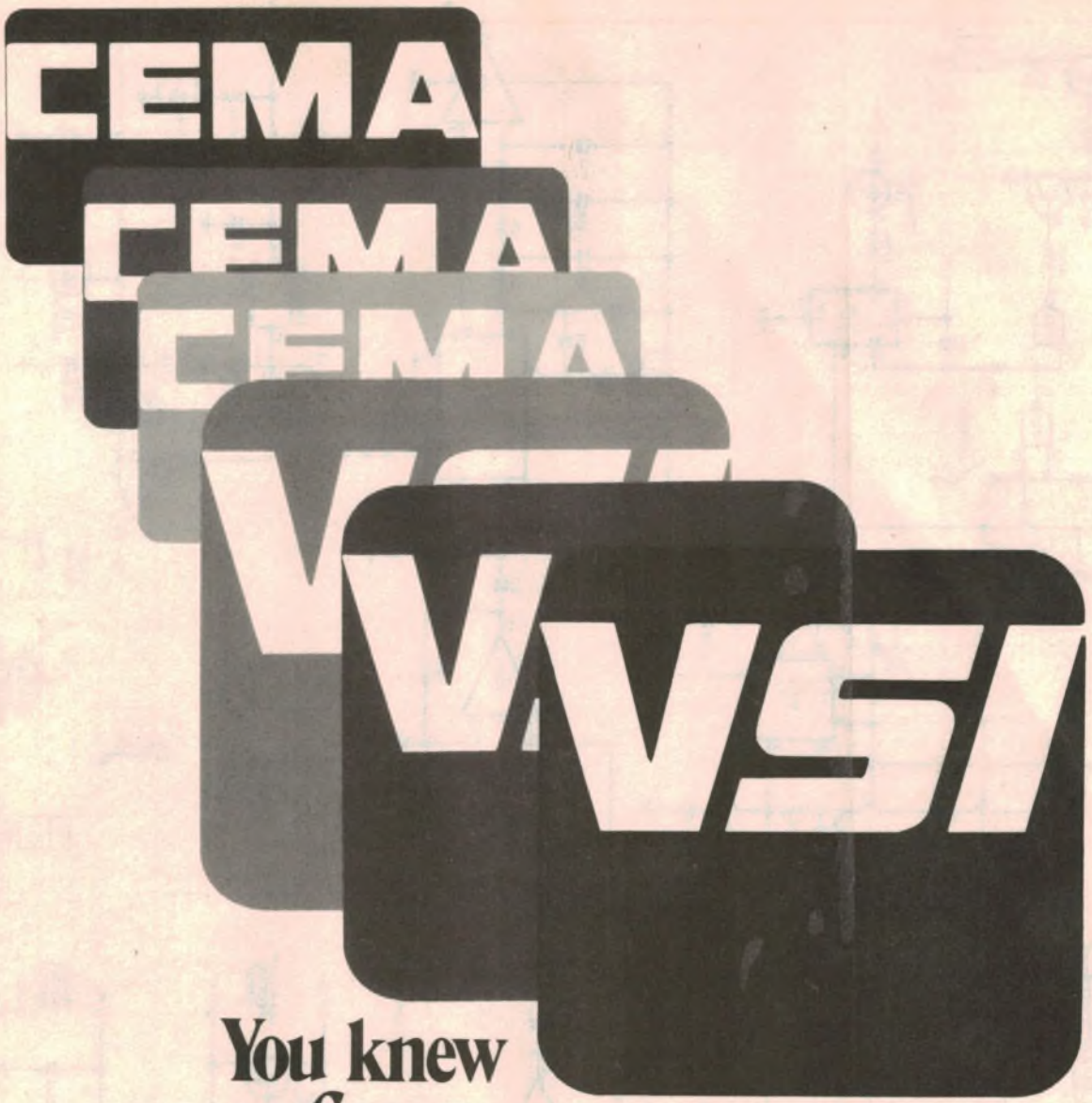
Quantity	Item	Item Price	Total
	Ready-assembled Sinclair ZX80 Personal Computer(s). Price incl. ZX80 BASIC manual, excl. mains adaptor.	$295.00	
	Mains Adaptor(s) (600Ma at 9V DC nominal unregulated).	$ 9.50	
	Memory Expansion Board(s) takes up to 3K bytes.	$ 28.50	
	RAM Memory chips — standard 1K bytes capacity.	$ 10.00	
	Sinclair ZX80 Manual(s) free with every ZX80 computer.	$ 15.00	
I enclose cheque/Bankcard/Diners Club/Amex		TOTAL	

Name _____ EA1

Address _____ Postcode _____




T1X+
20mA LOOP TRANSMIT INPUT
T1X−
1N4148
IC10
T2X+
T2X−
+5V
10k
Q8 BC547
1k
LINK OPTIONS
IC1a
IC1b
IC1c
IC1d
A
B
C
E
IC3a
SET
D
CK
CLR
Q
+5V
2.2k
Q4 BC547
TX
68k
RS-232 TRANSMIT INPUT
GND
TTL TRANSMIT INPUT
R1 10k
R2 10k
22k
IC4
IC5
100Ω
1000 10VW
100k
180pF
1k
27k
.01
.0033
.0068
Q3 BC557
2kHz LOW-PASS FILTER
20k 5%
.0012
10k 5%
IC6c
IC6b
IC6a
IC6d
.0047
.0068
8.2k 5%
9.1k 5%
100k 5%
100k
.018
.015
8Ω SPEAKER TO TELEPHONE EARPIECE
1.5kHz HIGH-PASS FILTER
IC7
IC8
R3 4.7k
0.15
.001
.018
33k
0.1
.0033
X
−5V
−17V
150Ω
R2X+
R2X−
IC2b
IC9
Q7 BC547
R1X+
R1X−
20mA LOOP RECEIVE OUTPUT
150Ω
IC1,IC2 : 7400
IC3 : 7474
IC4,IC5 : 555
IC6 : 4136
IC7 : 565
IC8 : 741
IC9,IC10 : 4N28
D1 1N4002
LM340-T5
IN
OUT
GND
1000 25VW
10 10VW
470Ω
POWER ON LED
POWER
D2 1N4002
330Ω
12VAC 500mA
D3 5.1V 400mW
D4 5.1V 400mW
Q5 BC557
Q6 BC547
470Ω 5W
10k
33k
1.5k
.0022
IC2a
RX
RS-232 RECEIVE OUTPUT
TTL RECEIVE OUTPUT
GND
A
K
IN
OUT
GND
B
E
C
VIEWED FROM BELOW
*TANTALUM
MODEM
Q2 BC327
Q1 BC548
68Ω
10Ω 2W
8Ω SPEAKER TO TELEPHONE MOUTHPIECE
IC2c
IC2d
470Ω
10Ω
TRANSMIT
TRANSMIT LED
IC3b
/2/CC/-



You knew us as Cema We're now called VSI Electronics Australia

VSI ELECTRONICS (AUSTRALIA) PTY LTD

CEMA ELECTRONICS PTY LTD

SYDNEY 439 8622 MELBOURNE 877 5311 ADELAIDE 516 483 BRISBANE 52 4261 PERTH 328 8091

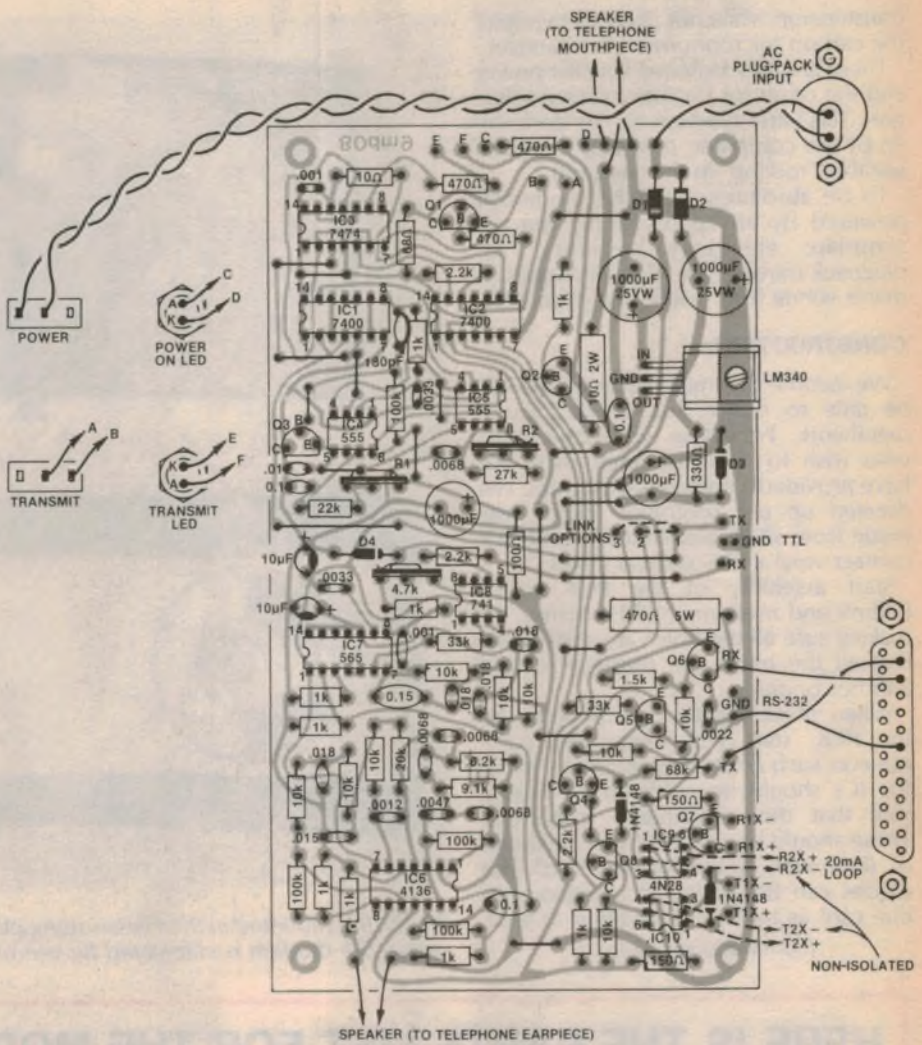
transmit and receive modes simultaneously. Therefore, our new modem uses the following two frequencies for encoding (decoding) the digital values of "1" and "0": 1650Hz and 1850Hz, respectively.

As such, this modem is suitable for serial data transmission rates up to 300 Baud. We'll explain these terms: "Serial" data transmission refers to data transmission one "bit" at a time over one signal line; as opposed to serial communication, parallel data transmission refers to a method whereby eight "bits" are transmitted at a time, over eight separate lines (for a typical "eight-bit" microprocessor).

One baud is equal to one bit/second. 300 baud is equal to 300 bits/second and corresponds to an audio frequency of 150Hz. So what happens in this FSK system is that the transmitted digital data causes the modem to switch between the two designated frequencies, 1650Hz and 1850Hz, at a rate of 150Hz. The result is unholy bedlam and not fit to listen to – but it can make sense to another modem and computer!

Where serial ports (interface) are provided on personal computers they generally conform to one of three standards (as far as voltage levels and source and load impedances are concerned): RS-232, 20mA loop or TTL (ie, 5V logic levels). Naturally, our new modem is compatible with all of these.

(Some personal computers do not have a serial port, notably the Tandy TRS-80 and Dick Smith System-80. At some time in the next few months we shall feature a suitable adapter for these two computers, so that these too, can be used with a modem such as this.)



The component overlay diagram shows the modem wired for standard RS-232 operation. Provision has also been made for 20mA loop and TTL level interfaces.

WHAT IT LOOKS LIKE:

Our modem is designed to be easy to build as well as easy to use. This meant that we had to design metalwork which could be fabricated relatively easily while still producing a unit compatible with the "difficult" shape of a standard telephone handset.

Consequently, our modem has a simple U-shaped chassis and cover assembly which is held together with eight self-tapping screws. On top are two foam plastic pads, each with a circular cutout to closely fit the mouthpiece or earpiece of a standard telephone handset. Under each of these cutouts, mounted underneath a grille (or pattern of holes) is a miniature loudspeaker. One of these is used as a microphone, to "listen" to the telephone earpiece.

The other loudspeaker "drives" the telephone mouthpiece at loudness which, while it is unpleasant to the human ear, is adequate for reliable

How the circuit works . . . ctd from p63

As mentioned previously, we have incorporated 20mA loop and RS-232 serial interfaces. TTL-compatible input and output can be directly used as the receive/transmit signals or the serial interfaces can be used. The receive interfaces are directly connected to the TTL output from IC8. The transmit interfaces on the other hand need to be selected with the linking options shown.

Some explanation is necessary for the 20mA loop interface. We have provided for an opto-coupler in this circuitry, however, some computers with the 20mA loop interface will already have opto-couplers. In this case, the opto-couplers should be removed and the transmit/receive connections made to the Rx2 and Tx2 positions shown on the overlay.

Power supply for the modem uses a plugpack transformer to drive positive and negative half-wave rectifiers, D1 and D2, which feed 1000uF/25VW filter capacitors and thence positive and negative 5V regulators. The positive 5V regulator is a three-terminal regulator, LM340-T5 (or A7805) while the negative regulator, which supplies a very light load, is a 330 ohm resistor and 5.1V zener diode. The output from the half-wave rectifiers also provides nominal ±17V rails for the RS-232 interfaces.

transmission while not likely to overload the carbon microphone in the handset.

There are two switches, one for power and the other for transmit/receive selection. This latter function can be performed by the computer, provided there is a suitable "routine" in the program.

To be absolutely safe, the modem is powered by an approved (by the appropriate electricity authority) AC plugpack transformer. This eliminates all mains wiring from within the modem.

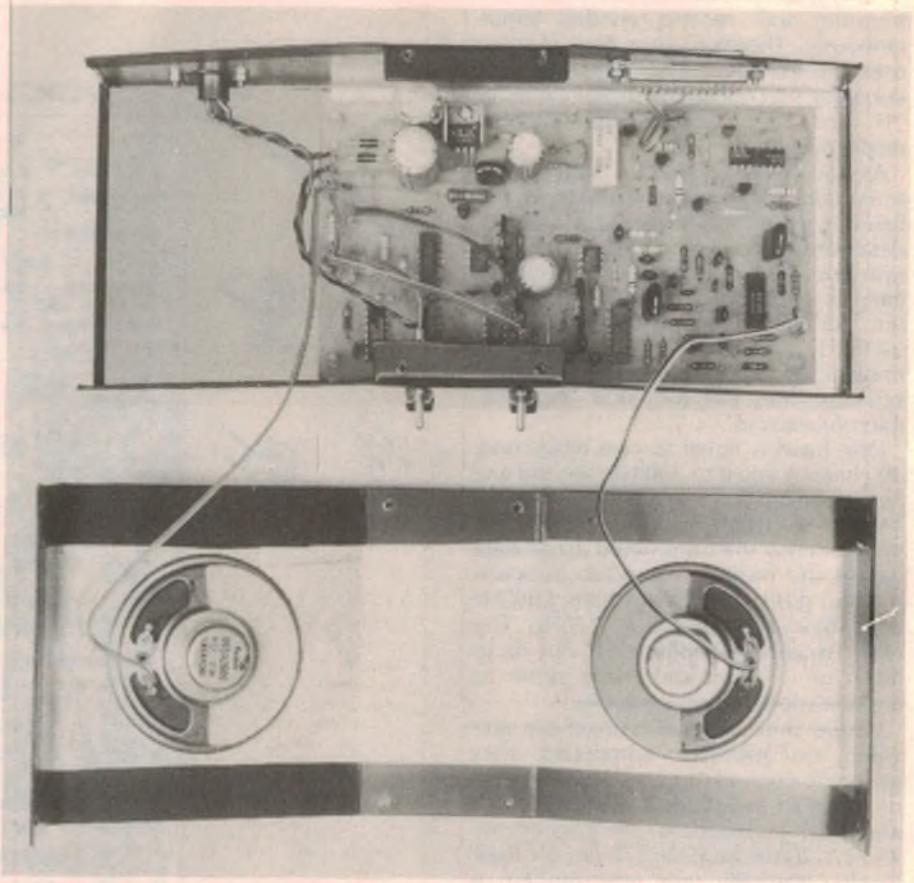
CONSTRUCTION:

We assume that most constructors will be able to obtain kits which include metalwork. For those who cannot or who wish to make up their own, we have provided a metalwork diagram. We dressed up our prototype which was made from sheet aluminium, with black contact vinyl and Scotchcal labels.

Start assembly of the PCB coded 80dm9 and measuring 170 x 95mm, by making sure all the holes are drilled and that all the tracks are properly etched and not bridging.

When mounting the components on the PCB, start with the small components such as resistors and links. Next, the ICs should be soldered in making sure that their orientation is correct. These should be soldered in a minimum of time with a fine tipped iron. The diodes can be placed in position with due care as to their orientation as well.

(continued on p74)



The PCB is mounted in the chassis using plastic snap-on board supports. Mains wiring within the modem is eliminated by use of an external 12VAC plugpack supply.

HERE IS THE PARTS LIST FOR THE MODEM

2 SPDT switches
2 57mm 8 ohm speakers
2 red LEDs and bezels
1 PC board, 170 x 95mm, coded 80dm9
1 DB-25S female panel mount socket
1 12VAC 500mA AC plugpack, Ferguson PPB 12/500
2 pads foam rubber 110 x 105 x 20mm thick
1 panel-mounting two-pin DIN socket
4 Richco plastic board supports
1 metal case (see text)
2 Scotchcal labels

SEMICONDUCTORS
2 7400 quad nand gates
1 7474 dual-D flipflop
2 555 Timers
1 4136 quad op. amp
1 741 op. amp.
1 565 phase-locked loop
1 LM340T5 5-volt regulator
2 1N4002 rectifier diodes
2 5.1 volt 400mW zener diodes
1 BC547, 548 NPN transistor
1 BC557 PNP transistor
1 BC327 PNP transistor

CAPACITORS
2 1000uF/25VW PC electrolytic
2 1000uF/10VW PC electrolytic
2 10uF/16VW tantalum
1 180pF ceramic
1 0.15uF greencap
2 0.1uF greencap
1 .015uF greencap
4 .018uF greencap
3 .01uF greencap
4 .0068uF greencap
1 .0047uF greencap
2 .0033uF greencap
1 .0012uF greencap
2 .001uF greencap

RESISTORS (¼W, 5% unless otherwise noted): 4 x 100k, 1 x 33k, 1 x 27k, 1 x 22k, 1 x 20k, 6 x 10k, 1 x 9.1k, 1 x 8.2k, 2 x 2.2k, 8 x 1k, 3 x 470 ohms, 1 x 330 ohms, 1 x 100 ohms, 1 x 68 ohms, 1 x 10 ohms, 1 x 10 ohms 2W, 1 x 4.7k vertical trimpot, 2 x 10k vertical trimpots.

INTERFACES
20mA loop:
2 4N28, TIL116 optocoupler
2 BC547 NPN transistors
1 1N4148 diode
1 x 10k ¼W, 1 x 1k ¼W, 2 x 150 ohm ¼W.

RS-232:
2 BC547 NPN transistors
1 BC557 PNP transistor
1 1N4148 diode
1 .0022uF metallised polyester capacitor (greencap)
1 x 68k ¼W, 2 x 10k ¼W, 1 x 33k ¼W, 1 x 2.2k ¼W, 1 x 1.5k ¼W, 1 x 470 ohm 5W.

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.

MICRO-80 PRODUCTS
FOR TRS-80 AND SYSTEM '80 MICROCOMPUTERS

77 TRACK DISK DRIVES
DOUBLE YOUR CAPACITY

DD-7S $775
Micropolis Floppy Disk, 77 Track, 100% larger capacity than most mini-floppy drives, complete with cable, power supply, chassis, and includes NEWDOS '80.

DD-7 ... ... $649
Same as above but no cable or Newdos '80.

DC-4 ... ... $45
4 drive connector cable.

★ ★ SPECIAL ★ ★
MPI DISK DRIVES ONLY $339!!

40 track bare drive for TRS-80. Only requires readily available 5 volt 0.7 amp and 12 volt 1 amp power supply to be up and running. Can be mounted in simple cabinet or used bare.

DISKETTES FOR TRS-80

GREENCORP ... ... $4.50 ea
VERBATIM 77 TRACK ... $7.99 ea
Minimum Order 10

EXATRON STRINGY FLOPPY
$352.50 incl p&p

15 times faster than cassette, infinitely more reliable. Completely under computer control, the stringy floppy is easier to use than disks and is a very much cheaper alternative. Will save and load any L2/16K software. Special software also available.

Wafers for Stringy Floppy
$3.50 ea. Any Size

MICRO-80 MAGAZINE

ANNUAL SUBSCRIPTION ... $24.00
Monthly Magazine dedicated to TRS-80 and System '80 users. Every issue contains at least 6 new programs, plus problem solving columns, hardware articles, readers' letters, hints, etc., etc.

FREE SOFTWARE OFFER

$40 WORTH OF SOFTWARE FOR TRS-80 AND SYSTEM '80 WITH EVERY NEW SUBSCRIPTION TO MICRO-80!
Every new subscriber will receive on cassette, ready to load, 3 x Level I and 3 x Level II programs (includes our fabulous household budget program), with a regular retail value of at least $40.

16K MEMORY EXPANSION KIT
ONLY $97 incl. p&p

These are prime, branded, 200 ns (yes, 200 ns!) chips. You will pay much more elsewhere for slow, 350 ns. chips. Ours are guaranteed for 12 months. A pair of DIP shunts is also required to upgrade the CPU memory – these cost an additional $4.00. All kits come complete with full, step-by-step instructions, no soldering is required. You don't have to be an electronic type to instal them.

THE FABULOUS
NEWDOS 80
IN STOCK NOW!

ND-80 ... ... $149
The disk operating system that gives:
- New basic commands that support variable record lengths up to 4095 bytes long.
- Mix or match disk drives – supports any number of tracks from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
- A security boot-up for basic or machine code programs. User never sees "Dos-ready" or "Ready" and cannot "break" clear screen or issue any direct basic statement including "List" . . . . . and much, much more

ND-35+ $99
Newdos+ for 35 track drives

ND-40+ $110
Newdos+ for 40 track drives

BOOKS

LEVEL II ROM REFERENCE MANUAL
$24.95 plus $1.20 p&p
Produced in Australia by MICRO-80, this book is a must for the machine language programmer or for the BASIC programmer who wants to understand how the BASIC interpreter works. Over 70 pages packed full of useful information and sample programs. Applies to both TRS-80 and SYSTEM 80.

TRS-80 DISK AND OTHER MYSTERIES
$24.95 plus $1.20 p&p
The hottest selling TRS-80 book in the USA. Disk file structures revealed, DOS's compared and explained, how to recover lost files, how to rebuild crashed directories – this is a MUST for the serious Disk user.

INTRODUCTION TO T-BUG
$12.50 plus $1.20 p&p
Describes in detail how to use Tandy's T-bug. Each command explained and discussed in detail with examples. A must for the T-Bug user.

AUSTRALIAN SOFTWARE

BMON (L2/16K) $19.95 plus 50c p&p
The ultimate program to assist BASIC programmers.

TOUCHTYPE (L2/4K) $19.95 plus 50c p&p
22 lessons to teach you to type on your own keyboard and screen!

RPN CALCULATOR (L2/16K & 32K)
$14.95 plus 50c p&p
Turns your computer into a $600 calculator. Ideal for Architects, Surveyors, Engineers, Teachers, Scientists, etc.

U-BOAT (L2/16K) $7.50 plus 50c p&p
You're the Commander, read all the guages, fire the torpedoes, crash dive, get the enemy before his depth charges get you!!

MMM-1 GAMES PACK (L2/4K)
$7.50 plus 50c p&p
3 fast moving games – INDY 500, SUB-HUNT, KNIEVEL

MMM-2 GAMES PACK (L2/4K)
$7.50 plus 50c p&p
3 more games with fast moving graphics – TANK, THIEF, SHOOTOUT

PROGRAMS BY MICROSOFT

BASIC COMPILER $210
Converts Level II basic programs to machine code, automatically. A compiled program runs, on average, 3-10 times faster than the original basic program.
(Requires 48K One Disk)

DISK EDITOR ASSEMBLER
Save $30 ... ... ONLY $109
Supports macros, linking loader, editor, cross reference.
(Requires 32K One Disk)

ADVENTURE ON DISK ... $37.15
This game fills an entire diskette. Endless variety and challenge as you seek to rise to the level of Grand Master (until you gain skill, there are whole areas of the cave that you cannot enter).
(Requires 32K One Disk)

EDITOR ASSEMBLER-PLUS ... $41.15
A much improved editor assembler and debug/monitor for L2/16K machines. Assembles directly into memory, supports macros and conditional assembly, includes new commands – substitute, move, copy and extend.

LEVEL III BASIC $59.95
Loads on top of Level II Basic and gives advanced graphics, automatic renumbering, single stroke instructions (shift-key entries), keyboard debounce. Suitable for L2/16K and up. (Not Disk Basic).

SCOTCH BRAND PERSONAL COMPUTING CASSETTES
C-10 pack of 10 . . . $26.00 incl. p&p
C-30 pack of 10 . . . $28.00 incl. p&p

To: MICRO-80 (08) 272 0966
P.O. Box 213, Goodwood, S.A. 5034

Please rush me the items checked below:

☐ 12 month subscription to MICRO-80 and my free software cassette $24.00

☐ 12 month subscription to MICRO-80 and the cassette edition, plus my free software cassette $60.00

☐ The lastest issue of MICRO-80 $2.50

PLUS THE ITEMS LISTED BELOW

DESCRIPTION	PRICE
TOTAL ENCLOSED	

Name .....

Address .....

..... Post Code .....

bankcard welcome here No .....

Please debit my Bankcard $ .....

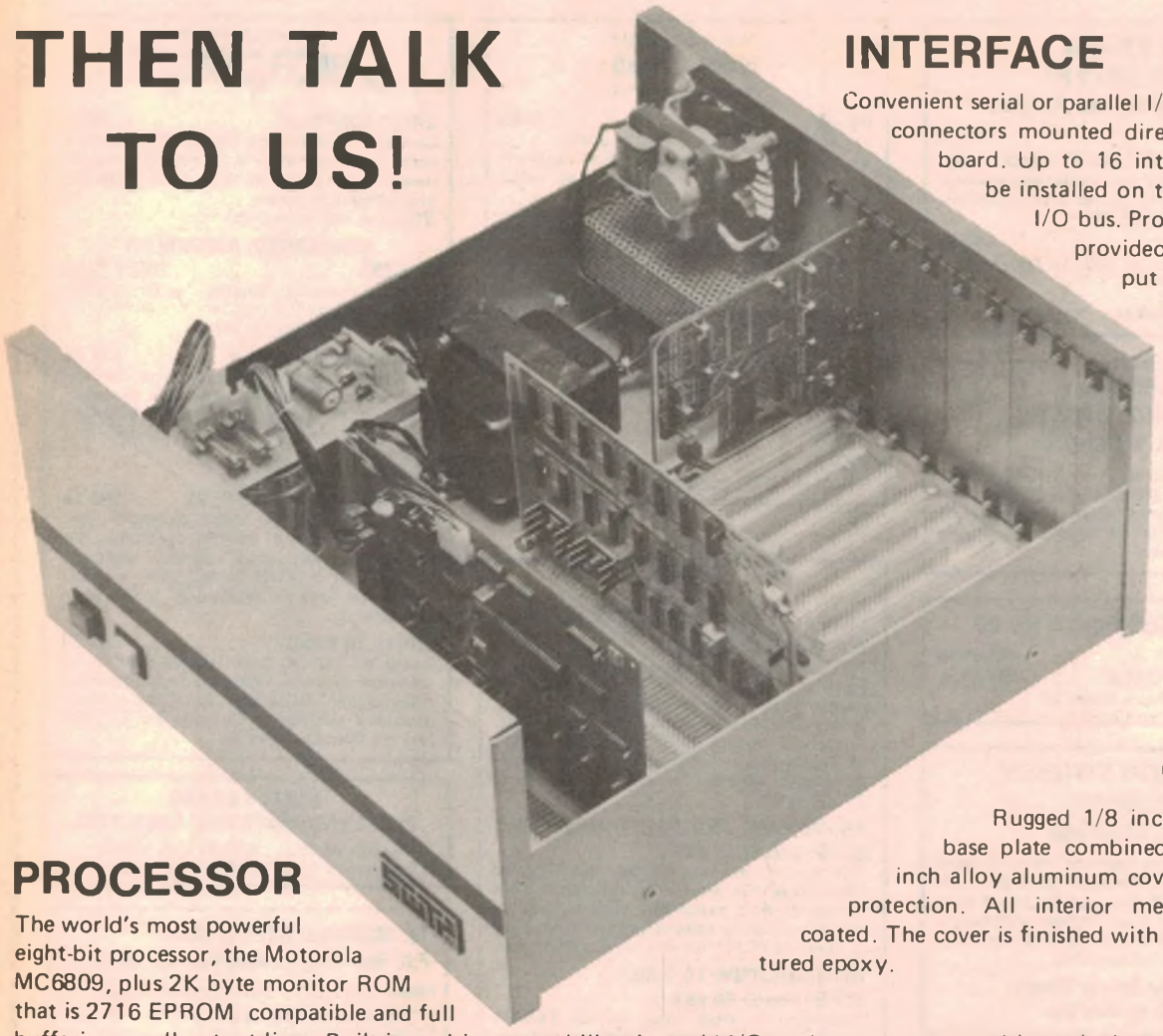
Expiry date .....

Signature .....

EA

ARE YOU READY TO OWN A 6809

THEN TALK TO US!



INTERFACE

Convenient serial or parallel I/O cards have DB-25 connectors mounted directly on the circuit board. Up to 16 interface devices may be installed on the address decoded I/O bus. Programming strips are provided for input and output baud rate selection on each port. All outputs are fully buffered.

CABINET

Rugged 1/8 inch alloy aluminum base plate combined with a solid 1/8 inch alloy aluminum cover for unsurpassed protection. All interior metal is conversion coated. The cover is finished with a super tough textured epoxy.

PROCESSOR

The world's most powerful eight-bit processor, the Motorola MC6809, plus 2K byte monitor ROM that is 2716 EPROM compatible and full buffering on all output lines. Built-in multiuser capability, just add I/O cards to operate a multi-terminal system.

MEMORY— You can purchase the computer with either 8K bytes of RAM memory (expandable to 56K), or with the full 56K. The efficient, cool running dynamic memory used in this system is designed and manufactured for us by "Motorola Memory Systems Inc."

PERIPHERALS—The wide range of peripheral hardware that is supported by the 6809 includes: dot matrix printers (both 80 and 132 column), IBM Electronic 50 typewriter, daisy wheel printers, 5-inch floppy disk system, 8-inch floppy disk systems and a 16 megabyte hard disk.

SOFTWARE— The amount of software support available for the 6809 is incredible when you consider that it was first introduced in June, 1979. In addition to the FLEX9 operating system, we have a Text Editor, Mnemonic Assembler, Debug, Sort-Merge, BASIC, Extended BASIC, MultiUser BASIC, PASCAL and PILOT.

69/K Computer Kit with 8K bytes of memory	**$ 660**
69/A Assembled Computer with 8K bytes of memory	**$ 760**
69/56 Assembled Computer with 56K bytes of memory	**$1660**

Prices + Sales Tax if Applicable

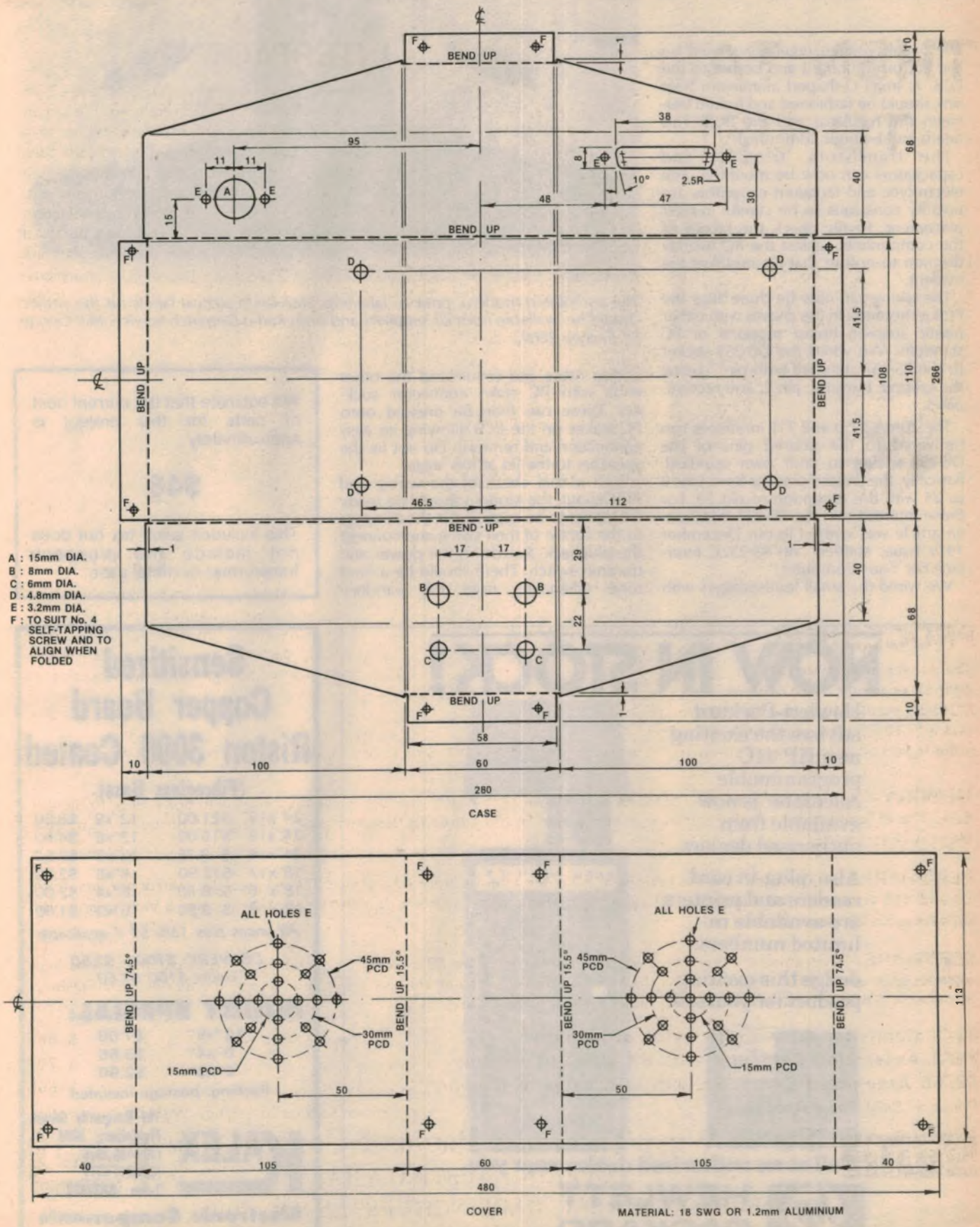
Prices Subject to Change Without Prior Notice.

SWTPC

SOUTH WEST TECHNICAL PRODUCT CORPORATION
(COVERING AUSTRALASIA)
7a BURTON STREET, DARLINGHURST, N.S.W. 2010.
P.O. BOX 380 DARLINGHURST N.S.W. 2010. PHONE (02) 31 3273

Acoustically-coupled modem

METALWORK DIAGRAM



This diagram is for readers who prefer to make their own metalwork. 18 SWG or 1.2mm aluminium is recommended.

The 5 volt voltage regulator should be laid flat on the board and bolted to the PCB. A small U-shaped aluminium heat sink should be fashioned and bolted between the regulator and the PCB. This needs to be about 10mm high.

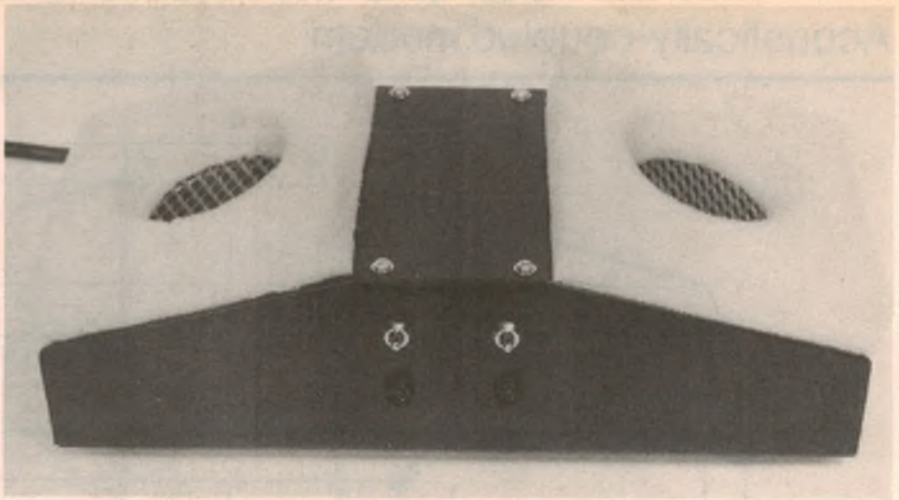
The transistors, trimpots and capacitators can now be mounted. The electrolytic and tantalum capacitors are polarity conscious so be careful in their placement. Finally check the layout of the components against the PC overlay diagram to ensure that no mistakes are evident.

The wiring can now be done after the PCB is mounted in the chassis with either plastic snap-on board supports or PC standoffs. We wired the DB-25S socket to the RS-232 standard with pin 7 being the ground; transmit, pin 2; and receive, pin 3.

The 20mA loop and TTL interfaces can be wired to the unused pins of the DB-25S socket to your own standard. Basically, the unused pins are from pins 9 to 25 with the exception of pin 20. For those interested in the RS-232 interface, an article was written in our December 1979 issue, entitled "An RS-232C Interface For Your Computer."

We wired the small loudspeakers with ribbon cable and terminated the other ends with PC stake connector sockets. These can then be pressed onto PC stakes on the PCB allowing an easy connection and removal. Do not fix the speakers to the lid at this stage.

With a final check of the wiring and PCB layout, the Modem should be ready for power to be applied. Set the trimpots to the centre of their swing and connect the plugback. Switch on the power and transmit switch. There should be a loud tone emanating from the earpiece



The completed modem, prior to labelling. Stick-on Scotchcal labels for this project should be available from kit suppliers and from Radio Despatch Service, 869 George St, Sydney 2000.

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

$48

This includes sales tax but does not include the plugpack transformer or metal case.

ROD IRVING ELECTRONICS
425 HIGH ST., NORTHCOTE

SPECIAL
YF 303

AUSTRALIAN MADE HEATSINK

(Higher thermal capacity than comparable types as well as being **100% Australian Made**)

			1-4	5-9	10+
HS1	38mm	(1.5")	$1.85	$1.65	$1.45
HS2	75mm	(3.0")	$3.00	$2.80	$2.50
HS3	150mm	(6.0")	$5.80	$5.40	$4.90
HS4	300mm	(12")	$8.90	$8.40	$7.90

(All above heatsinks are black anodised. Unanodised sizes are listed below)

HS11	38mm	$1.50	$1.30	$1.00
HS12	75mm	$2.50	$2.20	$1.90
HS13	150mm	$4.90	$4.50	$4.00
HS14	300mm	$6.50	$5.90	$5.30
HS15	600mm	$12.00	$10.00	$9.00
HS16	1200mm	(4') $20.00	$18.00	$16.00

Further quantity breaks and prices are avialable from Rod Irving, by phoning RITRONICS WHOLESALE PTY LTD (03) 489 7099.

Please note we are in the process of designing further products to be made in Australia.

QUALITY PANEL METERS

MU 45 58mm(w) *52mm(h)	
0-50-0 uA	$7.50
1mA FSD	$7.50
50 uA FSD	$7.50
10 ADC	$7.50
30V DC	$7.50
VU METER	$8.50
MU 65 100(w) *82mm(h)	
30V DC	$11.50
10A DC	$11.50
1mA DC	$11.50

$199.50

OSCILLOSCOPE

Specifications:
VERTICAL DEFLECTION — sensitivity: 10 MV/DIV
HORIZONTAL DEFLECTION — sensitivity: 500 MV/DIV
TIME BASE — Sweep frequency: 10 Hz — 100 KHz in 4 ranges
SYNCHRONIZING — Internal and external
POWER REQUIREMENTS — 100/234 V, 50/60 Hz approx. 10 Watt
DIMENSIONS — 202 (W) x 160 (H) x 305 (D) MM
WEIGHT — approx. 3.8 kg
PLUS — a comprehensive operator's manual.

YF 370
$19.50

YF 303 MULTIMETER $23.50
AC/DC volts up to 1200V DC current 3Ma to 12 A easily read OHMS range transistor checker etc.

YF 370 MULTIMETER $19.50
Our most popular tester. Includes transistor checker.

YF 300 CLAMPMETER $29.50
Up to 600V AC and up to 300AMPS includes OHMS range and meter pointer lock excellent value.

NEW PRINTED CIRCUIT BOARDS

80cm3a	$3.50
80cm3b	$2.50
80f3	$2.75
80hla5	$2.20
80PG6	$4.90
80pa6	$7.90
80sa3	$3.90
80AW4	$4.90
80c14	$2.70
ETI466	$5.90
80pp3	$2.20
80TV8	$3.90
78UP10	$12.50
80pc4	$2.90
80gps3	$1.90
ETI325	$1.50
ETI560	$2.00
ETi578	$2.50
80d6	$2.90
ETI650A	$4.50
ETI650B	$2.50
ETI650C	$2.90

ULTRASONIC TRANSDUCERS
$11.00pr
(40KHz Tx & Rx)

SPEAKERS
5W **$6.90**
10W **$17.50**

10 watt twincone speakers **$7.50** each.

PENLITE NICADS
1-9 $1.75
10 up $1.50

RECTANGULAR LEDS
Red green & yellow **$0.36EA**

HORN SPEAKERS IDEAL FOR ALARMS
5 WATT $6.90
10 WATT $17.50

C.ITOH BRAND DOT MATRIX PRINTER

The model 8300P dot matrix printer is a no nonsense unit that can churn out the full 96 character ASCII at a brisk 125 characters per second on standard fan-fold paper. Character spacing of 80, 40 or 132 columns which are software selectable. A quality unit that costs less than $1,000!!

$970.00

Low Cost transformers

PRIMARY	SECONDARY	TERMINATION	PRICE
240 V AC	12.6V CT at 150 MA	Flying Leads	$2.90
240 V AC	6.3, 7.5, 8.5, 9.5, 12.6, 15V @ 1 AMP	Lugs	$3.90
240 V AC	16, 17.5, 20, 24, 27.5, 30V @ 1 AMP	Lugs	$6.50

DYNAMIC EXPANSION KITS

These are top quality ICs that can expand your basic 16K Sorcerer to 32K or even 48K (expands the 8K to 16K etc) They can also be used with the TRS 80 level I and II and the Apple II computers to expand their on-board RAM. Superb value and complete with installation instructions.

$109.50

Bankcard Mail Orders Welcome

Please debit my Bankcard
Bankcard No.....
Expiry Date.....
Name.....
Signature.....

Heavier items add additional postage. Extra heavy items sent Comet freight. Prices subject to change without notice. Send 60c and SAE for free catalogues. MAIL ORDERS: PO Box 135, Northcote, Vic 3070. Minimum pack and post $1.00. Phone (03) 489 8131.

SOFTWARE • HARDWARE

TRS80/SYSTEM 80.

BASIC 111. A powerful interpreter that requires Level 11 and 16K RAM. Features convenient shift key entries to enter basic instructions and frequently used string expressions. Also includes line remembering, full error messages, advanced graphics and a host of other features.
TAPE, plus manual $39.95.

GAMES TAPE T1. ROBO NIM, AIR RAIDS. Enjoy the computer age with this version of NIM and then take command of an ANTI AIRCRAFT BATTERY to shoot down enemy aircraft.
TAPE with instructions $14.75.

GAMES TAPE T2. BIORYTHM, RACE TRACK, ANIMALS, HAMURABI.
Plot biorythms and amaze your family and friends. Try your hand at horse racing and bet against the BOOKIE. More value with the artificial intelligence game of animals — see how fast the computer learns. Lastly become king of an ancient kingdom and use your wits to govern this city.
TAPE with instructions $14.75.

2650.

GAMES TAPE (1) PIPBUG for EA2650.
ASTROTREK, RUSSIAN ROULETTE, POKER GUESSING GAME, TARGET
$14.75.

GAMES TAPE (3) BINBUG for 640 VDU.
Play TARGET on your 2650 — an ideal arcade type game for all. Also experiment with ELIZA DOCTOR a form of artificial intelligence that shows the computer has a mind of its own.
$14.75.

8080 EMULATOR PIPBUG.
Turn you 2650 into 8080 so that you can run 8080 machine code. Ideal for beginners. $14.75.

MICROWORLD "SARGON" CHESS. **BINBUG.**
You can play graphic chess on your 640 VDU. Select the computer lookahead for 1 to 6 moves and try to beat it!
$19.75.

MICROWORLD BASIC.
Written by IAN BINNIE this powerful 6K basic is virtually Microsoft compatible and comes with a very extensive manual.
$29.50.

MICROBYTE ASSEMBLER (BINBUG).
This comprehensive Editor and Assembler package is an extremely powerful tool for developing machine language programs for the 2650. Written by IAN BINNIE.
Cassette with manual $35.00.

MICROBYTE SOURCE GENERATOR (BINBUG).
This clever program written by IAN BINNIE produces from machine code directly assembly language. Ideal for understanding, modifying or relocating a program.
Tape with cassette $35.00.

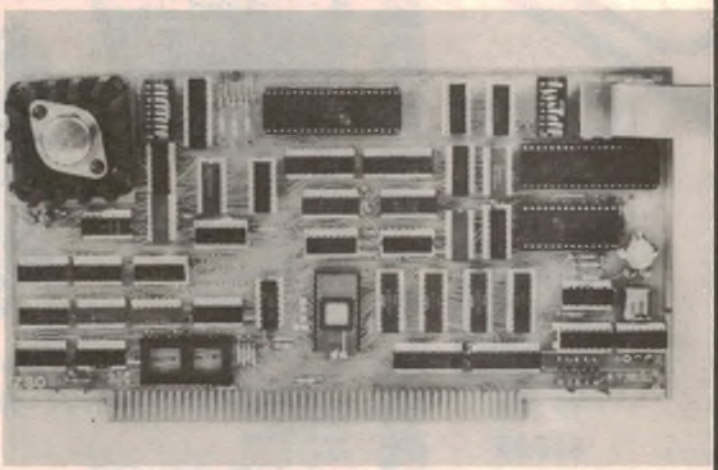
DGZ80 (DGOS).

MICROWORLD Z80 BASIC 11K.
At last a powerful extended basic which supports the 640 VDU and the ETI Z80. Requires 16K of memory at ppppp. Features floating point accuracy to 62 digits, full graphics, full error messages and unique editing function which pinpoints program errors. Of course MICROWORLD Z80 basic has regular features such as GOTO, IF . . ., THEN . . ., ELSE, IN, OUT, PEEK, POKE, PRINT, etc. etc.
Cassette with manual $32.50.
SPECIAL PRICE if purchased with DG Z80 KIT. $15.00.
MICROWORLD Z80 ASSEMBLER. Ideal for developing your own machine code programs $14.75.

Z80 GAMES TAPE (1).
Now adapted to the 640 VDU play TARGET and TREK as developed by Processor Technology. These are stimulating games which will amuse your friends for hours.
Cassette with instructions. $14.75.

EA MODEM.

As described in EA September 1980, this acoustically coupled Modem will convert your home computer to a remote terminal. Experiment with networking and information exchange with other computer owners. We supply a complete kit including fibreglass PCB, all components, top quality, prepunched anodized case plugpack and detailed assembly manual, troubleshooting guide.
EA Modem Kit $69.50.



S100 MODULAR Z80 HOME COMPUTER.

Build your own Z80 based home computer on the S100 buss using the DGZ80, CPU and DG640 VDU and the "Magic" Clare C70 keyboard. This budget system can be readily expanded to suit virtually any requirements. Don't get caught with inflexible, expensive-to-expand incompatible single board systems. With S100 there are about 200 manufacturers of compatible boards for virtually any application.

DGZ80. A single board Z80 baud computer with on board PIO (dual 8 bit input/output), CTC (programmable counter/timer), provision for on board 2K EPROM with monitor, 1K RAM expandable to 2K. When used with DGOS ROM and the DG640 VDU this becomes a basic system.
Kit comes complete with all components, sockets for all IC's, top quality PCB with solder mask and complete owners manual.
DGZ80 Kit $199.25. tax paid ($175.00 tax exempt).
DGOS operating system in EPSOM with manual $40.00.

DG640. A complete VDU which features 16 lines each of 64 characters, upper/lower case and chunky graphics (128 x 64 resolution), built in crystal locked TV scan circuits. Kit complete with all components, sockets for all IC's, quality solder masked PCB and owners manual. $149.50 tax paid

OTHER OPTIONS (all tax paid).

TCT 16K RAM card (kit)	$269.00.
JC100 9 slot mother board	$49.50.
JC200 Card frame	$49.50.
ETI 681 PCG kit	$140.00.
S100 Power supply	$79.50.
Clare C70 Keyboard	$165.00.

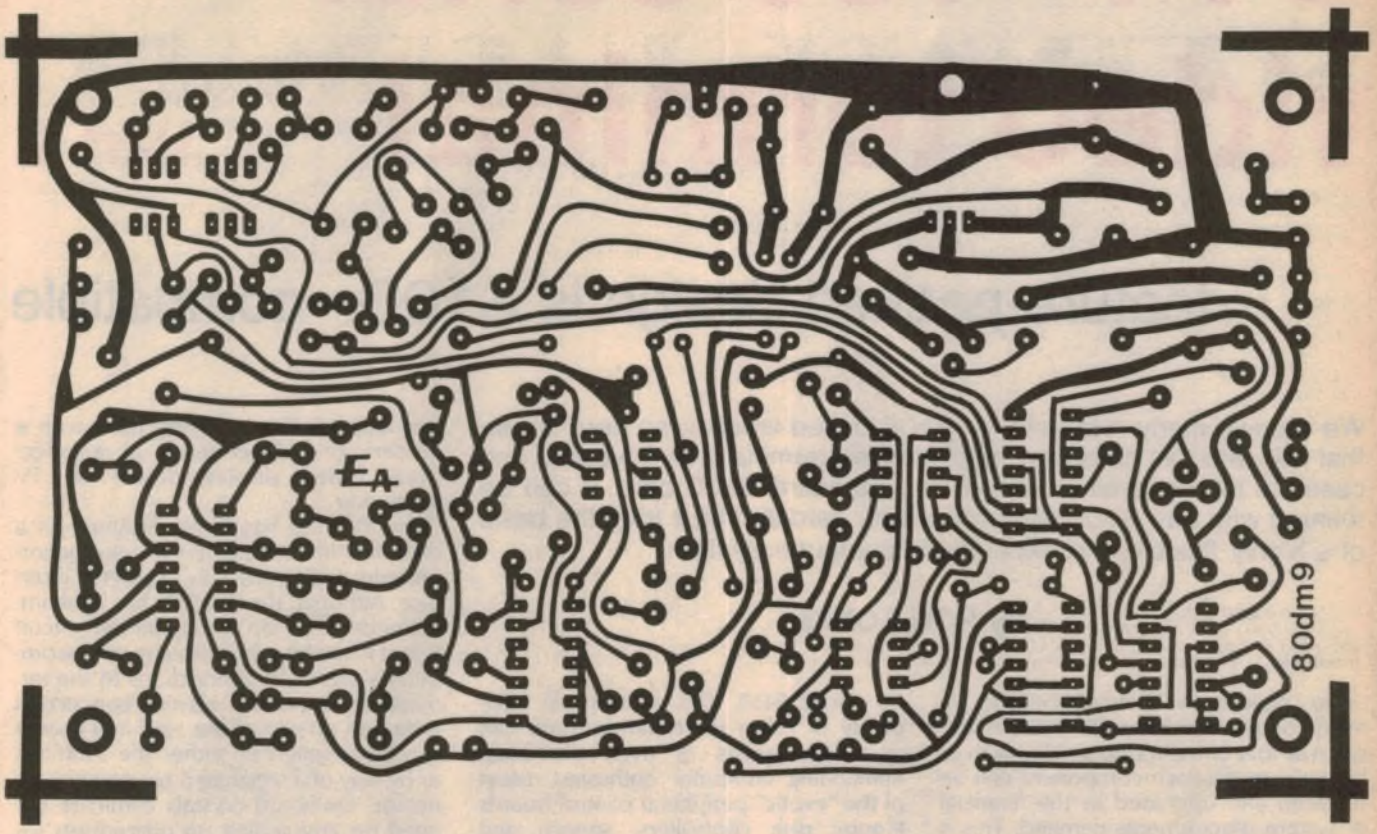
APPLIED TECHNOLOGY PTY. LTD.

MAIL ORDERS TO:
P.O. Box 355, Hornsby 2077

Please add $2.00 per order towards cost of post and packing.

OFFICE/SHOWROOM:
1a Pattison Avenue, Waitara 2077

Hours: 9-5 Monday to Saturday
Telephone: 487-2711



Here is an actual size reproduction of the PCB pattern.

loudspeaker. Check the power supply rails with a meter.

Setting up the modem can be done with a frequency meter or oscilloscope. Place the probe at pin 5 of IC3. Temporarily make the link for the RS-232 interface as shown on the component overlay. This will bring the transmitter input high. With the power applied and the transmit switch off (to stop the noise) read the frequency. The uppermost trimpot adjacent to the 555 timer is the one to adjust for a reading of 1650Hz. Now temporarily provide a link between the Gnd and the TTL transmit interface input. This will bring the transmitter input low. Adjust the lower pot adjacent to the 555 until a reading of 1850Hz is obtained.

The phase-locked loop can be adjusted by applying the probe to pins 4 and 5 of IC7, the 565. Remove the loudspeaker connected to the input of IC6 at the left hand side of the PCB. Adjust the frequency reading with the trimpot adjacent to the 565 until 1750Hz is obtained.

(Note that, ideally the above checks with a frequency meter must be performed in order that the modem be compatible with any other modem complying with the same standard).

Well that just about concludes the description of the Modem. All that is left to do is to fix the speakers to the lid with epoxy adhesive and to connect the link option for the RS-232 or 20mA interface and then begin transmission. The 565 may require fine adjustment when actually being driven from the computer to obtain a reliable transmission.

A CAUTION:

Although we believe that this modem will work satisfactorily over telephone lines, we must point out that the use of an unapproved device contravenes Telecom regulations. As far as we know, this modem could serve as the basis of a unit which could be submitted for approval by Telecom.

Telecom specifications state that for the most reliable operation of the carbon microphone in standard handsets, the microphone should lie at an angle to the horizontal, ie. not in the attitude it takes when used with our modem. Therefore, if used for longer than a few minutes (say, ten or more) it is possible that data transmission will become unreliable due to "packing" of the carbon microphone.

If this proves to be the case, one of two strategies could be used: (1) send data for short periods only; or (2) arrange for the modem to lie on its side, with a suitable cradle for the handset, so that the carbon microphone lies in an "ideal" attitude. We have not experienced any problems in our experiments.

SVT-100 serial video terminal Part 1.

feature-packed design is S100—compatible

We receive many requests for S100-based articles, so here is one that falls into this category: a serial video terminal with keyboard and cassette interface all mounted on a standard S100 card. It can be teamed with any S100 microprocessor card and thus form the basis of a highly flexible and expandable computer system.

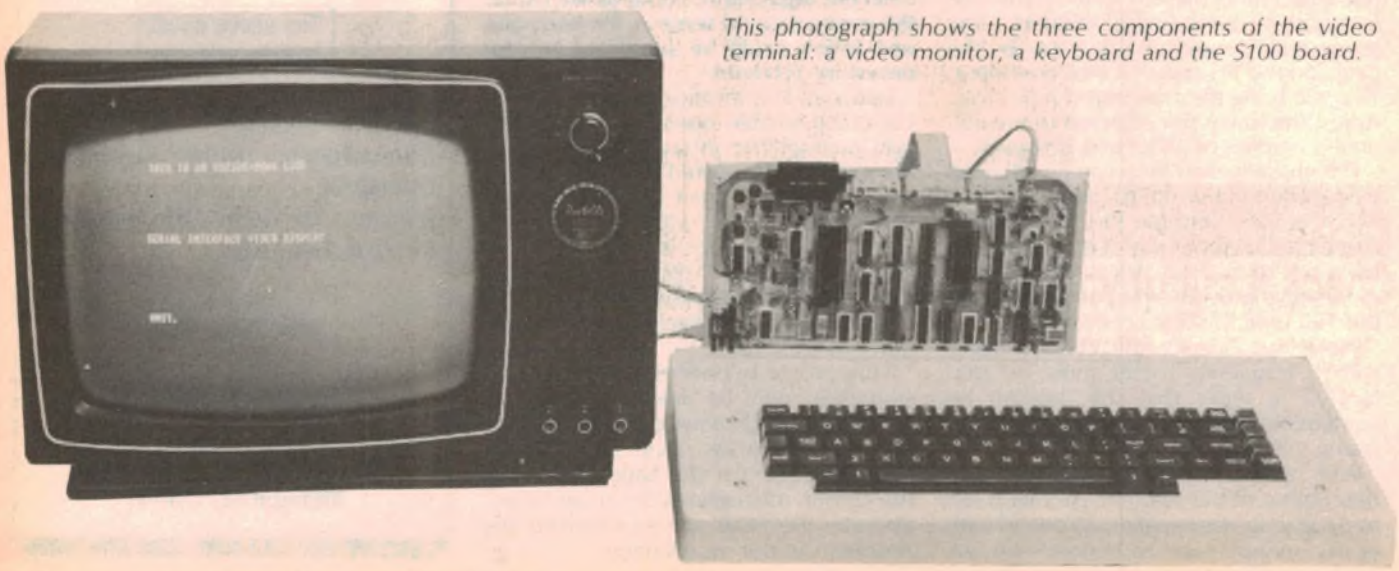
by RON KONIG

The philosophy behind building a microcomputer on the S100 bus is the same as that of the modular approach to hifi equipment. Each component can be replaced and upgraded as the financial or system requirements demand. This is especially true if the microcomputer is to be used for self or commercial educational purposes. Here the user may wish to evaluate several types of microprocessors at the same time or replace his existing device for the latest type. For example consider the forthcoming 16-bit microcomputers. All existing hardware could be retained and used with the new CPU boards.

A minimum S100 system consisting of the power supply, card cage, "single board computer" CPU card, video terminal and keyboard can be purchased for about $450. This system will have plenty of room for expansion and can meet the needs of even the most demanding computer enthusiast. Most of the "exotic" peripheral control boards (floppy disk controllers, speech and music synthesisers, etc) can be brought into service by inserting the board and loading the operational software. This is in contrast to the problems associated with purchasing many personal computers where future system expansion is limited and leads to the purchase of further "expansion units".

The video terminal described in this article is a serial communication type. It does not share the microprocessor's memory but is self-contained with its own video memory, keyboard interface and video processing circuitry. As such, it is also capable of being used with a modem or independently as an electronic video display device or TV typewriter.

The SVT-100 has been designed as a complete low cost Video Terminal incorporating a "Kansas City" cassette interface. Although the terminal has been implemented on an S100 printed circuit board it can be used with any microcomputer system. All connections to the terminal are made by way of connectors mounted on top of the card and power can be supplied by either the S100-bus or by way of a separate 5-pin power connector. On-board crystals eliminate the need for any setting up procedures for the baud rate and time-base oscillators and the on-board power regulators simplify power supply requirements. These regulators can also supply power to the keyboard through the keyboard flat ribbon connector. Serial communication from 50 to 1200 baud with a computer or modem is by way of a standard 25 Pin "D" connector using either RS-232C voltage levels or 20mA current loop. The terminal can be operated in either half or full duplex and a keyboard "Break" function is available for interrupting communications.



This photograph shows the three components of the video terminal: a video monitor, a keyboard and the S100 board.

LEADER TEST INSTRUMENTS

We've made a name for being ahead in reliability, user-designed features and economy.

But that's just the start!

1. Reliability.

Since 1954 we've built our reputation on equipment that keeps on functioning under a wide range of extreme operating conditions. We do this by only using components rated in excess of power requirements; by extensive pretesting of designs and by rigid quality control at every stage of production.

2. User-design features.

Compare our panel layouts with the others. You'll see how everything falls to hand easily with LEADER. Note the colour coding. Experts call this "ergonomic design". We think it's just good sense.

3. Economy.

LEADER gear is as practical in its price structure as it is in all other departments. Check our prices. Check around. Dependability and value is precisely what makes us so popular with schools, laboratories and work shops.

But there's more yet.

LEADER offers you the biggest range of specialized gear for audio applications. Including audio generators, distortion meters, frequency counters, wow and flutter meters.

Model LBO-520. A dual trace oscilloscope with a 30MHz bandwidth a 5mV/cm sensitivity. Delay triggering and a 130mm, post acceleration, CRT produces a bright, sharp display. Display offers chop, act, add and subtract, Ch1, Ch2, also X-Y.

When it comes to good test gear look to

LEADER

VICOM

Check it out at your VICOM dealer.

Queensland
Delsound
1 Wickham Terrace.
Brisbane. Queensland
(07) 229 6155

CW Electronics
Cnr Marshall Rd and
Chamberlain St.
Tarragindi
(07) 48 6601

South Australia
Electronic Components and Equipment
110 Tynte Street.
North Adelaide
(08) 267 2246

International Communication System
Dale Street
Port Adelaide

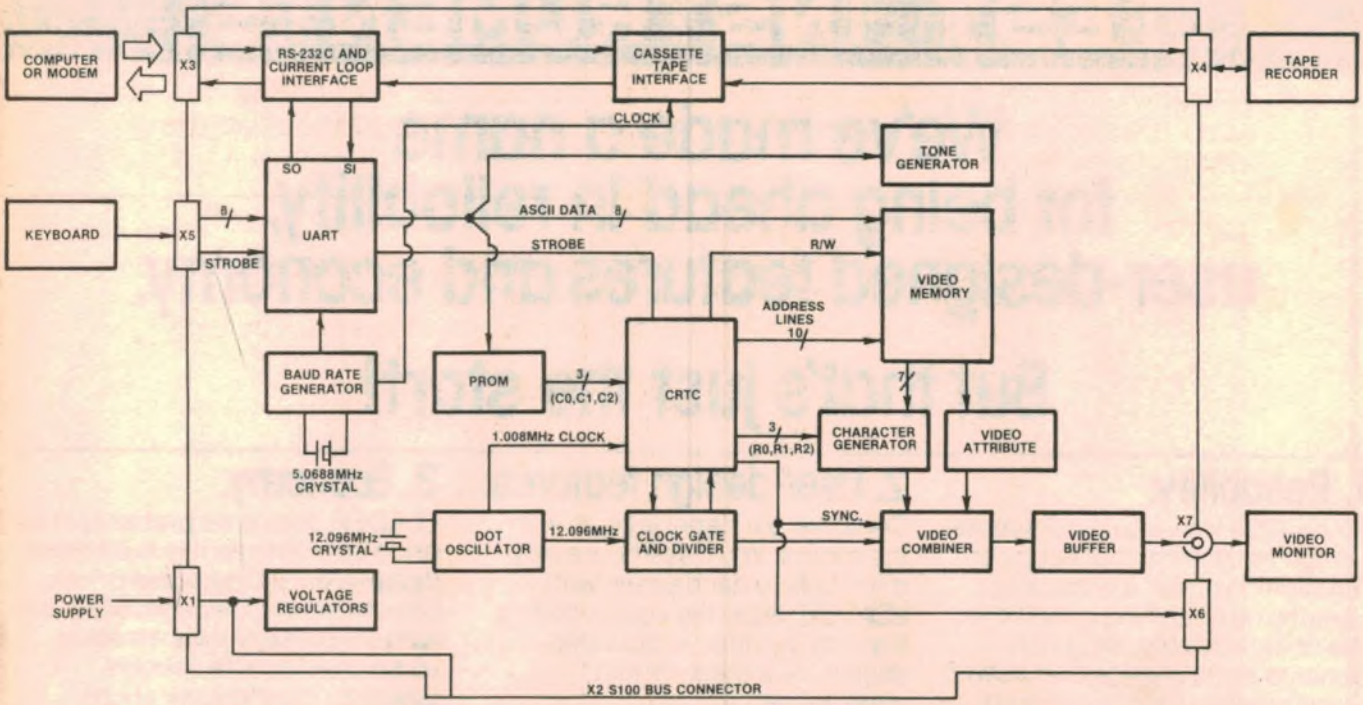
Western Australia
Atkins Carlyle
1-9 Milligan Street.
Perth.
(09) 321 0101

Vicom International Pty Limited
339 Pacific Hwy.,
Crows Nest
(02) 436 2766

68 Eastern Road.
South Melbourne
Ph 699 6700

SERIAL VIDEO TERMINAL

HAS FULL CURSOR CONTROL



Design features of the SVT-100 include upper and lower case characters, editing facilities, and a cassette interface.

The SVT-100 is based on the Thomson-CSF CRT-96364 single-chip CRT Controller and the Motorola MCM-6674 (upper and lower case) 5x7 dot-matrix character generator. The display format is 16 lines of 64 characters. An on-board static RAM of 1024 bytes provides storage for the full page of 1024 characters and their video attributes and a UART provides the serial communications between the keyboard, the computer and the video terminal. The choice of either half-intensity or flashing characters is available to enhance visual presentation.

Full cursor control is also featured. With the aid of 10 control codes the cursor can be "homed" (to the top left corner) with or without erasing the displayed page and it can be moved up, down, left or right without erasing displayed characters. The screen can be "rolled" (where characters on the top line are erased and reappear on the bottom line), "scrolled" (where a blank bottom line is produced) and the current cursor line can be erased. The terminal provides an auto carriage-return and line-feed when the cursor moves beyond the 64th character position, and a page scroll when doing so on the bottom line. The carriage-return command can be selected both with and without erasure from the cursor position to the end of the line. The cursor is an alternating flashing character and underscore.

The terminal provides composite video (from a miniature coaxial connector) and discrete line and frame sync pulses and video (from a flat ribbon connector) for connection to a video monitor.

Eight dual-in line (DIL) switches mounted near the top of the board select the terminal's mode of operation

SPECIFICATIONS

DISPLAY FORMAT

1024 Characters on 16 lines of 64 characters.

CHARACTER FORMAT

Characters are generated in a non-descending 5x7 dot matrix.

CHARACTER SET

Generated: 128 ASCII characters.

Displayed: 116 Characters (Normal Mode). 128 Characters (Test Mode).

In the "Normal" mode the 12 control codes decoded by the terminal are not displayed.

CURSOR

Full cursor control is available through the use of 12 non-printing control codes.

Character location and underscore flash alternately @ 2Hz rate.

VIDEO

Composite: 2V peak-to-peak (1.4V Video, 600mV Sync) or 1V peak-to-peak (700mV Video, 300mV Sync).

Line Sync: 4us pulse at a frequency of 15625Hz. TTL level (positive or negative).

Frame Sync: 320us pulse at a frequency of 50Hz. TTL level (positive or negative).

Video: 1.4V or 700mV (positive).

COMMUNICATIONS

Interface: EIA standard RS-232C and 20mA current loop.

Keyboard: 8-bit parallel word and strobe.

Word structure: 8-bit word, no parity, 1 start and 2 stop bits.

CASSETTE INTERFACE

Recording format: 300 Baud, 1200/2400Hz F.S.K. Kansas City Standard.

Input Sensitivity: 40mV (peak-to-peak).

Output Signal Level: 500mV, or 50mV peak-to-peak.

PHYSICAL DIMENSIONS

S-100 Card: 133mm high, 254mm wide and 19mm deep.

POWER REQUIREMENTS

Input: +8V at 500mA; +16V at 30mA; −16V at 50mA.

Attention all computer users

Electro Medical Engineering Pty. Ltd. proudly announce the release of their exciting new Sendata 700 Series acoustic modems. This low cost acoustic coupler is modular in design, easy to operate, and offers unsurpassed performance even when both ends of the connection are acoustically coupled.

700 Originate Only
Operates at up to 300 BPS Full Duplex and up to 1200 BPS Half Duplex.
Powered via the terminal interface from 9v plug pack.
CCITT V24 (RS232) compatible.
Suits most telephone handsets.

Use 700 Originate Only for portable terminal applications.
Plug compatible with Teletype 43, Digital LA34, and new GEC Terminet 2030.
Available with switch selectable answer/originate option.
Use 700 Answer/Originate to establish your own message exchange service.
Optional carry case available for above terminals ideal for portable applications.

700 Originate/Answer suits most home computers.
Suits all home computers with RS232 output
Communicate with other users using 700 Answer/Originate.
Exchange your programs over the telephone network.
Establish your own data base service.

The 700 Series is available in 1200 Half Duplex form or with split baud rates of 1200/75BPS.

Electromeds eight years experience in the design and manufacture of a range of acoustic couplers ensures highest possible performance.

REPRESENTED BY:
VIC. Anderson Digital Equipment Pty.Ltd. 543 2077. The Logic Shop Pty.Ltd. 51 1950. **NSW.** Anderson Digital Equipment Pty.Ltd. 848 8533. The Logic Shop Pty.Ltd. 699 4910. **ACT.** Anderson Digital Equipment (ACT) Pty.Ltd. 58 1811. **QLD.** Anderson Digital Equipment Pty.Ltd. 350 2611. **SA.** Applied Data Control Pty.Ltd. 79 9211. **WA.** W.J. Moncrieff Pty.Ltd. 325 5722. **NZ.** Anderson Digital Electronics (NZ) Ltd. 64 4585.

ELECTRO-MED ELECTRO-MEDICAL ENGINEERING P/L.

69 SUTHERLAND ROAD, ARMADALE, VICTORIA, 3143. AUSTRALIA.
TELEPHONE: (003) 509 5844 TELEX: AA36384

and its video characteristics. A burst of audio tone is generated when the "bell" control code (control L or 1) is received by the terminal and can be used to drive a small speaker or piezo-electric buzzer.

CIRCUIT DESCRIPTION

A general purpose Universal Asynchronous Receiver-Transmitter (UART) has been employed to provide the serial communication between the terminal and the computer. A UART is basically a parallel to serial (transmitting) and serial to parallel (receiving) shift register. The transmitter section converts parallel data into a serial word which contains the data along with start, parity and stop bits. The receive section converts the serial word with start, data, parity and stop bits into parallel data, and verifies proper data transmission by checking the parity and the receipt of a valid stop bit. The serial data word length can be set to either 5, 6, 7 or 8 bits, the parity can be odd, even or inhibited, and either one or two stop bits can be added. These parameters are set up on the SVT-100 by the wire link set W5 (see Table 1 next month).

The UART requires an external transmit and receive clock (16 times the communications baud rate). On this terminal the transmit-receive baud rate clock is provided by a crystal locked programmable dual Baud Rate Generator, IC21. One half of IC4 is wired to provide the clock for the cassette interface, and the other half provides the UART clock. The wire link set W4 sets the cassette interface clock and switch pack S1 selects the UART clock (see Table 2).

The UART's serial input and output lines are at TTL levels and as such are only suitable for short distance data interchange. A current loop can be employed to provide improved noise immunity, but for long communication links requiring good noise immunity the EIA Standard RS-232C interface should be employed.

This terminal provides both current loop and RS-232C interface through connector X3 (see Table 3) and TTL levels are available in lieu of the RS-232C by rewiring wire link-sets W2 and W3.

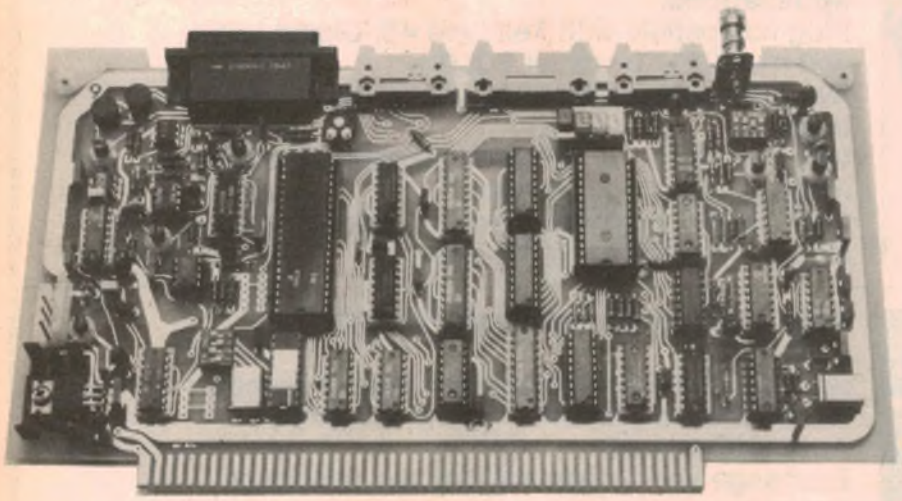
The RS-232C standard defines a logic 1 signal to be no more than −5V and no less than −15V, and a Logic 0 to be no less than +5V and no more than +15V. This terminal provides −12V and +12V level signals to meet this requirement by using an inexpensive 741 op-amp, IC5. This op-amp is powered from the on-board regulated ±12V supplies and has a 2V reference voltage applied to its non-inverting input. The signal for transmission is applied to the inverting input and is compared to the reference voltage on the non-inverting input. When the signal voltage level is greater than +2V the op-amp will deliver an output voltage of −12V and when the signal is less than 2V the transmitted output voltage will be +12V.

Two opto-couplers, IC6 and IC7, provide the interface between the terminal and the serial-out and serial-in current loops. With current loop communication, logic 1 is defined when current is flowing and a logic 0 when current flow is interrupted. Bridge rectifiers depolarise the current loop wiring and simplify its use. If the current loop is not used it should be disabled by closing the wire-link W1-B.

Effective half-duplex terminal operation has been provided by the wired-or gating of the current loop, RS-232C and S2-1 (full or half duplex select) switch signals. When the half-duplex mode is selected, the keyboard data being transmitted by the terminal is routed by S2-1 to the receive section of the UART and is immediately displayed on the monitor. Most modems use this mode of communication to save on transmission time as the remote computer does not have to "echo" the received data. The terminal can also be used in this mode as an electronic "typewriter" for annunciation displays independent of any computer.

CONTINUED NEXT MONTH

Next month, we will complete the circuit description and present full constructional details. Kits for this project are available from Applied Technology Pty Ltd – see advert this issue.



View of the assembled PC board. Eight DIL switches near the top of the board select the terminal's mode of operation and its video characteristics.

Is this page all that stands between you and a B&D Controll-A-Door?

If you have one or two questions you'd like to ask B&D, read on. You'll probably find we've already answered them.

The following questions were posed by the design and engineering team at B&D during the 5 year development of Controll-A-Door.

Only when all could be answered was the first unit sold.

Question:
If our neighbours have a Controll-A-Door is it likely that they could open ours?

Answer:
No. Your transmitter has its own special code which can be changed, if necessary, to any one of a thousand different combinations.

Question:
B&D Controll-A-Door operates on household power. What happens if there's a power failure – can I get locked in or out?

Answer:
No. You can convert the door to manual simply by moving a lever inside the garage. And if the door is the only access into your garage, we have an optional key-operated release that disengages the motor from outside.

Question:
Can CB, taxis or other electrical interference open the door?

Answer:
No. B&D Controll-A-Door has an advanced digital pulse system which is quite different from most other forms of transmission. It opens only when it receives the exact combination of frequency and coded pulses, and only a specifically coded B&D transmitter can open the door.

Question:
I've heard Controll-A-Door improves home security. How?

Answer:
When you close Controll-A-Door, it locks your garage door automatically. So it's never left open to tempt thieves and provide easy access to prowlers. And because it's so convenient to drive in, your car needn't be left in the driveway, an easy target for thieves.

Question:
Can I operate the Controll-A-Door if someone else in the family has the transmitter?

Answer:
Yes. You can have a spare transmitter with identical coding. There's a remote button on the control box. Or optional key switches can be positioned for your convenience.

Question:
Controll-A-Door has won an Australian Design Award. What does that mean to me?

Answer:
To meet the high standards of the Australian Design Award Judges, a winner must not only be designed for long life and reliability, it must also be innovative and good value for money. Controll-A-Door met all these standards with its combination of advanced technology and design, with specific attention to quality and reliability. Simply, it means you are assured of value and performance.

Question:
Is there any danger with an automatic door?

Answer:
Not with B&D Controll-A-Door. It was designed with safety top-of-mind.

Features like fully enclosed motor and gearing, low voltage transformer operation, automatic overload cut-out and fail-safe automatic reversing bar (deluxe model) won the approval of the Australian Design Council.

Question:
If I already have a B&D Roll-A-Door can it be fitted with Controll-A-Door?

Answer:
Certainly. New and most other B&D Roll-A-Doors fitted with Nylotell running strips can be fitted with B&D Controll-A-Door. We even have a model to drive two doors. (Note: B&D Controll-A-Door is specifically designed for B&D Roll-A-Doors.)

Question:
I know Controll-A-Door opens when I push the button, but what happens behind the scenes?

Answer:
When you press the hand transmitter, it sends a radio signal to a receiver inside the control box fitted to your garage wall. This signal is relayed through the control electronics and operates the motor drive unit. Power is then transmitted through the enclosed gearing system to open and close the door.

Question:
The motor drive unit looks neat and compact but will it perform and will it last?

Answer:
It certainly will! The B&D Controll-A-Door motor is a highly developed, long life, low voltage motor with very special torque characteristics. The motor, transformer and gearing system are designed to operate the door at the optimum speed and power to ensure performance and safety (as required to achieve the Australian Design Award). Exhaustive Controll-A-Door motor tests, under high load laboratory situations, indicate performance equivalent to well in excess of 20 years' normal use.

Question:
Working in the garage, can I still have the door half-way up for ventilation?

Answer:
Yes, just turn the wall unit off in mid-cycle.

Question:
Is Controll-A-Door a good investment?

Answer:
Most certainly. Not only is there the sheer convenience of not needing to get out of your car to get into the garage, but other advantages as well.

You'll be able to stay dry on a rainy night.

If you're concerned for your own safety, you'll appreciate never having to leave your car on a busy road or steep drive to open the garage.

And late at night, Controll-A-Door's automatic locking and protection from electrical or radio interference make it an investment in the security of your home and peace of mind for the safety of your family.

No wonder then that so many owners tell us that they don't know how they got by without it.

Question:
How much does a B&D Controll-A-Door cost?

Answer:
Around $340 plus installation for the standard unit to suit most situations. That's hundreds less than some options you might be considering for your car, like air conditioning. And it's of practical value year round, day and night.

The price includes not only the hand transmitter you see below, but also the control wall unit with a radio receiver and control electronics and a motor gearbox unit with safety overload cut-out. $105 extra buys you the deluxe model which includes an automatic, electronically controlled light, fail-safe reversing bar and remote button. And then there's a host of extra options available including extra transmitters, a key switch and even an automatic light for the standard model.

When you consider it, B&D Controll-A-Door is a very practical and useful investment which will add value to your home. Why not phone or send the coupon right now.

DO IT YOURSELF AND SAVE!

To: Byrne & Davidson Doors (NSW) Pty. Ltd.
34 Marigold Street, Revesby, 2212. 7715566

Please ☐ Send me a brochure.
☐ Send me an owner's handbook.
☐ Arrange a measure & quote.

Name

Address Phone P/Code

CONTROLL-A-DOOR

A Byrne & Davidson Doors Product

PHG 3720

The Serviceman

A job to break a serviceman's heart — and reputation!

Intermittents are nothing unusual these days; only the circumstances in which they occur, and how they are tracked down, makes them interesting. In this story the emphasis is on the length of time over which the fault came and went, the amount of frustration it caused, and the mystery of why the conditions for it existed in the first place.

The fault was in a Philips K9 colour TV set, about 18 months old when I first encountered it, but somewhat older before I had finished with it! The first service call was fairly routine: loss of sound caused by a dry joint in the output stage, and one which I was fortunate enough to find quite quickly.

Several months went by and the customer was on the phone again, with the comment that: "The set's playing up again. Could you have a look next time you're out this way?"

The "again" caused me to assume that it was the old fault, or something very like it, but the customer was quite definite that it was something completely different. Unfortunately, he was much less definite when it came to describing it. I did establish that it was intermittent, and I suppose this made it hard for him, but all I could get from him was a vague suggestion of streaks and lines across the picture.

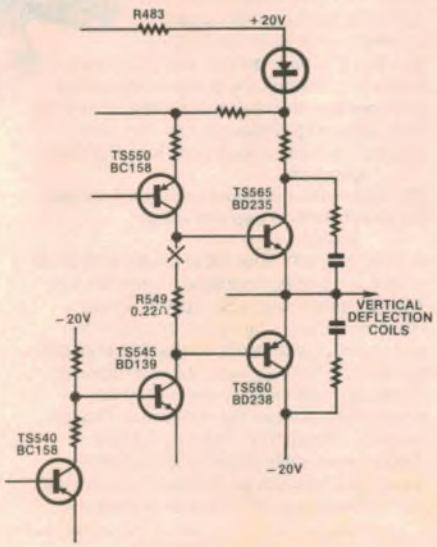
At the first opportunity I called in to see the set, but it goes without saying that there wasn't a sign of the fault when we switched it on. I waited for a reasonable time, questioning the customer while I watched the set, but I was really none the wiser by the time I left.

The next call came about a week later. Initially, his description of the fault was much the same as before, and just as vague, but then he added an afterthought which provided the first tangible clue. As he described it, the picture was coming down from the top and up from the bottom — in other words, partial frame collapse.

On the strength of this I made another call but, again, the fault stubbornly refused to show itself. I considered taking the set in at this stage, but the owner felt he would like to keep using it for the present. So we agreed that he would call me again immediately he encountered further trouble.

A couple more weeks went by, and then he was on the phone again. This time I felt we might really be getting somewhere, for he reported that the picture had vanished and been replaced by a thin white line. If only it would stay that way long enough for me to get to grips with it.

Dropping everything I hurried over to the customer's home, and was gratified to find that the fault was still there when I switched the set on again. I was even more gratified when a few quick checks revealed the immediate cause of the failure.



You would expect that an open circuit at the point marked with a cross would upset the vertical output stage. What you wouldn't expect is the way it came to be present.

The vertical deflection stage is fed from two rails, nominally 20V positive and 20V negative, and it didn't take long to discover that a thermal cut-out (spring resistor) in the positive rail, R483, had opened. A spot of solder restored the circuit and I stood by to watch for any signs of distress as I switched on.

It turned out to be a complete anti-climax. The set came on normally, with a full height picture, and no sign of any of the previous symptoms. I waited around for about half an hour, but eventually had to give it away. And, again, the customer was quite happy for me to leave the set with him until the fault showed again.

So where did we go from here? All I knew at this stage was that the fault appeared to be in the vertical deflection system, possibly the output stage, that it could cause flashes and streaks, partial frame collapse and even trip a thermal. On the other hand, the last named fault was the only one I had actually seen.

I heard little from the customer for the next three months or so. I did encounter him on one or two occasions and he confirmed that the set still played up at odd times, but not enough to worry him. Then I had another call from him with the news that the picture had again collapsed to a thin white line.

It was the thermal cut-out again, of course, but when I re-set it, the set behaved perfectly. However, the owner's attitude had changed. The set's tantrums were obviously getting him down. Its most recent failure had prompted him to dig out a smaller second set which he hadn't used for some time, and he was now reconciled to the idea of my taking the set away and keeping it until I had found the fault.

Naturally, I was quite happy with this suggestion, but I warned him that it might take some time; that I might need to keep it for three months or more, if it remained as stubborn as it had been. Little did I realise how accurate this prediction was to prove.

So I brought the set back to the shop, set it up in the corner reserved for such jobs, and let it run all day, every day. And, while this might be hard to believe,

RARE ADDITIONS FROM MARANTZ. SUPERIOR FM TUNERS.

Rare: very valuable.
Addi'tions: the things added.
Ma'rantz: a range of ultra-high performance FM Tuners which blend state-of-the-art engineering with operational versatility.

The name Marantz guarantees your choice from a superior range of AM/FM Stereo Tuners, guarantees exceptional quality and, with the advent of more FM stations, Marantz guarantees your total listening pleasure.

MARANTZ ST500
AM/FM STEREO COMPUTUNER

Sleek, slimline and microprocessor controlled — tune and recall stations with amazing speed and precision. The Computuner features state-of-the-art, quartz-locked, drift free frequency synthesised tuning with 7AM and 7FM memory presets. The LED signal strength display doubles as a multipath indicator and the Wide and Narrow IF Selector enables the switching of a tuning bandwidth best suited to reception area conditions.

MARANTZ ST600
AM/FM STEREO TUNER

This model incorporates a built-in oscilloscope that affords the most precise means possible to determine optimum reception, even from weak or distant stations. The functions of the oscilloscope extend well beyond those of conventional tuner meters.

MARANTZ ST400
AM/FM STEREO TUNER

A large, fuss-free Vacuum Fluorescent readout clearly displays the selected frequency and Electronic Gyro-Touch with Servo-Lock guarantees drift-free, razor-sharp tuning every time. Uncompromising quality through and through.

MARANTZ ST300
AM/FM STEREO TUNER

Consistent with all quality Marantz tuners, the ST300 features MOSFET FM front end and Phase Lock Loop demodulator for superlative performance — low distortion, extremely linear operation and wide dynamic range. Illuminated dial cursor, LED function indicators and Gyro-Touch tuning make the ST300 an exceptionally sophisticated buy at a modest price.

Your Marantz stockist will be pleased to demonstrate the complete range of Marantz tuners. If you see your hi-fi as an investment and, if you demand critical performance standards as well as the best value for money, listen to the future.

Listen to Marantz.

marantz
Now you're listening.

Distributed by MARANTZ (AUST.) PTY. LTD.
32 Cross Street, Brookvale, N.S.W. 2100.
Telephone: (02) 939 1900 Telex AA 24121
Melbourne (03) 329 7655 Brisbane (07) 48 8882
Adelaide (08) 223 2699 Perth (09) 328 3874

Spotlight on precision.

The Sanwa name has long been associated with high quality reliable test instruments and has gained wide acceptance in many areas including Telecom, military establishments, research, educational, trade and hobbyists. The above represents a selection of some of the more popular instruments from the comprehensive Sanwa power line up.

The "NO SWEAT" Insulation and Low Ω Meter

PDM 500c

- One man operation—no handle to crank.
- No wearing parts—solid state for long trouble-free life.
- Large easily read scale.
- Simple push-button operation.

High Performance—Rugged Construction

460 ED

- 10μA movement in a heavy-duty case.
- 12A A.C./D.C. measurement capability.
- Maintenance simplified with detachable indicator block.
- Polarity reversal switch.

Top of the Line—for Lab and Bench

N501

- VTVM performance with constant 1MΩ impedance on A.C.V. ranges.
- 2μA taut band suspension movement.
- High resolution of 0.05μA/1mV
- Fuse and diode protection.

Hot Favourite for Temperature Measurement

TH-510

- Thermometer measuring— 50°~300°C in dual ranges.
- N-1 type accompanies a pointed tip probe. S2 type a flat tip probe for surface temperature.
- Constant voltage IC circuit.
- Minimal current consumption (3mA) increases service life of battery— 150-hour continuous use.

Low Cost 3-in-1 Logic Pulse Scale NEW

YX-380TR

- Instant L.E.D. indication of pulses in excess of 0.5 VRMS. 0-30MHz (using optional probe).
- DC and AC simultaneously indicated on meter and logic probe.
- Multitester function may be expanded with optional hFE adaptor and HV probe.

Versatility Plus Sensitivity NEW

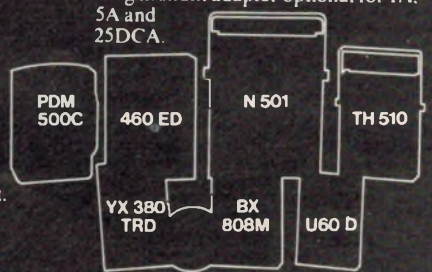
BX808M

- High sensitivity 30μA meter movement.
- Simultaneous measurement of A.C. and D.C. signals.
- A.C. signals may be measured even when mixed with D.C.
- Provides logic pulse analysis facilities with pulse and DCV range.
- Instant L.E.D. indication of pulses exceeding 0.5 RMS 0-30 MHz.

Popular Choice of Hobbyists & Servicemen

U-60D

- Easy to read wide scale.
- 44μA diode protected movement.
- Optional temperature probe for -30° to 150°C.
- Plug in shunt adaptor optional for 1A. 5A and 25DCA.



Available nationally from

WARBURTON FRANKI

• ADELAIDE 356-7333 • BRISBANE 52-7255 • HOBART 23-1841
• MELBOURNE 699-4999 • PERTH 277-7000 • SYDNEY 648-1711
• AUCKLAND N.Z. 77-0924 • WELLINGTON N.Z. 698-272

WF-694-80

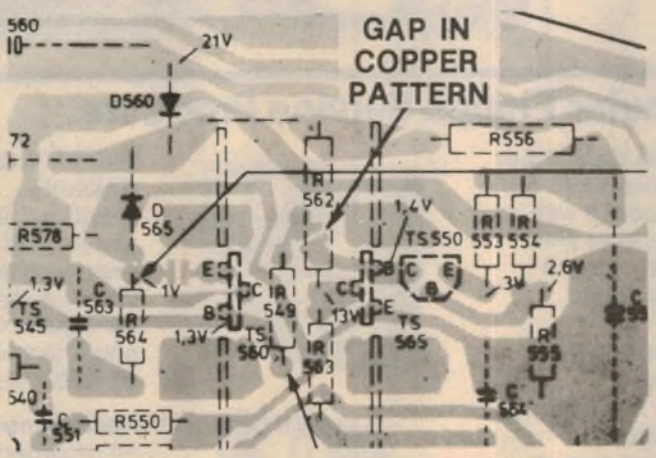
that set ran like that for the next three months, and not once did the picture so much as flicker. I couldn't make up my mind whether it was the customer or myself who was bonkers.

At the end of that time I felt bound to ask the customer whether, in the light of the set's behaviour, he wanted me to keep it, or whether he wanted it back. After some thought he decided to take it back and see what happened. "Perhaps it'll play up for me," he commented.

Again, a prophetic comment. Unbelievable though it may seem, it took less than 48 hours for the fault to re-appear; the thermal cut-out tripped for the third time. Talk about the ultimate in frustration!

The owner was thoroughly disgusted, and so was I, though I suspect our reasons were different. After all, I could hardly blame him if he felt that I had been less than honest; the events were enough to stretch anyone's credulity. Even so, we eventually decided that there was little alternative but to try again. So, back the set went into the corner of the bench.

Then it was the previous story all over again. Weeks went by, with the set playing every day, and with not a flicker to be seen. In fact, I was getting thoroughly fed up with it and, when I needed the space for another job, it was with a sense of relief that I pushed it under the bench.



Accidental breaks in a copper pattern are one thing but a deliberate break is quite another – especially when the manufacturer cannot say why it is there. Those with keen eyes may spot another one, below and to the right of D565.

And there, I'm afraid, it stayed for a couple of weeks, even after its space on the bench was available again. Then my conscience prevailed and I dragged it out and switched it on again. I wasn't surprised when it produced a perfect picture. I had no doubt that it would continue to perform like this for weeks to come.

But I was wrong. Within 20 minutes of switching it on things started to happen. And did it turn on a show – jittering, flashes, streaks, partial frame collapse, foldover, non-linearity – you name it, it was doing it; the first time it had done it while I was watching.

Well, at least I now had something to work on. From the symptoms I felt fairly certain that the trouble was somewhere around the vertical output stage, TS565 and TS560, the two preceding transistors, TS550 and TS545, or something closely associated with them. If I was right, it narrowed the field considerably.

I also felt that the chances were high that it was a dry soldered joint and, on this assumption, I went over that section of the board with a high powered glass, hoping that it might be visible, but without success. Then I decided on a different approach; to go over that section with a hot iron and re-make each joint. Granted, it would be a little tedious, but it would be time well spent if it solved the problem.

And so it was that, some time later, I switched the set on again and waited hopefully while it warmed up. Unfortunately, the result was nothing like what I expected. The picture was now suffering from partial frame collapse, foldover, and non-linearity as before, but it was a rock steady condition, minus the jittering, streaks and flashes. And a few seconds later the thermal cut-out tripped.

It did not take me long to confirm that this condition was now permanent. Somehow or other my soldering exercise had changed an intermittent condition into a permanent one; something which, most of the time, we can only hope for. On the other hand, I still didn't have a clue as to what I had done, and there was the complication that it was not possible to operate the set for more than 30 seconds or so without tripping the cut-out.

Even so, I didn't imagine it would be too difficult a job. It now looked as though my dry-joint theory was wrong, and that I should be looking for a faulty component, making as many checks as possible with the set switched off.

Nevertheless, I did manage to make some dynamic tests. One was the waveform from the vertical oscillator into the driver stage, TS540, and this appeared to be correct according to the circuit. I also measured the two rail voltages and some of the the transistor voltages.

The rail voltages had changed significantly. The 20V negative rail had dropped to 17V, while the 20V positive

You spent thousands of dollars getting hi-fi. Keep it that way for a few dollars more.

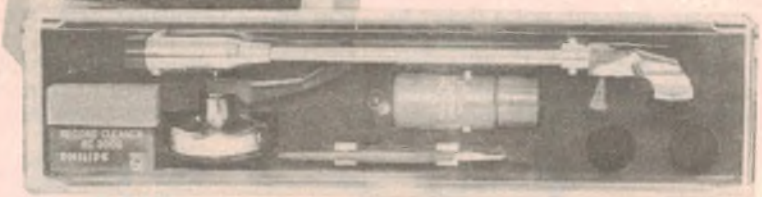
To maintain the best performance from your cassette, reel to reel recorders and decks, video tape recorders and record playing equipment use Philips Maintenance Products.

Philips manufacture a very large range of maintenance aids to assist you to keep your valuable equipment in good order.

All these and many more products are available from your Philips Service Centre or dealer outlets.

Drop In Cleaning Cassette
Philips Drop In Cleaning Cassette is a complete kit for cleaning, tape head guides and capstan. **$4.20***
Code 38920015

Philips RC3000
Hi Fi Record and Stylus Cleaner. Length pivot to pad 200 mm, arm overhang 35 mm. Complete with 2 pads, stylus brush, cleaning fluid. **$25.46***
Code 39590159



Other popular Philips Service Products.

Philips Disco Combi Set
Gets down deep into the recorded grooves with a long lasting velvet pile, complete with special cleaning fluid. **$3.89**
Code 39590157

Philips Hi Fi Stereo Headphones
Hi Fi Stereo Headphones with twelve extra membranes for spatial sound. **$96.00***
Technical Data (Subject to modification without notice) Frequency response 16-20000 HZ (±3 5 DB); Impedance (nominal) 2 x 600 ohm; Sensitivity 94 DB S.P.L. at 1 MW: Nominal power input 2 x 1 MW; Maximal power input 2 x 200 MW; Distortion <1%; Weight 390 g approx
Code 242 47017

Philips V.C.R. Cleaning Cassette
Maintains highest quality of picture and sound, removes deposits from video, audio heads and tape guides. Use every 30 hours for maximum results. **$19.20*** Code 39590102

Head Renovator Cassette
All recorders eventually lose performance through their heads becoming gradually magnetized. Thanks to the new SBC 137 you can effectively clean and demagnetize recorder heads all in one easy operation. **$4.85***
Code 39590165
*Recommended retail price

All Philips audio and video service products are available through your nearest Philips Service Centre or selected dealers.

Sydney: 443 Concord Road, Rhodes, N.S.W. 2138. Telephone: (02) 73 0231. Philips Building, 2 Blue Street, North Sydney, 2060. Telephone: (02) 922 0181. **Newcastle:** 190 Parry Street, Newcastle West, 2302. Telephone: (049) 61 1631. **Canberra:** 86 Wentworth Avenue, Kingston, A.C.T. Telephone: (062) 95 0321. **Melbourne:** Cnr. Miles & Dodds Street, South Melbourne, 3205. Telephone: (03) 699 2711. **Hobart:** 2A Pierce Street, Moonah, Tasmania, 7009. Telephone: (002) 28 0121. **Brisbane:** 55 Forbes Street, West End, Brisbane, 4101. Telephone: (07) 44 8121. **Townsville:** 38 Punari Street, Currajong, 4812. Telephone: (077) 79 7422. **Adelaide:** 81-97 Flinders Street, Adelaide, 5000. Telephone: (08) 223 2999. **Perth:** 875 Wellington Street, West Perth, 6005. Telephone: (09) 321 5131.

PHILIPS ServiceServiceService

AHEARN PSI

rail was down to 7V. Some of the transistor voltages differed a little from the circuit values, but with rail voltages so far out, this didn't mean very much.

And so began the tedious task of component checking. Not to make too big a story of it, I measured every resistor, checked all the diodes, replaced three electrolytics, and no less than eight transistors — and finished up achieving absolutely nothing.

To say that I was frustrated would be to put it mildly. As far as I could see I had either checked or replaced virtually every component in the suspect section, yet the fault persisted. Either I had overlooked something, or the fault was somewhere else. But right now I was out of ideas on either possibility.

There's my basic service fee, plus the labour charges, plus house calls and cartage, plus the cost of electricity to run it on my service bench for a total of 40 weeks!

I put the set aside for a couple of days, hoping that a break might help me to think more objectively. At the end of that time I had come up with only one more idea, and a long shot at that. Was it possible that, during my soldering exercise, I had damaged the board in some way, or flicked a tiny sliver of solder between tracks?

I pulled the board out of the set, picked up the magnifying glass, took them out into the bright sunlight, and went over the board with the utmost care. And that's how I found it. Even under the glass it looked like a thin line of flux across the solder track — until I dug at it with a sharp probe. Then it became obvious that it was flux and nothing more, there was no solder under it.

Digging deeper — literally — I found the real cause. For some reason the copper pattern was broken at this point, even though I felt sure that it should be continuous. In fact, checking against the circuit confirmed this. The break was between the collector of TS550 and the .22 ohm resistor which connected it to the collector of TS545.

Once convinced that the break should not be there, I bridged it with a scrap of pigtail, and switched the set on. And up came a perfect picture, along with normal rail voltages and passive thermal cut-outs. And that, as far as the customer was concerned, was the end of the story, because the set has now operated for many months without a flicker.

But how had it all started? Putting aside, for the moment, the reason for the break in the copper, it was now fairly obvious that this had been bridged with solder — except that the bridge had contained a dry joint, and that this had caused the original symptoms, sometimes going completely open long enough to activate the cut-out.

When I went over the board with the iron, I would have re-soldered a joint only a few millimetres away, melting the solder bridge and creating a permanent open circuit. Which leaves only the question as to why the copper pattern had been broken in the first place.

At first I considered that it might have been deliberately cut, during production testing, in order to trace some obscure fault. (I have done the same thing myself many times.) But when I took a closer look at the board pattern in the manual I realised that the break is deliberate; it is an integral part of the pattern.

Why? I don't know and, what's more, neither do the makers. At least, I have not been able to get an explanation from them. My own view is that it my have been included to accommodate — originally — a slightly different circuit arrangement. Either that, or it is (or was) intended to allow certain static tests to be made during production.

But, whatever its purpose, I feel that the method of bridging it leaves something to be desired. Not long after this episode I had another set of the same model on the bench (for a quite different fault) and took the opportunity to heat the adjacent joint and watch what happened.

The prophet Moses would have been proud of the effect; the solder rolled back like the parting of the Red Sea waters, leaving a clear area of blank board in between. And, for some reason, it was much wider gap than in the original case.

So there it is. I've found dry joints in some funny places, but never one in an actual run of solder before. I hope nobody else encounters these same symptoms but, if they do, this story may save them a long search.

If you have a factual and interesting story to tell about electronic servicing, write it in your own words and send it to "The Serviceman", c/- "Electronics Australia", Box 163, Beaconsfield 2014. If the Serviceman uses it in his column, we will pay an appropriate fee.

CIRCUIT & DESIGN IDEAS

We invite readers to submit circuit ideas and solutions to design problems. Explain briefly but thoroughly the circuit's operating principle and purpose. Sources of material must be acknowledged and will be paid for if used. As these items have not necessarily been tested in our laboratory, responsibility cannot be accepted.

Conducted by Ian Pogson

Bi-directional LED chaser

A 555 timer IC is connected as an astable multivibrator whose output frequency is adjustable with the 100k potentiometer. The output pulses from the 555 are fed to a 4516 IC, which is a programmable binary up/down counter. The logic level on pin 10 governs the count direction and can be changed with the switch.

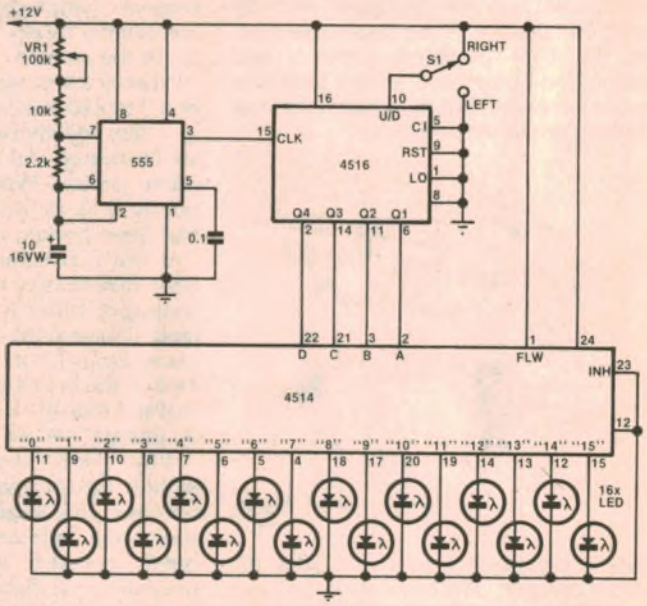
The 4516 has four outputs (Q4, Q3, Q2 and Q1) which can yield 16 unique states and these are fed to the D, C, B, A inputs of a 4514, a four-to-16 decoder, and cause each of its outputs (from 0 to 15) to yield, in turn, a unique high state. This will give the impression that the LEDs that are connected to these outputs are "moving".

It may be seen that the LEDs are driven directly from the 4514 IC, the amount of source current available being sufficient to drive the LEDs to adequate brightness.

The 100k potentiometer should be linear and it can vary the output frequency from 30Hz to 1.4Hz. The LEDs may be arranged in a straight line, a square, a circle, or any other desired configuration.

Finally, a suggested use for this device, is to fit it to a T-shirt to provide psychedelic lighting. The battery for the power supply may be fixed to a belt, or any other position which may be considered convenient.

(By Mr J. Petroulias, 30 Whitehorse Road, Blackburn, Vic 3130.)



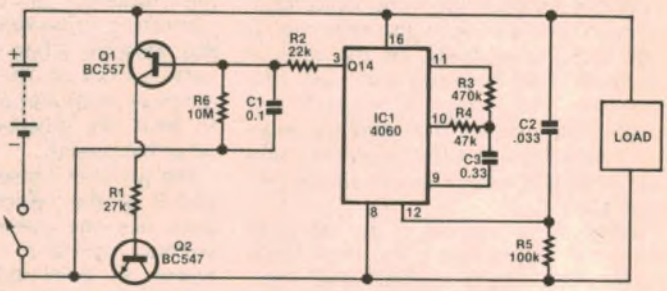
Automatic switch-off circuit saves batteries

Users of battery operated test equipment know how frustrating it is to find that batteries are flat because an instrument was not switched off. Here is a circuit which will automatically disconnect a load from a battery after a predetermined time. When the load is disconnected, the current is so small, less than a microamp, that it can be disregarded. To reconnect the load, the battery switch is turned off and then on again.

The part of the circuit which determines the "on" time is IC1 and its associated oscillator circuitry. The output of the oscillator is divided successively by two in each of the 14 stages of the counter. By pulling the reset line high, all outputs can be set low and this feature is used to ensure that the full number of divisions are carried out each time, thus ensuring equality of timing periods. Division restarts when the reset line goes low again.

When the switch is closed, current flows through the emitter-base junction of Q1 to charge C1 and in doing so, switches Q1 on momentarily. Q1 switches Q2 on and applies power to the load and to IC1. The reset line of IC1 is pulled high while C2 charges through R5 causing the counter outputs (Q14 in particular), to go low. With Q14 low, Q1 is maintained in a switched on condition, Q2 therefore remains switched on and the load continues to receive power.

With the component values shown, the oscillator oscillates at about 30Hz. This is divided by 16,384 with the result that after about nine minutes, Q14 goes high and switches off Q1, which in turn switches off Q2. This disconnects the load from the battery.



None of the component values appear to be critical. R1 is sized to allow sufficient base current to flow to saturate Q2. For light current loads, a value of from 10 to 15 times the load resistance is of the right order.

Q2 must be large enough to carry the load current. Since power transistors tend to require relatively large base currents, a Darlington pair may be used. As drawn, the circuit will operate over a voltage range of about 4.5 to 15 volts. For higher voltages, the Vss connection of IC1 could be connected to load negative via a zener diode so that Vdd to Vss across the IC is no greater than 15V. R5 should be connected beween pins eight and 12.

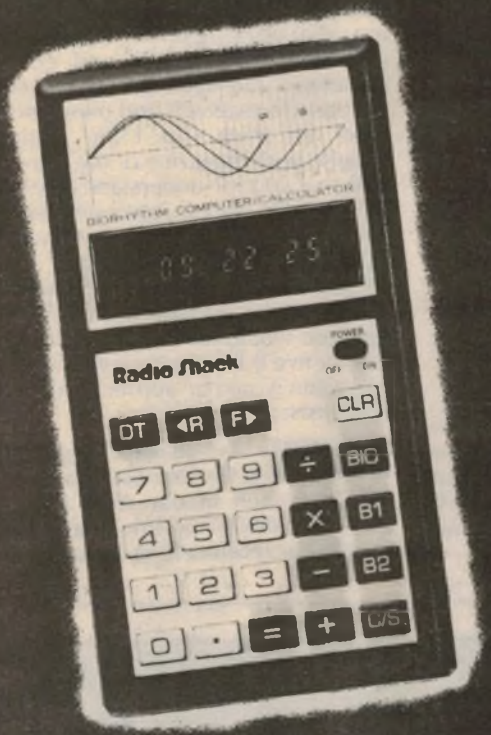
Longer timing periods could be obtained by increasing the capacitance of C3 and/or the values of R3 and R4 in accordance with the data book information on the IC.

(By Jim Parnell, ZL2APE, in "Break-In", January-February, 1980.)

It was Written in the Stars that

TANDY ELECTRONICS

Would Bring Out Innovative Computer/Calculators



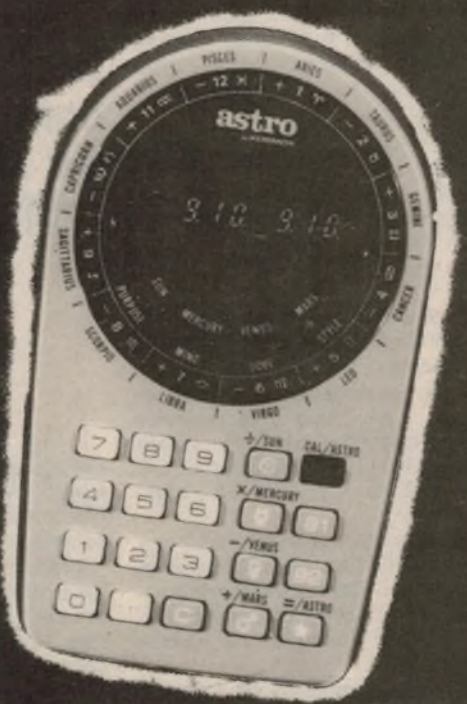
Radio Shack Biorhythm Computer/Calculator

NEW FOR '81

39.95

- *Calculates biorhythms for any past, present or future date*
- *Functions as a standard 4-function calculator also*

Biorhythms and the theories behind them have generated a great deal of public interest over the past few years. In fact, the interest has been to the effect that many daily newspapers are publishing regular columns intended for those who wish to know when "critical days" will be coming along, when the body's "inner clock" is in transition! Our Biorhythm Computer/Calculator will chart you and your friends' individual physical, emotional and intellectual cycles — it could help you to avoid arguments and from catching a cold on a bad day. An up to date concept that's lots of fun. Requires 2 "AA" batteries. 65-802



Astrological/Computer

NEW FOR '81

49.95

- *Calculates daily horoscopes scientifically*
- *Goes beyond the common newspaper forecasts*
- *With case*

Every daily newspaper has a column with your "stars" written by an "astrologer". These columns fall short of accurate forecasts for two main reasons. Firstly, the forecasts are only concerned with star or zodiac signs and not the specific birth dates of individuals. Secondly, the methods of the astrologers are all based on human calculation. Our Astrologer Computer/Calculator gives horoscopes for specific birth dates. Just enter birthdate and it computes the position of the Sun (purpose) Venus (emotion) and Mars (style) on that particular day! Compare personalities with, and of friends, boss or spouse by entering two birthdates. It's also a 4-function calculator! Requires 2 "AA" batteries. 65-801

Available at all Tandy Stores and Participating Dealers Around Australia or Mail Order Department. P O. Box 229. Rydalmere. N.S.W. 2116

Letters to the editor

Ideas wanted for work co-operative

I am writing on behalf of a group of unemployed people here who are looking at starting a work co-operative to create our own employment.

We are interested in electronics as a possible source of material for manufacturing (small scale), but we are so far away from where it's all happening we don't know where to start.

We'd like suggestions from your readers, from manufacturers, retailers – anyone who has a practical idea for a way for us to enter the field.

We are willing to work for a fair return – anything is better than the dole!

B. Davis, PO Box 55,
Cooktown, Qld 4871.

More wanted on the DREAM 6800

Last year, I, along with a great many other newcomers to the realms of computer science, embarked on a rather bewildering journey into a land of foreign words and phrases that dazzled the uninitiated and fired our imaginations to boot.

I refer of course to the DREAM microcomputer, an amazing creature of which I am now the proud owner.

Yes, I encountered a few hitches on the production line, but these were sorted out – I must confess to having held a soldering iron before. In fact, I must also confess to being a television technician and therefore not as stupid as I look!

However, I have been in a quandry lately as I try to fathom out the jealously guarded code of 33 instructions that are Chip 8 – not to mention the basic Chipos language.

It then occurred to me that it has been a year since the first article and, gauging from your latest invitation to submit programs, you haven't been flooded by offers. Ergo, I'm not the only one who is stumped in places.

Perhaps another article by M. J. Bauer could illucidate us (with apologies to the August 1979 article) – something that tells how to move an object under control or under certain conditions; how to sense timing; how to understand the format of computer actions. These are all aspects which I find confusing when trying to dissect the programs given in July 1979.

Personally, I would like to know more about controlling the inputs and outputs, both the software and hardware aspects. In short, I would like to know more to do more and this I find very difficult with the current level of printed matter in EA and in some selected books I've read.

At this point I must affirm my faith in the machine and my own capacity to learn from it. I trust that anyone else out there in magazine-land who feels a similar frustration will write in and lend some weight to my proposal.

D. Willaton,
Brisbane, Qld.

COMMENT: A manual describing the Chipos language and Chip 8 instruction set is available for $5 from Michael Bauer, PO Box 343, Belmont, Vic. 3216. Further articles on the Dream 6800 will be published as space permits.

What's wrong with radio receivers?

Being a regular subscriber to "Electronics Australia", I was wondering why your magazine does not print more circuits on receivers.

I was first introduced to the electronics magazine in Palmerston North, NZ, in 1947 and some very good circuits on receivers were published, of which I built quite a number. I know times have changed and vacuum tubes are almost dead since transistors and ICs took over but, after glancing through some of your magazines of the 50s and 60s, you somehow managed to blend certain adapters to receivers and television sets.

Do not think that I am writing to criticise your magazine of the 80s – I am sure that you will understand the feelings of a reader who is interested in radio, and that you understand that each reader has his own pet subject.

I know that it would be impossible for you to please everybody, but I feel sure that you would know that a circuit for a four or five transistor receiver every now and again would be appreciated by most hobbyists.

COMMENT: An all-wave regenerative receiver using two transistors and one IC was described in our April issue. We plan to publish a low-cost superhet shortwave receiver in the near future.

Dissolve control for slide projectors

I refer to a letter in the Information Centre of the June 1980 issue of "Electronics Australia" on the subject of an electronic dissolve control for slide projectors.

It may be of interest to readers that we have such a unit, photographs of which are enclosed, for controlling two projectors, either manually or under tape control.

The unit is intended primarily for use with Kodak Carousel S-AV or S-AV 2000 slide projectors; other projectors can be used but may require modification. Lamps of 24V, 250W rating can be easily handled.

Three rates of dissolve are possible: SNAP, FAST and SLOW. SNAP results in an instantaneous slide change, whereas FAST and SLOW provide two adjustable dissolve rates.

Tape encoding and decoding is also provided, which allow the unit to be operated automatically from a conventional cassette or reel-to-reel recorder. The slide change signal consists of variable length 900Hz tone burst recorded on one channel which generates alternate fades for the two projectors.

We would be very interested to hear reader reaction to this unit.

N. Jameson,
Pascal Electronics,
106 Bradley's Lane,
Warrandyte, Vic 3113.

WE'LL GET YOU INTO ELECTRONICS. ONE WAY OR ANOTHER.

At International Correspondence Schools, we have at least 16 career courses you can take in electronics and other inter-related fields, like computers and television. These are the fields of the future that you *should* progress in now. And they are all ideally suited to home study. And ICS, being the largest institution of its kind in the world, has access to the latest world-wide developments and its teachers are amongst the best in Australia. So, if you're interested in one or more of the courses below, mail the coupon to ICS, and we'll send back everything you need to begin a more successful career.

1 Basic Electronics course for a sound knowledge of radio theory and the industrial applications of electronics.

2 Electronics Technician course, with specialist courses in Audio, Radio and Hi Fi; Communications/Broadcasting; Electronic Computer Servicing; Industrial Electronics. Approved by TETIA.

3 Electronic Instrumentation and Control Systems course for electronics technicians interested in industrial instrumentation and control.

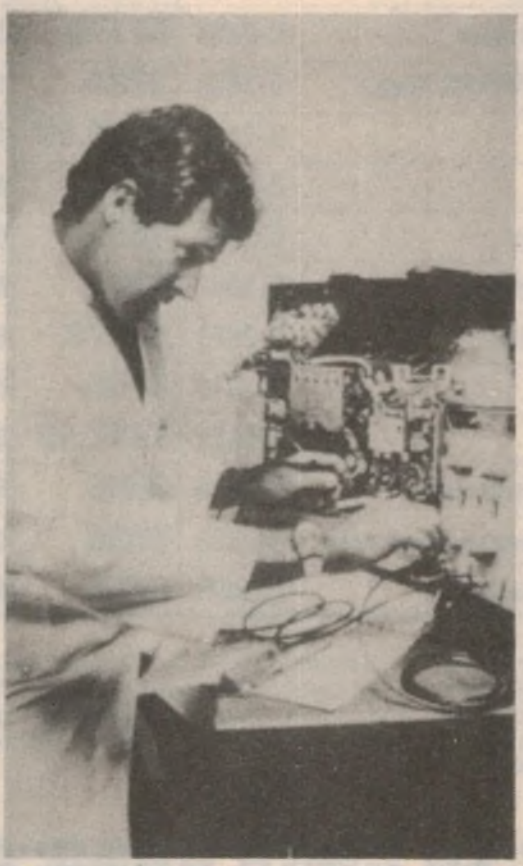
4 Electronic Technology, a program that will fit the ambitious technician for a wide variety of jobs.

5 Electronics Maintenance for basic principles and electronic theory, followed by a practical section of maintenance procedures and techniques.

6 Radio-Electronic Telemetry covers electrical and electronic aspects of telemetering. Employment opportunities abound in this very modern field.

7 Amateur Radio Operator's Certificate of Proficiency prepares you for the examination leading to the Certificate of Proficiency issued by the Postal and Telecommunications Department.

8 Digital Electronics course, as new as today, gives you a thorough understanding of the applications of integrated circuits in electronic equipment.



9 Data Processing. Various courses including Electronic Computer Servicing.

10 TV Servicing courses, in black and white, and PAL colour. Approved by TETIA.

11 TV Principles course for basic television technology. And TV engineering course for complete practical coverage of television engineering.

12 Electrical Engineering Technician course, is especially for those who want to make a start in the industry or want a broad technical knowledge.

13 Electrical and Electronic Drafting is designed for experienced draftsmen wishing to enter this specialised field.

14 Automobile Electrician gives you the basics of servicing the automobile's electrical system.

15 Industrial Electrician course gives comprehensive training on all aspects of the electrician's work.

16 Electrical Mechanic course prepares you for external examinations.

International Correspondence Schools
(A'asia) Pty. Ltd., 400 Pacific Highway,
Crows Nest, N.S.W. 2065. Tel: (02) 43 2121.

Please send me, without cost or obligation, information about the **ICS courses in Electronics.** ☐

or, I am interested in a (Please specify). ..... course.

Mr/Mrs/Miss .....
(Please Print)

Address ..... Postcode .....

Occupation ..... Age ..... Phone .....

Tick here if currently full time student. ☐

Write to your nearest ICS city: **International Correspondence Schools.**

ICS

Sydney: 400 Pacific Highway, Crows Nest, NSW 2065. Tel: (02) 43 2121
Melbourne: 18-20 Collins Street, Melbourne, VIC. 3000. Tel: (03) 656 1950
Brisbane: 131 Elizabeth Street, Brisbane, QLD, 4000. Tel: (07) 221 0178
Adelaide: 28 Grenfell Street, Adelaide, S.A. 5000. Tel: (08) 219 4154
Perth: P.O. Box D157, Perth, W.A. 6001. Tel: (09) 321 8530
New Zealand: 182 Wakefield Street, Wellington C.I. N.Z.

224194

Bankcard

ICS.017

It's not so difficult to own the best . . . YAESU!

Owning a Yaesu need not be an impossible dream . . . Dick Smith Electronics offers you the choice of cash, Bankcard or easy terms* payments.
Yes – you could be talking to the world on your new Yaesu tomorrow: why not call in to your nearest Dick Smith store and make your dreams come true?

This chart shows just how little your monthly payments can be: *To approved, personal customers only

DESCRIPTION:		Cash or Bankcard Price	TERMS DETAILS Deposit	Monthly Payment	Months Over
FRG-7 Communications Receiver	D-2850	$350	$35	$17.25	24
FT-901D All-mode HF transceiver	D-2854	$1175	$135	$34.96	48
FC902 Antenna Tuner (with WARC freq.)	D-2855	$224	$24	$13.77	18
Memory Unit for FT-901	D-2858	$139.50	$15.50	$8.53	18
FT-101Z HF Transceiver	D-2862	$775	$85	$23.19	48
FT-7B HF Mobile Transceiver	D-2868	$599	$59	$18.15	48
FT-707 Solid State HF transceiver	D-2869	$735	$75	$22.19	48
FT107M 'The Ultimate' HF rig	D-2871	$1278	$138	$38.32	48
FC-107 Antenna Coupler	D-2873	$196	$26	$11.70	18
FC-707 Antenna Coupler	D-2875	$157.50	$17.50	$9.64	18
FT-625 6 metre all mode transceiver	D-2886	$695	$75	$20.84	48
FT-207R 2 metre microprocessor hand held	D-2888	$358	$38	$17.52	24
FP-707 12 volt 20A power supply	D-2895	$215	$25	$13.08	18

MAIL ORDER CUSTOMERS: Finance company regulations restrict finance to 'approved, personal customers' only. However, if you wish to 'pay off' a Yaesu and cannot call into one of our stores, you can always ring us and order your Yaesu by Bankcard. All you do is quote your Bankcard number, name and address, and we charge your Bankcard account. What is more, we'll send your new Yaesu anywhere in Australia for only $6.00 road freight: that's below what it costs us!

AND DON'T FORGET OUR

'WIN A TRIP TO HONG KONG' CONTEST . . .

Yes! Every purchaser of Yaesu equipment between August 1st and October 31st receives an official entry form in the fantastic 'Win a Trip to Hong Kong' contest. Entry is available ONLY to purchasers of Yaesu during this period, so you must stand a very good chance of winning!

All you have to do is tell us, in fifty words or less, the best way that Dick Smith Electronics can promote the fantastic hobby of Amateur Radio to the benefit of Australia.

For more details of this exciting contest, see our adverts in the August issues of Australian electronics and amateur magazines. **You** could be the one flying to Hong Kong!

NOW, MORE THAN EVER, IT PAYS TO BUY YAESU FROM DICK SMITH!

AMATEUR RADIO

by Pierce Healy, VK2APQ

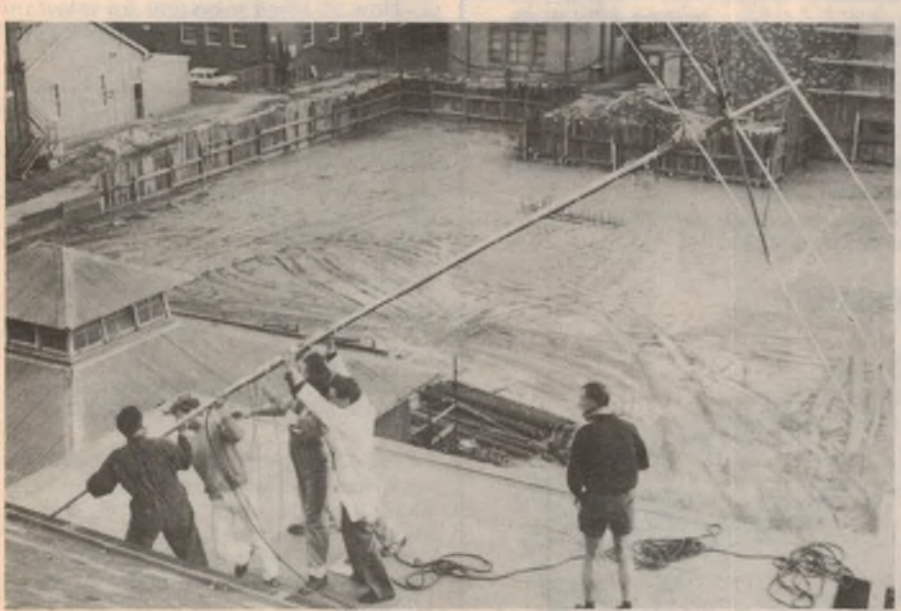
Amateur initiative — can it be maintained against today's technology?

Amateur radio has been in the forefront in extending the range and modes of radio communication. How will its performance be judged between now and the turn of the century?

Amateur radio holds a unique place in the history of world-wide radio communications. It has many achievements to its credit, from spanning oceans and continents to space satellites and providing services to communities in times of emergency. More recently, in spite of pressures from other services, it maintained its status as an international communication service at the World Administrative Radio Conference (WARC 79).

In the past, amateurs experimented mainly in exchanging messages that could be sent, received, and understood in a leisurely fashion, which met the everyday needs of the times. Now the volume and speed of communication required by society is often beyond human capability, so terms such as computer controlled data banks, digital networks, and microprocessors are part of the everyday language. All refer to the ever increasing use of electronic machines and aids.

Listen on any amateur band or copy amateur radio teletype today and you will become aware that a new activity is growing among the younger generation of amateurs – and it has to do with computers and data processing.



SYDNEY, June 1980: erection of the TH3DX antenna for amateur radio station VK2BQK on the roof of the Museum of Applied Arts and Sciences, Sydney Technical College. The task, supervised by Jeff Sergel (curator of electronics; white coat), and assisted by Keith Landy (Museum electrician) and Department of Works riggers, was not without its anxious moments.

So, can amateurs continue to accept the challenge of the future and maintain their tradition in the era of high and expanding technology? Will the inquisitiveness and inventiveness of amateurs, who gave the lead in radio communication, be a feature of their activity between now and the next WARC at the turn of the century?

These thoughts were highlighted while reading an address by Mr Richard Butler, Deputy Secretary-General ITU, given in Rome on June 23, 1980 to the IBI World Conference on Transborder Data Flows Policies.

There were many thought provoking points made such as "... the potential low cost applications of microprocessing units and their move from commercial enterprise to the home, or away from capital and provincial cities to developing rural and isolated centres which have never had real access to sophisticated information processing devices".

"Consider also the simple way such units, when associated with suitable telecommunication facilities, might be used to call up and receive information data for local social and economic needs at the village level."

Here may be an area in which amateurs could show the way.

NZ REPEATER BANDPLAN

The annual general meeting of the New Zealand Association of Radio Transmitters (NZART) held at Greymouth in May 1980 approved a new plan which will shift the FM repeaters to the 146/148MHz segment of the two metre band and use 600kHz offset.

The plan has provision for 15 repeater channels on 50kHz spacing, the same as that used in Australia. However, the channel numbering will use three digits indicating the frequency of the repeater transmitter, ignoring the decimal point and the last figure, eg 146.650 is channel 665.

AMATEUR RADIO

Simplex channels will also be spaced at 50kHz on the 25kHz segments and be identified by a four digit number, eg 146.475 is 6475.

A mixture of old and new systems may exist for about 12 months. If visiting New Zealand a note to the Chairman NZART Frequency Management Working Group, C/- PO Box 40-212 Upper Hutt, New Zealand, will get you up-to-date information on the old and new repeaters.

BLUE LAKE AWARD: This award is offered by the South East Radio Group, Mount Gambier, South Australia. The object is to create contacts between amateur radio operators throughout the world and the south east of South Australia.

The award is available to any amateur who establishes two-way communication with five South East Radio Group members.

All amateur bands and modes are permitted. Crossband operation is not permitted.

No QSL cards are required, but a full log entry giving date, time frequency and mode of contacts should be sent with the application for the award.

One dollar ($1) or 5 IRC's must accompany an application. Make applications to the Awards Manager, SERG, PO Box 1103, Mount Gambier SA 5290.

Contacts made on or after January 1, 1980 will be eligible for the award.

Here are some details of the area, and the lake for which the award is named, as given by Len Cowin, VK5ALC, the awards manager.


BLUE LAKE AWARD

SOUTH EAST RADIO GROUP

The South East Radio Group has pleasure in granting this certificate

to

who has complied with the conditions under which this award is granted by contacting the required number of members.

Date

SERG: MOUNT GAMBIER, SOUTH AUSTRALIA

Mount Gambier – Blue Lake City – is located in the south eastern corner of South Australia and is approximately 28km from the coast and 19km from the Victorian border.

Mount Gambier's Blue Lake is one of Australia's best known tourist attractions. Late in November each year the colour dramatically changes from sombre grey to a beautiful turquoise and remains that colour until late March when it resumes its winter appearance. Many theories have been advanced about this mystery but none is completely proven.

The lake bottom is relatively flat, the average depth being about 77 metres. In one section, called the Bung Hole, the depth is approximately 197 metres. The Blue Lake has a circumference of 5km and its surface area is 70 hectares. With a capacity of 36,000 megalitres it is an excellent domestic water supply for some 20,000 residents of Mount Gambier.

Mount Gambier was named after Admiral Lord Gambier RN, on December 3, 1800 by Lt James Grant who sighted the mountain while exploring the southern coast line of Australia aboard the HMS Lady Nelson.

RTTY NEWS

Have you conversed with a computer? Think before you answer, especially if you are a newcomer to teletype. It is possible to do so and not be immediately aware of the fact; at the time these notes were being prepared details had been received of two such stations in Europe, one in Switzerland and the other in Germany. Both operate on the 14MHz band and are accessible by amateur stations around the world.

Here is information from HB9AVK regarding his computer auto station on 14.075MHz. (Note: As in normal RTTY, upper case (capital) letters and "Q" code is used to show how the system works.)

1. How to see if the system is ready: type – HB9AVK DE (OWN CALL SIGN) QRV? BK
2. How to see if messages for relay are stored: type – HB9AVK DE (OWN CALL SIGN) QSP FOR QSP (NAME) BK
3. To store a message for relay: type – HB9AVK DE (OWN CALL SIGN) QSP FOR (NAME) BK YOUR TEXT (MAX 500 CHARACTERS) END WITH NNNN OR "::"
4. To receive a message to be relayed to you: type – HB9AVK QSL for (OWN CALL SIGN) BK
5. To enter a message to be replayed for checking: type – HB9AVK DE (OWN CALL SIGN) REPLAY REPLAY = YOUR TEXT (MAX 500 CHARACTERS) END WITH NNNN OR "::"
6. To see this information: type – HB9AVK DE (OWN CALL SIGN) INFO ???? BK

Please note:– Under poor conditions type HB9AVK two or three times. A relay name can be your own call sign or another six character name.

Permanent relay names are: DAYFILE; DXNEWS; AMTOR; APPLE; HUMOR; SCOUTS.

When operating, the German station DL1WX transmits the following on 14.100MHz.

INFORMATION DE DL1WX QTC-QSP-SELCAL DE DL1WX CQ CQ CQ DE (JUPP)

AMATEUR RADIO

DL1WX QTH: LANGENFELD R-08 WITH THE FIRST QTC-QSP-SERVICE INSTALLATION, AND ELECTRONIC LOG IS QRV HERE FOR MESSAGES TO YOUR FRIENDS.
DO YOU WANT A QTC OR LOG??? THEN TYPE:
RYRYRY DL1WX QTC FOR (YOUR CALL SIGN)? NNNN
IF YOU WANT INSTRUCTIONS FOR USE??? THEN TYPE:
RYRYRY DL1WX – DL1WX – QST QST NNNN
HERE IS DL1WX QTC-QSP-SERVICE WITH INSTRUCTIONS FOR USE. PLEASE START ALL COMMANDS WITH RYRYRYRYRY
1. DL1WX QTC FOR (YOUR CALL SIGN)? NNNN
THIS COMMAND INCLUDES THREE FUNCTIONS:
A. IF A MESSAGE IS STORED, YOU WILL RECEIVE IT.
B. IF NO MESSAGE IS STORED, YOU WILL RECEIVE INFO FROM ELECTRONIC LOG: YOUR CALL SIGN, DATE OF LAST QSO WITH ME, RST AND QSO – NR.
C. AT FIRST QSO WITH ME, YOU GET RECEIPT THAT YOU ARE REGISTERED IN THE ELECTRONIC LOG.
2. DL1WX QSL FOR (YOUR CALL SIGN) TNX NNNN
THIS COMMAND DELETES THE MESSAGE THAT YOU HAVE JUST RECEIVED. WHEN MORE MESSAGES ARE STORED FOR YOU, YOU WILL RECEIVE THE NEXT MESSAGE. AT LAST YOU GET YOUR DATES FROM THE ELECTRONIC LOG.
3. DL1WX QSP (FOR ANOTHER CALL SIGN) DE (YOUR CALL SIGN) NOW YOU CAN STORE A MESSAGE NOT EXCEEDING 240 CHARACTERS, WHEN YOU ARE FINISHED, PLEASE TYPE: NNNN TO TERMINATE THIS . . . YOUR MESSAGE IS STORED FOR 10 DAYS . . .
4. DL1WX LOG FOR GGGG? NNNN. YOU WILL RECEIVE A LOG-LIST FROM ALL G-STATIONS WORKED OVER THIS SYSTEM. FOR ANOTHER PREFIX-LIST, SET 4 FIRST LETTERS FROM A PREFIX-GROUP FOR THE GGGG IN THE COMMAND. SET FOR SM, SV, SP ONLY THE . . S . .
5. DL1WX QST FOR DX-NEWS? NNNN IF DX-NEWS IN MEMORY, YOU WILL RECEIVE IT.
6. DL1WX QST FOR INFO? NNNN YOU WILL RECEIVE MY WORKING TIME AND SPEC-NEWS.
7. DL1WX QRV ??? NNNN YOU GET RST. IS QRG AND CONDX-TEST.
8. DL1WX-DL1WX – (MESSAGE UP TO 300 LETTERS) AND ON THE END: QSL QSL NNNN. YOU WILL RECEIVE A PLAYBACK.
9. DL1WX – DL1WX – QST QST NNNN THIS COMMAND IS START FOR INSTRUCTION TABLE. I HOPE THAT YOU ENJOY THE USE OF THE FIRST COMPUTER QTC-QSP-SERVICE INSTALLATION WITH AN ELECTRONIC LOG HERE IS DL1WX (JUPP) STANDBY NNNN.

Such is a current technique in amateur radio. How long before the first worldwide DX contest in which the only participants will be fully automated amateur stations?

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

The Australian CB SCENE

NCRA AWARD: "For outstanding contribution to CB"

In conjunction with the 1980 NCRA Convention being held at the Astor Motel, Wickham Terrace, Brisbane on the weekend of November 22 and 23, the 1980 CB Merit Award is to be presented. This year the award is being sponsored by South Pacific Radio of Kalangur, Qld, and will be known as the "NCRA — South Pacific Radio CB Merit Award for 1980".

The prize, donated entirely by South Pacific Radio, consists of: a Cobra 148 GTL-A SSB/AM mobile rig, a 3-metre stainless steel antenna complete with heavy duty spring base, and a silver trophy, suitably engraved. The Award is to be presented at the National Assembly meeting on Saturday November 22, 1980, by the owner of South Pacific Radio, and the National Director of the NCRA.

Nominations for the award are open to any person in Australia who has made an outstanding contribution to CB in the 12-month period ending October 31, 1980. Nominations must be seconded, and must be accompanied by a statement of 250 words or less as to why the person is being nominated.

Neither the owner of South Pacific Radio nor the National Director of the NCRA are eligible for nomination.

On another subject, the National Director, Terry Watkin, and I went to see Senator Mal Colston the other week and presented him with 681 signatures requesting the retention of the 27MHz band. Senator Colston is to pass the petition on to a colleague in the House of Representatives for presentation when the House resumes in August. In the meantime we are gathering signatures on another petition for the retention . . . this one to be presented by Senator Colston to the Senate.

Terry and I have been requested by the Minister to meet him in Brisbane in the first week in August.

Because of the recent affiliation between the NCRA and the NCBC of Ireland, and the possible forthcoming entry of Australia (via the NCRA) into either the World CB Union or the proposed Eurasian CB alliance, the Queensland Division of the NCRA decided to do something about it.

There is only one way that the NCRA could talk legally with members of other CB Associations around the world . . . on the Amateur bands. So, thanks to the efforts of the Queensland State Technical Advisor, David Meyrick (who holds an amateur licence) the Queensland Division now holds the Novice licence number VK4VGT.

However, I would like to make one point clear: the licence was applied for with only one intention in mind . . . furthering YOUR aims by the means of quick, personal communication between like organisations overseas and ourselves. The NCRA always has been and always will be a CB organisation.

REPORT FROM CREST

I have referred on previous occasions to the number of calls handled by CB operators on behalf of non-CBers. This is supported by a detailed report sent to me by CREST ACT, Queanbeyan. In round figures the percentage of calls taken in 1979 for non-CBers was for: ambulance 5%; fire brigade 11%; police 39%; road services 17%; other 28%.

Of the 366 calls taken in 1979, 78% were made up as follows: 25% car accidents; 23% car breakdowns, assistance, etc; 11% road hazards, traffic light faults, straying or injured stock; 11% fires; 8% telephone message relays.

I gather from the rest of the report that the above is in spite of a decrease in the number of monitors able (or willing) to help the Division. In view of the job Queanbeyan CREST is doing, it would be good to hear that the number of monitors was on the increase again. How about it you CBers in the ACT?

Still on the subject of CREST, I attended the CREST Australia Inc National Council meeting which was held here in Brisbane on the weekend of June 28 and 29. I won't go into details, as I believe that CREST will be making its own statements on it. Sufficient to say that the National Director of CREST Australia Inc is now Mike Hurst-Meyers, a past National Director of both the NCRA and CREST. But there is one person who I would especially like to mention. I think I can speak on behalf of all who attended in thanking Mr John Briggs, who worked for two solid, hectic days ensuring that everyone had what they wanted.

THE MAIL BAG

I thought you may be interested in the following letter – or rather a precis of a letter – originally published in the English magazine "Practical Wireless" for January 1980. It has a lot to say about present-day CB in Germany. I include it in "mailbag" because I received a copy of the letter by mail. I quote:

"As an expatriate who has lived in Bavaria for the last six years, I have taken advantage of the privilege granted by the PTT in 1975 and installed a CB set in my car and a base station at home. Maximum output power is restricted to 500mW, 12-channels in the 27MHz band being set aside exclusively for CB. Directional antennae are forbidden.

"Every 'approved' transceiver has an FTZ number stamped on its chassis (Funk Technische Zullassungstelle Pruf Nummer), indicating that the design has been approved by the authorities. I say 'approved' transceivers, because it is easy to buy an imported set which does not comply with the emission regulations, ie, 4W, 40-channel, and of late a very sophisticated 18W, 120-channel SSB job. 'After-burners' ('add-on' power amplifiers) are also available.

"When one purchases an approved apparatus for use in the car, a set of regulations, an FTZ certificate corresponding to the set purchased, and a licence granting the purchaser permission to use the equipment is included. The documents must be kept with the car papers, and may be inspected together with the set at any time by a policeman or any authorised agent for the PTT. The latter are also empowered to carry out tests on

the equipment to ascertain whether any 'modifications' have been incorporated. There is no licence or registration fee for mobile installations.

"Operators of home stations must register with the Post and Telecommunications authority and pay a monthly fee of DM15.00 (about £4). Call signs (or call names) are either dreamed up by the operator or allocated by the PTT, where several 'Tweeties' or 'Bushy Bears' might cause confusion.

"As with most privileges granted by any authority, there are regrettably those who abuse them. No one would deny that Germany has its quota of rogue CBers. There are those, for example, who squirt 18 watts of RF down a transmission line, but, since this invariably results in TVI and breakthrough on approved sets, they don't operate for long, at least in our area!

"It seems to me that there are three distinct 'types' of CBers: the 120-channel, 18W cowboys (a tiny minority); the CBer who uses his (or her) set as an extension to the telephone; and finally, the chap who is considering amateur radio as a hobby, but for the moment content to carry out experiments using very low power equipment.

"In conclusion, it must be significant that in this area alone, the number of applications to sit for the German radio amateurs' examination has tripled in the last four years. The local education committee is running for the first time two RAE courses at the nearby Hochschule. I shall be enrolling this week.

"So I would say to all anti-CBers: accept the fact that CB is here to stay, and it will certainly come to England. Better to have a properly controlled CB facility available to those who can show they'll use it responsibly, than illegally imported sets, illegally and irresponsibly operated."

"Bird Dog", V.A. Sancto Miesbach, West Germany.

It was good to hear from my most regular correspondent, Ken Upton of Lethbridge Park, NSW. Unfortunately the story Ken tells could have had a tragic ending . . . were it not for the timely assistance of Alan, Gwen and Selena Fairweather of Trunkey Creek Base Station between Bathurst and Goulburn (NSW).

Thanks for the story, Ken, and a special thanks to the Fairweathers at the Trunkey Creek base station (Channel 4) for their assistance. "It does my heart good" to hear stories like that.

Well, that seems to be about it for this month. If you have any news which you would like to tell us all about, please feel free to write to me and tell me about it. I will include your name if you wish. My address again: PO Box 406, Fortitude Valley, Queensland 4006.

Jan Christensen.

SHORTWAVE SCENE

by Arthur Cushen, MBE

AWR celebrates 30 years broadcasting

Radio Monitors International is a session for shortwave listeners produced in Poona, India, by Adrian Peterson and broadcast by the Sri Lanka Broadcasting Corporation. In October, RMI will celebrate 30 years of operation of Adventist World Radio in Asia with a special DX contest.

The first broadcast on behalf of the Seventh Day Adventist Church in Southern Asia took place from Radio Ceylon on Sunday October 1, 1950. Since that time Radio Ceylon has changed its name to the Sri Lanka Broadcasting Corporation and the international shortwave broadcasting conducted by the Adventists in Southern Asia has been organised under the name Adventist World Radio-Asia.

Programs are recorded in the studios of AWR-Asia in Poona, India and sent to the Sri Lanka Broadcasting Corporation in Colombo for direct broadcasting according to a pre-arranged schedule.

Currently, 23 weekly programs are broadcast by AWR/SLBC. These programs present a varied format which includes devotional, musical, health, temperance, and service programming. AWR-Asia is on the air for 16 transmitter hours per week from the various SLBC stations.

The DX Program, Radio Monitors International, was first broadcast on Sunday June 1, 1975 in the All Asia Service of the Sri Lanka Broadcasting Corporation. It is the only international DX program produced and broadcast in Southern Asia, and thus far more than 260 weekly editions have been produced. The first broadcast was a segment of DX news within the popular program "Radio Journal". In early 1978 the news was extended to 15 minutes duration and became a program in its own right.

From the beginning of 1979 the program was extended to 30 minutes with the title "Radio Monitors International" and broadcast three times over the weekend. Reception in Australia is possible at 1100-1130UTC on Sunday on 11835, 15120 and 17850kHz. There are two other broadcasts at 1500-1530UTC on 6075 and 9720kHz, and 1800-1830UTC on 11800 and 15115kHz.

Adrian Peterson, Producer of Radio Monitors International.

The DX Contest will be held between October 5-12 in three sections. On October 5 entrants are asked to listen to Radio Monitors International and identify different radio stations as presented in the quiz. During the week from October 5 0001UTC until Sunday October 12 2359UTC listeners should log as many AWR channels as possible. On Sunday October 12, Radio Monitors International listeners will be asked to identify different radio stations by their tuning signals, themes etc.

Listeners may participate in one or all sections of the contest, and a variety of prizes are offered to the winners. Entries should be sent to Radio Monitors International, PO Box 15, Poona 411001, India.

ISRAEL'S EXPANDED SERVICE

For some months the Israel Broadcasting Authority at Jerusalem has been broadcasting a new service to North America which has also been received in the South Pacific. The transmissions are at 0000-0030UTC and 0100-0130UTC on 11637, 15582 and 21710kHz. The third transmission at 0200-0230UTC is on 9815, 11637 and 15582kHz.

Two other English transmissions can also be received on several frequencies, with a broadcast 0500-0515UTC being observed on 11637kHz, while a transmission at 2000UTC is carried on 9009kHz.

ENGLISH FROM KIEV

Radio Kiev in the Ukraine broadcasts three transmissions in English each day and two of these can be heard in this area. The broadcast in English to Europe 2000-2030UTC is on 7175, 9560, 11880kHz. The second transmission to North America 0300-0330UTC is received on the new frequency of 9800kHz. Other channels are 11735, 11790, 15170, 15405, and 17870kHz. The Kiev transmission includes news and commentary from the Ukraine and the Soviet Union as well as musical programs.

SIGNALS FROM ZAMBIA

After a breakdown of several months duration which transmissions were suspended because of lack of equipment, Zambia Broadcasting Services has again been heard on shortwave. Leigh Morris, of Palmerston North, NZ has heard Lusaka, Zambia on 4910kHz with an English news bulletin at 1800UTC.

Another frequency, 9578kHz, has been observed opening at 1555UTC. This transmission included an interval signal, station identification, English commentary and African musical and political

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

SHORTWAVE SCENE

programming. There was some sideband interference from Radio Moscow on 9580kHz.

According to a BBC Monitoring Service Report, the failure of the Zambia Broadcasting Service in recent weeks has been put down to staff attitude. The Minister of Information & Broadcasting Services said that there had been widespread misuse of equipment because staff had developed an "I don't care" attitude in handling equipment, under a mistaken notion that it "belonged to the Government". Representations had been made to the Ministry asking that Zambia Broadcasting Services be turned into a semi-autonomous corporation.

NEW BRAZILIAN SIGNALS

After a silence of 10 years Radio Nacional at Rio De Janiero has returned to shortwave. In the interim, a new powerful station has been put into service at Brazilia, with its transmissions to Africa, Europe and North America being widely heard.

Our earliest verification from the Government radio in Brazil was in 1941 when PSH was heard with an English broadcast each Monday at 0100UTC. PSH broadcast on 10220kHz and was operated by The National Department of Propaganda.

Radio Nacional is the successor of this station and is now on 9705kHz. The station has been heard with sports relays, closing at 0300UTC.

Another new signal, Radio Aparecida, has been heard on 6010kHz, which we presume is a frequency change from the listed 5035kHz. The transmission opens at 0900UTC and closes at 0300UTC, and should provide good reception during our summer months. The station has previously been received on 9635kHz.

RECENT VERIFICATIONS

GREENLAND: Broadcasts from Godthab are seldom heard in the South Pacific and reception will be even more difficult due to the fact that all shortwave broadcasts are now on 3999kHz. Our verification was for reception on 9575kHz at 1014UTC when transmission began in February. The folding card shows a picture of buildings under snow at the lonely UHF repeater station, West Greenland.

Greenland has a population of 50,000, largely of Eskimo ancestry. The population of Godthab, the capital, is 9,000. Nine tenths of the country is covered by 3.2km thick ice cap. Radio Greenland operates for 13 hours a day with broadcasts in Danish and an Eskimo dialect.

VANUATU: Radio Vanuatu, formerly Radio New Hebrides, now verifies reception reports with a new card which includes the new name of the station following the change of name in July. The station was formerly operated by the New Hebrides Broadcasting Service in Vila, and reception has been very good on two frequencies; 3945 and 7260kHz. English is broadcast 0830-0845UTC and then follows a program in French, and at 0900 to close at 1000UTC a broadcast in Bislama. Radio Vanuatu also operates on 1125kHz medium-wave. The addres of the Station is PO Box 49, Port Vila, Vanuatu.

NEW COUNTRY

The latest country to broadcast on shortwave is Namibia, formerly South West Africa, which is using two 100kW transmitters located near Windhoek. The shortwave service is to operate 24 hours a day and provides reception throughout the country. Broadcasting services in the past have been provided by an FM service which did not cover parts of Namibia.

The shortwave service is operated by the Namibia Broadcasting Service and is scheduled to operate on two frequencies for morning and evening transmissions and on higher frequencies for the midday broadcast, according to a BBC Monitoring Service Report. Transmis-1200-1730UTC on 9550kHz.

USSR: Radio Tashkent in Uzbekistan broadcasts twice a day in English and provides good reception in this area. The present schedule is 1200-1230UTC and 1400-1430UTC on 9715, 9750, 11785 and 15460kHz.

LISTENING BRIEFS
ASIA

MALDIVES: "Radio Maldives" has become the "Voice of Maldives". Adrian Peterson of Poona, India advises that the present schedule is 0030-0330UTC (Friday 0500) on 4754kHz; 0800-0930UTC (Friday 0700) on 9550kHz and 1200-1730UTC on 9550kHz. USSR: Radio Tashkent in Uzbekistan broadcasts twice a day in English and provides good reception in this area. The present schedule is 1200-1230UTC and 1400-1430UTC on 9715, 9750, 11785 and 15460kHz.

AMERICAS

BELIZE: Radio Belize has been heard in New Zealand on 3285kHz, closing at 0500UTC, while a report from Adelaide indicates that the station has been observed opening at 1100UTC. Radio Belize was formerly the Broadcasting Service of British Honduras.

SURINAM: Radio Apintie currently operates with 50 watts on 4794kHz, but the power is to be increased in the near future to 500 watts. This station was first reported some weeks ago, opening at 0830UTC, by Leigh Morris of Palmerston North, NZ.

Another innovation from Hioki

MEET A TOUGH BABY

HIOKI 3012
Thin
Drop-Proof
Multimeter

**Only 22mm thick and can drop from a height of 1 metre without any harm.*

Specifications:

DC VOLTAGE 0.3, 3, 10, 30, 100, 300, 1000V
20kΩ/V, ±3% of F.S.
DC CURRENT (50μA), 1, 3, 30, 300mA 300mV
drop, ±3% of F.S.
AC VOLTAGE 10, 30, 100, 300, 1000V 10kΩ/V,
±4% of F.S.
RESISTANCE 10k, 100k, 1MΩ (Rc100Ω) ±3% of
Scale Length
POWER SOURCE 1.5V (Size AA)
ACCESSORY CIRCUIT Meter protecting circuit Circuit
protecting 0.5A fuse DC-AC1000V measuring terminal
OUTPUT terminal
METER TAUT BAND type (with mirror scale)
DIMENSIONS Approx. 140Hx84Wx22Dmm (Max. 26D)
Approx. 250g
ACCESSORIES Test leads, 0.5A Spare fuse
Soft case, Strap

Our little pocket tester is so slim, small and light you might overlook the fact that it is a rugged, hard working precision instrument – tougher than most multimeters twice the size. It can fall from a work bench (1 metre high) and still work perfectly well.

The "DROP-PROOF" pocket multi-meter demonstrates our claim that "HIOKI puts you years ahead". It gives you the advantage of HIOKI Core Magnetic TAUT BAND for precise readings.

It is friction-free and is remarkably resistant to shock.

The pencil type leads fittted with guards are a pleasure to handle, especially when testing complex electronic circuits, etc. HIOKI innovation is apparent in every detail.

HIOKI PUTS YOU YEARS AHEAD!

• SYDNEY 6016600 • MELBOURNE 3296511 •
• BRISBANE 525231 • ADELAIDE 466411 • PERTH 4466622 •

H. ROWE & CO. PTY. LTD.

SOLE AUSTRALIAN AGENTS

NEW PRODUCTS

CCTV camera for surveillance & security

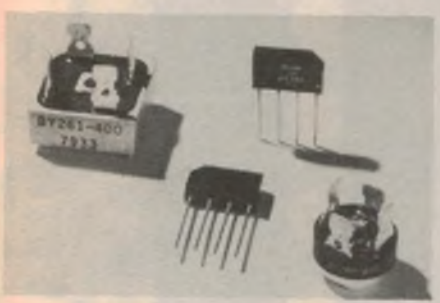
Javelin Electronics Inc has released a new Spectar Closed Circuit Television (CCTV) camera which uses medium scale integration chips to achieve a component count claimed to be 65% less than CCTV cameras currently on the market. All the major electronic components of the camera are contained on one PC board which plugs into the camera.

"Spectar was designed to virtually eliminate downtime inherent in CCTV surveillance cameras," says Ron Perry, International Sales Manager for Javelin Electronics. "Traditionally, camera malfunction meant sending the entire unit to the manufacturer for repair or replacement, defeating the purpose of a security system. Since all of Spectar's connections are pluggable, Javelin dealers can remove the cover and replace the malfunctioning PCB or MSI chip with a new one – on site."

Spectar incorporates three Javelin designed MSI chips, one each for video and vertical and horizontal sync. All the electronics, including the power supply, are contained in one compact camera housing measuring 400mm x 112mm x 65mm. Only half of the enclosure is utilised for components, leaving space available for optional equipment. Options now available include a camera identification circuit, a video line amplifier, and an "Inserter/Splitter" which allows video from two separate cameras to appear on the same monitor simultaneously.

The Spectar series is available in 14 different configurations for security and surveillance applications. Sole Australian agents are Photo-Scan (A/Asia) Pty Ltd, PO Box 588, Potts Point, NSW, 2011.

New range of bridge rectifiers



Philips has extended its range of full wave bridge rectifiers with the addition of four new types, the BY256, BY257, BY260, and BY261. The first two are 1.5A types with a maximum voltage rating (RMS) of 80V and 280V respectively. The BY260 and BY261 series have three versions, with maximum RMS input voltage ratings of 140V, 280V, and 420V. The BY260 has a maximum output current of 12A, while the BY261 is rated to 25A.

Contact Philips Electronic Components and Materials, 67 Mars Road, Lane Cove, NSW, 2066 for further information.

Multi-function test instrument

Presto-Tek Corporation recently announced the availability of "Poly-Pram", a portable, multi-parameter instrument which tests pH, millivolts, conductivity, and temperature. With four facilities in a single package, Poly-Pram will be of benefit to plant engineers and field researchers who previously had to carry a number of different instruments for measurement use.

The 3½ digit Liquid Crystal Display can be used at temperatures from −10°C to +88°C, and is easily read in full sunlight. Accuracy is given as ±.015 for pH, ±.15°C in temperature measurements, and ±.1% and 2% of full scale for millivolt and conductivity measurements respectively.

Test ranges available are 0-14pH; ±1999mV; −15°C to +100°C; and conductivity in four ranges to 200,000 Siemens.

Poly-Pram measures only 15.2cm x 7.6cm x 6.3cm and weighs 283g. It is expected to find wide usage in the laboratory, water and pollution treatment, petroleum and chemical processing, farming and horticultural operations, and photographic processing. Further details can be obtained from Tecnico Electronics, PO Box 50, Lane Cove, NSW, 2066.

THE SORCERER

The Sorcerer is the expandable Z-80 based microcomputer that allows you to add peripherals to take it from basic computing through to advanced office business systems.
● 16K RAM expandable to 48K (on board) ● Serial I/O and Parallel I/O ● S-100 BUS compatible ● Cassette I/O for two recorders at speeds of 300 or 1200 baud ● Video I/O - 1920 characters full screen ● Full ASCII 128 characters (64 defined characters and 64 undefined characters) ● Graphic resolution 122,880 pixels ● Includes 8K BASIC plug-in ROM PAC™ in MICROSOFT™ ● Dimensions 490 x 330 x 100mm ● Weight 6 kilograms
(Ask for our FREE comparison chart between the Sorcerer and other well known computer brands).

$1,395.00

VIDEO MONITOR

This is a superb 30cm black and white video monitor that can be used on AC and DC. Simple connection to your computer. Features jitter free and distortion free characters. Can be used with most computers on the market.

$149.50

WORD PROCESSOR PAC

Remove the plug-in BASIC PAC™ and replace it with the powerful WORD PROCESSOR PAC™ and you will have the basis of an office computer system.
Features ● Automatic text wrap ● Automatic checking of diasbc commands ● Powerful search function ● Auto commands ● Macro programming - all this plus extensive user instructions.

$275.00

HITACHI OR MAXELL HI QUALITY CASSETTES AT DISCOUNT PRICES

	1-9	10-24	25-99	100UP
C60LN	$1.90	$1.80	$1.70	$1.60
C90LN	$2.70	$2.50	$2.25	$1.99
UDC60	$3.20	$3.00	$2.75	$2.50
UDC90	$3.60	$3.20	$3.10	$2.90

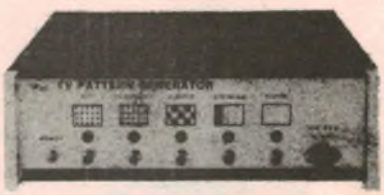
EXIDY S-100 BUS EXPANSION

By using plug-in cards with the S-100 BUS and your Sorcerer you can use many other manufacturers peripherals (see our special "Blue Board" cards on this page). The world of computing has been made even more exciting through the S-100 BUS. Comes complete with in-built powre supply, ribbon cable and connector.

$499.00

● Allows up to 6 plug-in cards ● Connects directly to Sorcerer's 50-way expansion socket via supplied cable ● All S-100 lines fully buffered ● Separate 2.000MHz crystal clock provided for S-100 cards which cannot use the Ø1 and Ø2 clock signals derived from the Sorcerer's 2.106MHz clock ● Provision for mounting up to six 25 pin "D" connectors for additional I/O ports, etc.

Versatile TV Pattern Generator



VERSATILE TV PATTERN GENERATOR KIT INCLUDES ALL COMPONENTS SCOTCHCAL FRONT PANEL: F/GLASS PCB: HORWOOD CASE FOR ONLY

$54.90

CUSTOMERS PLEASE NOTE

SHOP ENQUIRIES 489 8131
MAIL ORDER ENQUIRIES 481 1436
WHOLESALE ENQUIRIES 489 7099

ROD IRVING ELECTRONICS ARE PLEASED TO ANNOUNCE TO THEIR CUSTOMERS THAT MOST OF THE DICK SMITH RANGE OF PRODUCTS ARE NOW AVAILABLE.

NEW KITS

TRANSISTOR ASSISTED IGNITION SYSTEM

(EA Dec 1979 79TILL one of our extremely popular projects from our wide range of kits) $32.50
60W low distortion AMP module ETI470
(with heatsink) $25.00
(without heatsink) $22.50
ETI471 preamp control module $45.50
Digital Capacitance Meter (March EA)
(80cm3a 80cm3b) $57.50

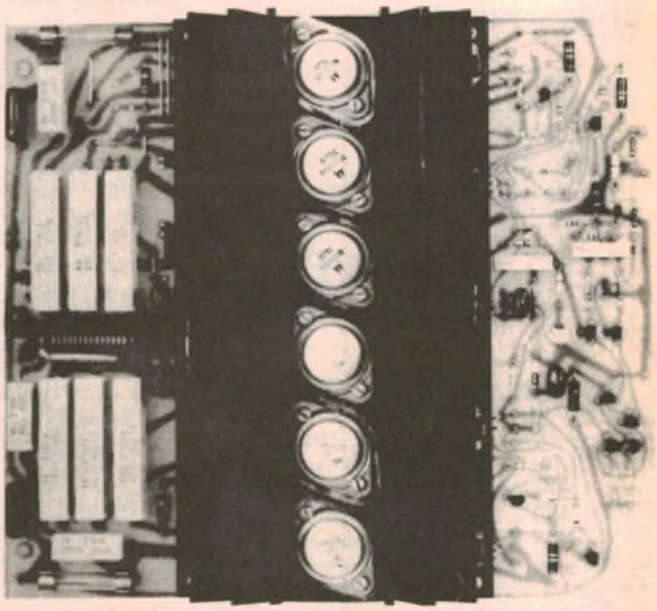
4116 MEMORY CHIPS PRICE BREAKTHROUGH

1-9	$8.00 each
10-19	$7.50 each
20+	$6.90

"BRUTE" POWER AMP

As featured in June EA 300 Watts of **POWER**
FOR ONLY ..... **$63.50 (Kit)**

Separate Parts
MJ15003 ..... $4.00
MJ15004 ..... $4.00
80pa6 PCB $7.90
ROD IRVING ELECTRONICS HEATSINK
(More cooling fins and aluminium than comparable types)
All this for only $8.90



ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE VICTORIA. Ph (03) 489-8131.

New Products

World map displays amateur prefixes

The Radio Society of Great Britain has released a new multi-coloured world map (Mercator projection) which gives amateur radio prefixes for different countries and regions of the world. The large area of the map (approximately 1190 x 820mm) allows detailed coverage, particularly of islands, while the usual insets, shipping routes etc, have been omitted to give a clean and uncluttered appearance.

The World Prefix map is available from the Radio Society of Great Britain, 35 Doughty St, London, WC1N 2AE. The price is £2.21, including packing and postage worldwide.

Engine driven battery charger

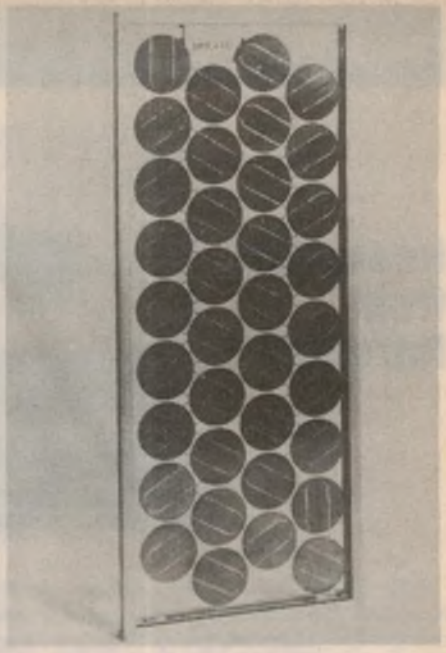
Plessey Aerospace Ltd of the UK has developed a lightweight portable 300W engine driven battery charger. At present prototype units have been supplied to the British army and various equipment manufacturers for evaluation. The set comprises a single cylinder four stroke petrol engine coupled directly to a brushless generator. The control system allows a voltage of 24-36V to be selected with regulation to ±1V under all load conditions.

Typical uses of the generating set are charging battery operated communications and medical equipment or 24V battery systems. More information can be obtained from Electronics Systems Division, Plessey Australia Pty Ltd, Faraday Park, Railway Rd, Meadowbank, NSW, 2114.

Solar cell modules from Philips

Philips has announced three additions to its range of solar cell modules. The new modules use the same proven construction techniques as the earlier BPX47A, incorporating 100mm diameter solar cells.

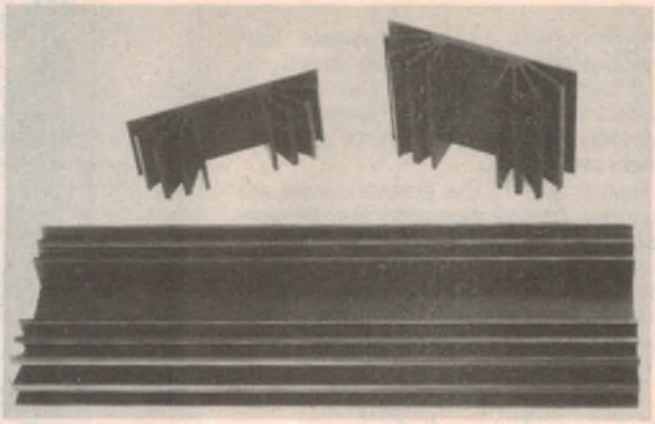
The BPX47B/18 is designed for charging 6V batteries, supplying 16.5W at 8.2V, while the BPX47B/36 is designed for 12V batteries, providing 33W at 16.4V. The BPX47B/20 is intended for applications which do no require batteries, and provides 18.3W at 9.1V.



In all the modules, the individual solar cells are encapsulated in transparent resin between toughened glass sheets, thus maintaining the performance of the units in high ambient temperatures and severe environmental conditions. Output connections are provided within a sealed junction box.

For further information contact Philips Electronic Components and Materials, PO Box 50, Lane Cove, NSW 2066.

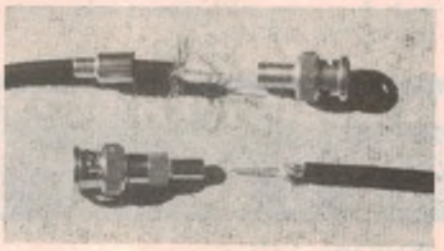
Heatsinks from Ritronics



ROD IRVING of Ritronics Wholesale Pty Ltd has announced the availability of moulded aluminium heatsink material which offers a higher thermal capacity than comparable imported types. The new heatsinks are almost identical to those used in the EA Transistor-Assisted Ignition (Dec 79) and the 300W amplifier module (June, 1980). They are available cut to standard sizes (38mm, 75mm, 150mm and 300mm) in black anodised finish and in unanodised lengths of 600mm and 1200mm in addition to the standard sizes. For details contact Rod Irving by phoning Ritronics Wholesale Pty Ltd, (03) 489 7099.

"Fastfit" one-piece BNC connector

Electronics enthusiasts looking for a BNC connector which eliminates the time-consuming assembly procedures usually associated with conventional models can now buy the "Fastfit" series in Australia. The series, available from JAL Enterprises, features a one piece BNC connector which can be installed with no contact soldering or crimping, and no additional parts such as clamps, nuts, insulators, or sub-assemblies.



The connector can be used in applications such as amateur VHF equipment and antenna connections. The entire assembly process takes about 40 seconds. A centre contact, pre-assembled in the body of the connector, provides a positive mating of the centre conductor and the contact, while cable attachment is by means of a tapered and threaded back opening which allows the unit to be twisted onto the cable braid and jacket, insuring a strong termination with good grounding.

Trade enquiries should be made to the Australian agent, JAL Enterprises, 71 Narrabeen Park Parade, Warriewood, NSW, 2102.

Arlec moulded instrument cases

A & R Electronics Pty Ltd has a range of moulded instrument cases available which feature slots for flow through ventilation, multiple fixing positions for PCBs and transformers, and a metal back plate which doubles as a heat sink. The cases are constructed of high impact plastic with a removable top cover and end plates for easy access to equipment, and an integral carrying handle is supplied as standard. Pictured here is the Arlec PC 3, which measures 198mm x 220mm x 94mm.

Details can be obtained from A & R Electronics Pty Ltd, 47 Drummond St, Belmore, NSW, 2192.

New range of Collet knobs

C & K Electronics (Aust) Pty Ltd has announced that it has been appointed sole Australian agent for Sifram Ltd of the UK, who are manufacturers of a wide range of Collet knobs and accessories. The range of Collet knobs includes six sizes from 10mm to 38mm in 19 different styles. Snap-on colour caps are also offered, with a line or a spot for positive identification, together with pointers, figure dials, nut covers and fixing tools.

For further information contact C & K Electronics (Aust) Pty Ltd, Office 2, 6 McFarlane St, Merrylands, NSW, 2160.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

RACHMANINOV: Symphonies from Rotterdam Philharmonic

RACHMANINOV – Symphony No. 1 in D Minor. Rotterdam Philharmonic Orchestra conducted by Edo de Waart. Philips Stereo Disc 9500 445. Symphony No. 3 in A Minor. The Rock, fantasie for orchestra. Both played by the same artists as above. Philips Stereo Disc 9500 302.

When thinking of Dutch orchestral music one is tempted to recall the great Gewandhaus Orchestra, to the exclusion of all others. Yet there are, to my knowledge, at least two others of great merit: the Rotterdam and the Hague. I heard the last-named in a superb performance of Brahms' Second Symphony under poor old crippled Carl Schuricht, when I was in Holland some years ago. The playing and recording of these two symphonies by the Rotterdam under Edo de Waart will surprise many listeners who haven't heard this orchestra before.

Since the Third is rather more accessible at first hearing than the first, I shall start my review with that. The first thing to strike one right from the start is the lovely tone of the strings, both at the top and the bottom.

The orchestra's accuracy is beyond praise and if at times you disagree with some of the things the conductor does, others may agree with him. There remains the query of why its performance at present day concerts is so neglected in favour of the Beethoven, Brahms, Tchaikovsky and other pieces from the 19th century musical museum, all repeated time after time.

As to de Waart's reading, I feel he could have used a little more spirit in the second subject of the first movement. He picks it up further along, only to lose it again towards the end of the sequence.

The second movement, adagio ma non troppo, contains a scherzo-like section, taken so solemnly by de Waart that it acquires quite a Dance Macabre air. But he atones generously by gloriously swelling strings, which eloquently fade into silence at the end of the movement. In this he is aided by the wonderful sound provided him by Philips' engineering.

His skill is displayed continuously throughout the whole work, but special sections I would pick out are the fugal passages in the Finale. De Waart slows up the final bars of the symphony in direct contrast to Rachmaninov's own recording (on 78s during the '30s). Though effective, this is less good than the composer's up to tempo finish. Even I must admit that the temptation to put it de Waart's way is very strong.

The Third is an unremittingly serious work and after it the fill, The Rock, is quite without interest. A student work, it has none of the piano concertos' lustrous melodies (the Third Symphony has only one, by the way, although it is a much later work). The themes are trite, as are its harmonies. And what is worse, it is repetitious, to add to its longueurs. There are strong hints of Rimsky-Korsakov and, in these, the scoring sounds all wrong. The only feature of interest is the wonderful sound made by the Rotterdam's strings. However, in these days, this is not a disc to be neglected.

The First Symphony was composed

Edo de Waart

only two years after the amateurish "The Rock" but it is a much more difficult work to appreciate and bring off than the Third. It is as difficult to play as it is to conduct and, in this case, the orchestra excels the conductor. De Waart never quite captures the spirit of the work, as does Previn with the London Symphony Orchestra. But de Waart only misses by a whisker and the beautifully engineered disc has still many merits. To save space I mention only one of the conductor's shortcomings - the lack of animato in a Scherzo marked Allegro animato. (J.R.)

KODALY: Orchestral Works (Vol 2)

KODALY – Orchestral Works (Vol 2). The Philharmonic Hungarica conducted by Antal Dorati. WRC Stereo Disc R. 04232.

This is the second volume of Kodaly's complete orchestral music. It includes the well known and often heard Hary Janos Suite and two pieces that might be unfamiliar to those who have not heard much of this composer's music. The weightiest of these is a Symphony in C Major. Before offering an opinion on this work I must point out that I consider the authenticity of the performance as beyond question. The orchestra is Hungarian – as was Kodaly – and its fine conductor of the same nationality. (My apologies if he has changed it.)

The symphony has its moments, including a few very good ones, but composed close to the end of Kodaly's life, it lacks the vitality found almost everywhere else in his music.

It is consistently tuneful but in a bland sort of way and is, of course, expertly scored. But those looking forward to something as good as the Psalmus Hungaricus or the Peacock Variations will be disappointed. Kodaly does not sound comfortable in such an extended form as a symphony – of the old kind (I do not mean the Webertian type). Even in the work under review he gives evidence of being essentially a miniaturist. The first two movements are very brief. The Finale too long and out of proportion with the rest of the work. Moreover, after it was finished, I was left with the impression that Kodaly had done it all before. The performance and and engineering leave nothing to be desired.

I find it easy to write that Dorati's performance of Hary Janos is the best I have ever heard. It is an alluring mixture of

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

lyricism and excitement. There is real humour in the piece describing Napoleon's army's defeat singlehanded by Janos, real passion in the love song which is adapted from the opera from which the Suite is made up; and Dorati leaves no doubt about when Janos is lying and when he is speaking the truth. He does this most subtly in a way I have never heard before, and I know the work well. He leaves one in no doubt that the pomp of the Entrance of the Emperor and His Court is completely bogus.

The Minuetto Serio is a highly original work described by the anonymous writer of the sleeve notes as what Kodaly thought a French court dance must have sounded like at the beginning of the 18th century — when taken over by the Hungarian gentry through Austrian mediation. It could not be described better! (J.R.)

★ ★ ★

DELIUS — Fennimore and Gerda. Opera by Frederick Delius. Elisabeth Solderstrom, Brian Cook and Robert Tear with the Danish Royal Chorus and Danish Radio Symphony Orchestra conducted by Meridith Davies. World Record Club compatible Stereo/Quadraphonic discs WRC OR 05250/1. Two Discs.

My copy of this opera arrived without a libretto. This made it difficult to follow although I could still enjoy Delian sound, with its slow-moving beauty and the composer's customary romantic use of the orchestra. The work, which surprisingly predicts future tendencies in opera composition, consists of a series of 11 pictures which illustrate, without dramatising, the story. An occasional passionate climax is not necessarily operatic; the moments of ecstacy musical rather than theatrical.

Delius, despite his many other merits, was notoriously lacking in a sense of

theatre, a fact made patent to anyone acquainted with his other opera "A Village Romeo and Juliet", now remembered only by occasional performances of "The Walk to the Paradise Garden".

It is interesting to reflect that a musician of no less stature than Sir Thomas Beecham once described Delius as the greatest composer of the early 20th century, when recalling the fate of a Village Romeo. Beecham may have been quite wrong in his estimate of Delius' greatness but the composer left behind a legacy of a beautiful sound immediately recognisable as essentially his own. And you can note with satisfaction that, at any rate gramophone-wise, he is slowly coming back into favour.

Some assert that Delius couldn't write for the voice but "We Take the Road to Samarkand" in his incidental music to Fleckner's Hassan makes nonsense of this claim. The Fennimore and Gerda the "dramatic" episodes are always static, without movement on the stage, moving (no pun intended) only in the beauty of their sound but never in exposition of character or action.

But despite this treatment of an operatic script there are still moments of unforgettable beauty, too numerous even to summarise in the space available here. I think the best way to sum up Delius' opera in terms of its dramatic quality is to compare it to Berg's Wozzeck, which achieves enormous theatrical impact using a series of short but vivid pictures, each brief and all with a clout that at first hearing is likely to "knock you rotten", to descend to vulgarity.

In Fennimore many might eventually become wearied by the mostly slowish tempos, with their sliding chromatic harmonies wandering through various inversions of different chords of the dominant. Others will revel in so much pastoral sound which sometimes works up to into compelling outbursts of passionate love, all too soon to revert to what even such an ardent admirer of the composer as myself might justly describe as rambling.

But as something used to unwind tension and taken as a dose of tranquilliser — not in over-large doses — the opera has much to offer. As an example I recommend listening to Band Six on the first of the two discs, both, by the way, admirably recorded. I am aware that the more malicious listener might describe much of the music in terms of "twas brillig and the slithy tove, etc". Unfortunately there is a modicum of truth in this. But I vastly enjoyed listening to most of it all the same.

Lovers of Delius will recognise scraps of the second subject of Brigg Fair at the beginning of the second disc, but then all the work is unmistakably Delius. There are only three principals, Elisabeth Soderstrom, Brian Cook and Robert Tear and all are fine. So is the orchestra and chorus under Meridith Davies.

The balance between voices and orchestra is always entirely satisfactory. If you are a Delius admirer you will love the work; if not you just won't. (J.R.)

★ ★ ★

ALBENIZ: Iberia — Books I & II. Claudio Arrau, piano. CBS Odyssey monophonic disc ODA 5144.

Here's teaser! Arrau has been concertising and recording for four decades; he comes from South America (Peru) and his native language is Spanish; I've been listening to him, with decreasing pleasure, since the early post-war years: and his repertoire has always been European-romantic, with very exceptions. On his first Sydney appearance, in 1947, he did play some Granados, but that was it. And here, out of the blue, is a superbly "Spanish" recital; it was probably recorded in the 1950's when Arrau was at the height of his artistry and should become quite a collector's item.

The pieces on this disc (admittedly, the quantity of music is not impressive) are

DIGITAL TRUMPETS

"superb in its presence"

THE SOUND OF TRUMPETS. Gerard Schwartz, Conductor and Trumpet Soloist, with trumpet choir, other instrumentalists and the Strings of the Y Chamber Orchestra. Delos digital mastered stereo, D/DMS-3002. (From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122).

If one were to express a single major reaction to this recording, it would be in the word "incredible", applied to the trumpet virtuosity of Gerard Schwartz. His flawless technique, his impeccable phrasing and timing, his dynamics, are all breathtaking.

What is also noteworthy is the support and technique of his seven fellow trumpeters, who are entirely equal to the demands of the trumpet baroque style music: Johann Ernst Altenburg: Concerto in D-Major. Antonio Vivaldi: Concerto in C-Major. H.I.F. Biber: Sonata "Scti Polycarpi" in C-Major. Giuseppi Torelli: Sonata a Cinque No. 1 in G-Major. Georg Philipp Telemann: Concerto in D-Major.

The trumpeters are backed, as appropriate, by violin, cello, bassoon, harpsichord, timpani and the Strings of the Y Chamber Symphony of New York, of which Gerard Schwartz is the Musical Director.

And the recording itself? Superb in its presence and clarity. It is of little wonder that it has received rave reviews overseas. (W.N.W.)

WOW! SOUND EFFECTS FROM YOUR SYSTEM 80!

(Also suitable for TRS-80 Level 11)

SOUND OFF!

Yes! At last there is an add-on sound effects generator for your System 80 or TRS-80 level II computer. It will give you exciting music synthesis and sound effects facilities that you haven't had before!

Add another exciting dimension to your computer with this superb system.

Here's what you get:

- **A battery powered amplifier unit which connects to the 16K System 80 or TRS-80 computer via the normal external cassette recorder cable.**

  A software cassette, which tells the computer how to manipulate its cassette interface. On one side of the cassette is a sound effects demonstration program; on the other a 'patch' program, designed so that the user can combine sound effects with almost any other BASIC programs!
- **Plus a very comprehensive 8 page user's manual to tell you what is going on, and how to change the system to suit your particular requirements.**

Hurry! Limited stocks available at present!

'SOUND-OFF' PACKAGE:
Includes amplifier module, software cassette and very comprehensive user manual:

ONLY $19.50

Cat X-3648

STOP PRESS

GREAT NEWS for System 80 and TRS-80 owners . . .

We can now offer the lowest cost light pen EVER!

$9.95!!!

Cat X-3645

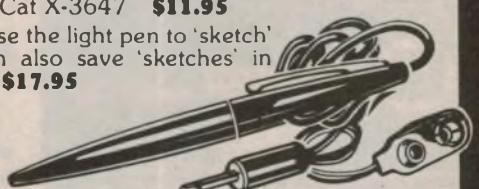
Due to the incredible popularity of these light pens we're now getting them assembled locally – you reap the benefit of lower production costs!

So now you can give your System 80 or TRS-80 Level II an 'eye', for even less than before . . .

- **Uses external cassette recorder as a preamplifier**
- **Comes complete with full instruction details, how to get your programs to use the pen, etc.**
- **Save time! Uses matching software cassettes, also available:**

Demo Cassette: Has noughts and crosses game, sample 'Menu' program. Cat X-3647 **$11.95**

SKETCH 80: Lets you use the light pen to 'sketch' on the screen! You can also save 'sketches' in memory. Cat X-3646 **$17.95**



DICK SMITH ELECTRONICS

NSW	125 York Street	SYDNEY	Ph 290 3377
	147 Hume Highway	CHULLORA	Ph 642 8922
	162 Pacific Highway	GORE HILL	Ph 439 5311
	30 Grose Street	PARRAMATTA	Ph 683 1133
	613 Princes Highway	BLAKEHURST	Ph 546 7744
	263 Keira Street	WOLLONGONG	Ph 28 3800
VIC	399 Lonsdale Street	MELBOURNE	Ph 67 9834
	656 Bridge Road	RICHMOND	Ph 428 1614
QLD	166 Logan Road	BURANDA	Ph 391 6233
	842 Gympie Road	CHERMSIDE	Ph 59 6255
ACT	96 Gladstone Street	FYSHWICK	Ph 80 4944
SA	60 Wright Street	ADELAIDE	Ph 212 1962
WA	414 William Street	PERTH	Ph 328 6944

bankcard welcome here

SHOPS OPEN 9AM to 5.30PM
(Saturday 9am till 12 noon)
BRISBANE: Half hour earlier.
ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY
RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113. Ph 888 3200. PACK & POST EXTRA.

"Evocacion", "El Puerto", "Fete Dieu a Seville", "Rondena", "Almeria" and "Triana". Each and every one of them is played with the utmost sensitivity, occasionally touched with passion and with strong rhythmic feeling. Though the monophonic sound is not likely to enthuse the ultra-hi-fi fans, the piano is quite respectably reproduced; in any event, this is a "rary" musically and to be treasured. (P.F.)

★ ★ ★

MOZART: Flute Concertos in G major, K.313 and D major, K.314; Andante in C, K.315. Aurele Nicolt, flute; Concertgebouw orchestra, Amsterdam; conducted by David Zinman. Philips stereo disc 9500 392.

After all the hoo-ha generated by James Galway and his collection of flutes — the music being a minor "also-ran" — this recording, made in Holland in 1977, is most refreshing. Nicolet, a native of Switzerland and pupil of the glorious Marcel Moyse, shares at least one thing (flute apart) with Galway: he was the principal flautist of the Berlin Philharmonic Orchestra; chosen by Furtwangler, he held that post for nine years before setting out on a career as soloist and chamber player.

Presumably, Nicolet did not pursue Galway's ambitions; he never made a million, has remained but modestly known outside Europe (and, lately, Israel) and has remained faithful to the purity of tone and articulation required for Mozart's music. These are simply glorious performances, not least because of the obvious sympathy between soloist and conductor. The Andante in C, all there is of Mozart's planned third concerto, has never sounded better and Concertgebouw Orchestra, as has happened so often before, play as with a single mind. Full marks to all concerned, including the recording team! (P.F.)

★ ★ ★

ANCIENT DANCES OF HUNGARY AND TRANSYLVANIA: The Clemencic Consort, directed by Rene Clemencic. World Record Club stereo disc R 06195

This is yet another in the stream of "ancient music" recordings coming from all over — but not to be taken lightly, by any means. Rene Clemencic is a great scholar, researcher and collector of old instruments and as such he has considerable competition nowadays, in many parts of the world. Where he has a definite advantage over others (particularly those toiling in areas such as Australia) is in his access to original material in Central and Southern Europe — plus intuitive musicianship.

On this disc are thirty-one items — dances, sacred and profane songs, of Hungarian, Slovak, Polish, Czech and Ukranian origin; they are played on viols, bagpipes, organs, trombones, dulcimers, on recorders, harpsichords and lutes . . . I have no doubt that all of it is as authentic as it possibly can be; some of it sounds delightful, some sounds a bit odd, but none of it is long enough to become dull or monotonous. For the student this is, no doubt, an invaluable aid; for the ordinary listener it is highly interesting and great fun; the recorded sound is very good and the disc proves a good introduction to 17th-century ethnic music in Central Europe. (P.F.)

New devotional albums

THE VERY BEST OF THE VERY BEST. Bill Gaither Trio. WORD WSB 8835. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

As well as providing a useful number of Sunday School Choruses, the 20 tracks on this record should be required listening for Sunday School teachers, reminding them of their responsibility in guiding their charges. This comes through strongly in the track, "Kids Under Construction".

The record uses the voices of a young group called "The Sunday School Picnic", as well as the Bill Gaither Trio but it does it in a way that avoids the sometimes cloying effect that very young voices can produce.

The overall production is of a very high standard and the theme throughout emphasises the importance of each individual in the sight of God. (N.J.M.)

★ ★ ★

THE POWER AND THE GLORY. The Alshire Singers with the 101 Strings. Stereo, Alshire (Astor) S-5176.

Based on the contents, this album would have a potential appeal to a particular audience, but they could well be disappointed. First off, the quality of the sound is nothing to write home about, with the strings in particular being anything but clean.

Nor was I very impressed with the arrangements and their execution, in fact, to my ears, "Praise My Soul" on side two sounded little short of awful. A pity, because the tracks have an evergreen appeal:

All People That On Earth Do Dwell — Onward Christian Soldiers — O Holy Night — Jesu, Joy Of Man's Desiring — Old Rugged Cross — Battle Hymn Of The Republic — A Dream Of Peace — Praise My Soul The King Of Heaven — All In This April Evening — The Lord's Prayer.

Not recommended. (W.N.W.)

★ ★ ★

"BORN AGAIN," Movie Soundtrack Lamb and Lion Records LL1041. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

This record is difficult to place. It is released by Word records who specialise in Gospel records and, with a title such as "Born Again", that is what you would expect.

What we have are sound track excerpts from the movie of that name, being the story of Charles Colson, one of the Watergate conspirators and his subsequent conversion to Christianity.

As such, it is a reminder of a notable movie but don't buy it expecting the normal run of inspirational Gospel music. There are snatches of dialogue from the film together with some of the songs including the titles, plus a lot of disco style music, especially on side two.

Make up your own mind. (N.J.M.)

MOZART: Piano Concerto in E flat, K.271 "Jeunehomme"; Concerto for two pianos in E flat, K.365. Alfred Brendel and Imogen Cooper (in K.365), pianos; Academy of St Martin-in-the-Fields, directed by Neville Marriner. Philips Stereo disc 9500 408.

Collaboration between Brendel and Marriner, ever since they first came together in Mozart concerti (I remember it as being at the Cheltenham Festival in 1971) has always been something to be thoroughly enjoyed. Here, once more, is a fruit of this uncanny singlemindedness: a remarkably fine reading of the much-recorded K. 271 concerto (even Brendel had previously recorded it, about 1968) which may well be anyone's choice for the best version currently available.

The coupling of two such unlike works, though in the same key, is a little surprising. Miss Cooper, as far as I know, studied under Brendel at some stage, but she is an established artist in her own right and a far from negligible pianist. The two-piano combination is unexceptional; I would guess that Brendel laid down the broad plan and both his partner and conductor Marriner were happy to concur. Almost twenty years ago, Brendel recorded this work in collaboration with Walter Klien — certainly not as good a performance and recently there have been good readings by Previn and Lupu and Ashkenazy and Barenboim; whatever the reason, I certainly prefer this latest one, not least because of the orchestral playing and lovely sound. (P.F.)

★ ★ ★

CHARLIE BYRD, Sugarloaf Suite. Interfusion L-37338. Festival release.

Charlie Byrd's background in both classical and jazz guitar playing shows through in this beautiful record of jazz with a strong Latin and Bossa Nova flavour.

Together with his brother Joe on bass and Wayne Phillips on drums, he creates a very sensitive mood of Latin music on eight tracks, some of them fairly long: Primeira Palavra — Favela — Na Praia — Meninas Brinando — Saudade Da — Bahia — Sapatos Novos — The Gentle Rain.

Byrd studied under two world famous classical guitar masters in Sophocles Papas and Segovia and it shows in his masterly use of his instrument. (N.J.M.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

LAWRENCE WELK — REMEMBERING — The Sweet & Swing Band Era, Volume 1 and 2. Stereo Interfusion (Festival) L-37330.

After 30 or more years of making music on television, Lawrence Welk scarcely has to prove his judgment of what pleases a major audience segment. And on this album you get a generous sampling: 10 of his "sweet band" arrangements on side one and 10 of his "swing band" numbers on side two.

Here's just a few of the titles: Sentimental Journey — The Waltz You Saved For Me — Cumana — Sunrise Serenade — Oh Johnny — Take The A-train — Ciribiribin — One O'Clock Jump — Woodchopper's Ball — Begin The Beguine — South Rampart Street Parade.

With a practiced ear for the bands that made the various titles famous, Lawrence Welk imparts to each something of the traditional mood — adding up to a pleasant program of nostalgia, backed by adequate sleeve notes.

No less important, the sound is clean and well balanced, so you need have no hesitation to turn it up a bit, if that is your mood. (W.N.W.)

Effortless hifi sound

DUKAS: The Sorcerer's Apprentice. CHABRIER: Espana. DEBUSSY: "Fetes" from "Nocturnes", Prelude to the Afternoon of a Faun. Zoltan Rozsnyai conducting the Philharmonia Hungarica. M and K Realtime, Digitally mastered stereo, RT-202. (From MR Acoustics, PO Box 165, Annerley, Qld 4103).

Although recorded throughout with state-of-the-art equipment and processed to disc by Teldec in Germany, one gets the firm impression that M and K were not in the business of proving something by a display of orchestral fireworks. On the contrary, the performance is normal, the levels are normal and the Faun Prelude is as gentle and langorous as you're likely to encounter anywhere.

What does impress is that the performance is thus unmarred by any suggestion of the mechanics of reproduction — no tension, no hiss, no plops, no resonances. It's just clean, relaxing sound, and music that scarcely needs introduction.

Even so, the rear face of the jacket is packed tight with information about the composers, the excerpts, the conductor, the orchestra and, of course, the digital technology.

Pleasant for listening and a good one for demonstrating non-flamboyant orchestral sound. (W.N.W.)

M-M-MEL LIVE. MCA 3208. Astor release.

Recorded live in the Symphony Hall, Phoenix, Arizona with his backing group, The Statesiders, Mel Tillis gives 10 country and western style tracks with a lot of chit-chat in between that becomes rather boring. Some of the tracks are: Remember Me — Send Me Down To Tucson — Good Woman Blues — Heart Over Mind — Ruby, Don't Take Your Love To Town — Detroit City. (N.J.M.)

HOT FOR THE ORIENT. Skyhooks. Mushroom L37179. Festival release.

It has been two years since Skyhooks released their last studio album. This new album "Hot For The Orient" is the band's seventh, being produced by American Eddie Leonetti.

Skyhooks, the band which best embodied Australian rock during the last decade, are now charging into the eighties with a very impressive sound. It is sure to pick up new markets with this latest release.

The tracks on the album are: Bondage On The Boulevarde — This Town Is Boring — White Skin And Black Sheets — She's OK But She's Not You — Cars, Bars And Girls — Red Fingernails — My Heart Gets Blown To Bits — Fathers And Daughters — No Inspiration — Keep The Junk In America. (D.H.)

ME MYSELF I. Joan Armatrading. A & M Records L37333. Festival release.

The new album from Joan Armatrading has a very refreshing appeal, with brilliant musical arrangements and concise vocals. All of the ten tracks were written by Joan Armatrading.

The first single lifted from the album, "Me Myself I", has received considerable airplay and the rest of the album is up to the standard of this single. All in all an excellent album.

"Me Myself I" has the following tracks: Me Myself I — Ma Me O Beach — Friends — Is It Tomorrow Yet — Turn Out The Light — When You Kissed Me — All The Way From America — Feeling In My Heart — Simon — I Need You. (D.H.)

Big building, big organ and a big sound

CARLO CURLEY Plays Charles-Marie Widor. Organ Symphony No. 6 in G Minor, Opus 42. Stereo, no brand, DLW-1020. (From Allen Organs Aust, 32 Woodhouse Rd, Doncaster East, 3109. Phone 03 842 3465. Price including post and pack $7.85).

The organ featured in this performance is a custom built system 1203 Allen digital computer electronic. The church in which it is installed is St. Alphonsus, Grand Rapids, Michigan, USA. No details are given of the building but, from the sound, one would judge it to be very large — sufficient to sustain reverberant sound for the best part of four seconds at the end of a climactic chord.

The organ itself is a large 3-manual classical instrument, with draw stops and an impressive array of appropriate classical voices. It must also have an impressive array of power amplifiers and loudspeakers, to judge by the immensity of the sound.

Indeed, debate on acoustic v. electronic would seem to be superfluous in the particular environment. Except in the quieter passages — some of them very quiet — the music of Widor and the style of Carlo Curley is significantly masked by the massive following reverberant sound.

Even though the sound was clean, my own reaction was to turn down the bass, somewhat, and secretly wish that the mics had been placed to pick up a little more organ and a little less ambience.

In short, it's the kind of recital and the kind of sound that invokes only strong reactions. Some reject it as chromatically organised noise; others thrill to its sheer acoustic immensity!

The choice is yours. (W.N.W.)

Books & Literature

How To Build A Robot Dog

HOW TO BUILD YOUR OWN WORKING ROBOT PET, by F. DaCosta. First Edition. Soft covers, 238 pages, 290mm x 130mm, illustrated with photographs and diagrams. Published 1979 by TAB Books. Price in Australia $8.50.

"How to Build your Own Working Robot Pet" is a complete guide to constructing a microprocessor-controlled robot dog. The author's robot navigates by means of ultrasonic sensors, accepts verbal commands, and responds to orders with an electronic bark. Frank DeCosta defines a robot as "an electromechanical simulation of animal life" and explains that he chose to build a robot pet as a sort of tutorial experiment.

A robot capable of performing tasks now performed by a human being is at present beyond the scope of the home constructor, or for that matter, IBM. A robot which simulates a dog is a much more realistic proposition, and at the same time provides the experimenter with valuable experience in robot design and construction.

There is ample information provided to enable the reasonably skilled hobbyist to copy the author's design exactly if he wishes. In 17 chapters the book covers the initial design and planning of a robot, the construction of the "body" or chassis, the power system and drive, construction of a "brain board" using the 8085 microprocessor, the construction and operation of the ultrasonic rangefinder, the construction of "Excom", the author's scheme for vocal communication with the robot, and the construction of "Audigen", the audio generator which enables the robot dog to "bark".

Other chapters cover ideas and circuits which are not used in the original design but which can be added on – little refinements like a wagging tail, for instance, or a more sophisticated version of the battery monitoring circuitry. Later chapters cover programming techniques for the 8085 and software for the robot dog. These chapters are worth reading in themselves for a clear presentation of how a microprocessor is programmed for use as a controller of other devices.

As originally designed the author's robot stores its programs in RAM, which means that there is a possibility of the data being lost as the batteries run down. The book describes an interesting circuit for a tape interface which allows quick restoration of the programs in memory, even when the microprocessor is halted. The cassette interface not only stores the program data, but also generates all the timing signals required to load the program into RAM, completely by-passing the processor.

In his discussion of design objectives and goals the author states that he decided not to use EPROMS (Erasable Programmable Read Only Memories) because of the expense and complexity of the necessary programming device.

Although the book does provide clear instructions and a step-by-step description of how the author built his robot, its chief value is probably as a source of ideas and inspiration for the constructor who may wish to build a completely different robot. The author recognises this, and treats each circuit of his design separately, in enough detail to allow modification for use in other projects. As such the book is a sourcebook of circuits, plans, and overall design philosophies for the robot constructor. Even if you disagree totally with the approach the author has taken the book will still be of interest.

Our review copy came from McGill's Authorised Newsagency Pty Ltd, 187 Elizabeth St, Melbourne, 3000. (PV).

Components Catalogue

STANDARD COMPONENTS CATALOGUE for 1980. Stiff paper covers, 108 pages 295mm x 210mm, freely illustrated. Price $3.00 plus 50c postage.

Although they have been suppliers to the electronics industry for something like 20 years, this is the first formal catalogue which Standard Components have issued. As such, it does them proud with its colour cover and headings, and the heavy coated paper stock on which it is printed.

There are seven sections, the first six listing items relating to: Radio, Audio, Test Instruments, Tools, Television, and Electronic Components. Under "Radio" for example, are listed amateur, CB and car radios and accessories, walkie-talkies and intercoms. "Audio" takes in headphones, microphones, tapes, cartridges, styli, leads, plugs and sockets, and power supplies.

The final section deals briefly with marine equipment and services, although there is a reminder elsewhere that Standard Components also service TV tuners and CB transceivers. In addition, the Company can handle production runs of small equipment.

No prices are quoted in the catalogue but we understand that a trade price list will be supplied with the catalogue to retailers and service organisations, for which the catalogue is primarily intended.

Copies are available at the price stated above from Standard Components Pty Ltd, 9 Hill St, Leichhardt NSW. Phone (02) 660 6066. (W.N.W.)

8080 Cookbook

SCELBI 8080 SOFTWARE GOURMET GUIDE & COOK BOOK. By Robert Dindley. Published by Scelbi Computer Consulting, Inc. Milford, Conn. 06460. 1978. 215 x 140mm, 225 pages. Price in Australia $10.00.

Have you tried cooking up a program on your 8080 system lately, and found that you just can't seem to get the right mixture of instructions? Or that the maths recipe that your friend gave you. . . This is how the introductory text starts out, and as anybody who has had any programming experience will know, this sort of thing is quite easy to identify with. The aim of this book is to familiarise the reader with the 8080 instruction set, and then show how these instructions are put together to form a working program.

The first chapter, which I feel is the most important, deals exclusively with the instruction set. Each instruction is taken, one at a time and discussed in detail, covering such things as the effect each of the instructions has on the various flags, what each of these flags means to the instructions etc. The depth to which the instruction set is examined here is more satisfying than some other publications on the subject that I have read.

The following chapter discusses in detail the use of the stack for subroutine calls and saving of register data, and again the presentation of the subject matter is excellent, and above all, informative.

The chapters that follow deal with a wide variety of "standard" utility routines, including such things as single and double precision number routines, floating point arithmetic, code conversion etc. Good examples of all these are provided, including a complete floating point routine that should be of a great deal of use to almost any programmer.

The last two chapters deal with I/O processing and searches and sorts respectively.

Unlike many other texts on the subject, this one removes all the mystery involved in I/O processing, making this usually difficult to understand concept quite clear to the reader.

The final chapter, as mentioned before, deals with search and sort routines. Of all the routines and subject matter presented in the book, this has to be the most interesting, particularly to those people interested in data manipulation such as alphabetic sorts etc.

At the end of the book there are six appendices covering the following:

- A summary of the 8080 instruction set.
- Octal to hexadecimal conversion.
- Hex to Decimal conversion.
- The ASCII character set.
- The Baudot character set.
- A dump (in octal and hex) of the floating point math routine.

All in all I feel that this is one of the better texts on the 8080. It is informative without being unduly tedious and as such represents good value for money.

The copy for review came from McGills Authorised Newsagency, 187-193 Elizabeth Street, Melbourne. (G.C.)

Household Projects

ELECTRONIC HOUSEHOLD PROJECTS by R. A. Penfold. Published 1980 by Bernard Babani Ltd, London. Stiff paper covers, 108 x 181mm x 98pp. Price in Australia $5.25.

Intended primarily for the enthusiast who likes building gadgets for use around the home, this book offers some interesting ideas and circuits, many of which can be used as the basis for other projects.

The circuits all employ commonly available components and the diagrams and descriptions are concise enough to avoid confusing the reader.

The text is divided into three chapters, the first of which deals with projects for the home and covers such things as a Two Tone Doorbell, Automatic Porch Light, Lamp Dimmer etc. The second chapter deals with projects which will be of use in many households and covers such things as Christmas Tree Lights Flasher, Bedside Radio, Soil Moisture Detector and more.

The final chapter deals with alarm circuits and includes Burglar, Baby, Water, Smoke and Gas alarms.

If you enjoy dabbling in electronics and like to build up small projects then you will find this book most interesting. It represents reasonable value for money at the quoted price of $5.25.

The copy for review came from The Technical Book and Magazine Company, 289-299 Swanston Street, Melbourne, 3000. (G.C.)

HARDWARE & SOFTWARE From DICK SMITH

PROFESSIONAL DAISY WHEEL PRINTER
FOR WORD PROCESSOR SYSTEMS

This superb unit is a self-contained printer with in-built asynchronous serial interface conforming to the established RS-232C standard. It prints on business stationery up to 380mm wide at the rate of 45-65 characters per second – three times faster than golf-ball typewriters. Top quality office systems printer that is below competition prices

$3,390.00 Cat. X-3260

EXIDY S-100 BUS EXPANSION UNIT
The way to go if you want extra versatility from your Sorcerer.

$575 Cat. X-3010

● Allows up to 6 plug-in cards ● Connects directly to Sorcerer's 50-way expansion socket via supplied cable ● All S-100 lines fully buffered ● Separate 2.000MHz crystal clock provided for S-100 cards which cannot use the Ø1 and Ø2 clock signals derived from the Sorcerer's 2.106MHz clock ● Provision for mounting up to six 25 pin "D" connectors for additional I/O ports, etc.

THE SORCERER

Cat. X-3001 ***SORCERER***

Cat. X-1196 ***MONITOR***

The Sorcerer is the expandable Z-80 based microcomputer that allows you to add peripherals to take it from basic computing through to advanced office business systems

● 16K RAM expandable to 48K (on board) ● Serial I/O and Parallel I/O ● S-100 BUS compatible ● Cassette I/O for two recorders at speeds of 300 or 1200 baud ● Video I/O – 1920 characters full screen ● Full ASCII 128 characters (64 defined characters and 64 undefined characters) ● Graphic resolution 122,880 pixels ● Includes 8K BASIC plug-in ROM PAC™ in MICROSOFT™ ● Dimensions 490 x 330 x 100mm ● Weight 6 kilograms.

(Ask for our FREE comparison chart between the Sorcerer and other well known computer brands).

Dust cover to suit Cat. X-3005 ***$5.95***

$1,395.00

LIGHT PEN FOR SYSTEM 80

Cat. X-3645

$9.95

Fantastic light pen for use with your TRS-80 or System 80 computer. Uses your cassette player as a preamp. Complete with plug & battery snap. Use with program tapes below

ALSO FOR TRS-80

NOUGHTS & CROSSES

Just insert this program cassette into your computer cassette player and enjoy playing the game with your light pen

Cat. X-3647 ***$11.95***

MICROPOLIS™ QUAD DENSITY DISC DRIVE

The Micropolis mod 2 drive with controller enables you to store 315,000 bytes on just 1 disc. By adding the mod 2 add-on drive (up to 3) you can obtain up to a maximum of 1.26 Megabytes! Complete with all software to enable you to be up and running in a very short time.

Model 1043/mod 2 with controller

Cat. X-3205 ***$1,350***

Model 1023/mod 2 add-on

Cat. X-3208 ***$750***

VIDEO MONITOR

This is a superb 30cm black and white video monitor that can be used on AC and DC. Simple connection to your computer. Features jitter free and distortion free characters. Can be used with most computers on the market.

Cat. X-1196 **$149.50**

WORD PROCESSOR PAC™

Remove the plug-in BASIC PAC™ and replace it with the powerful WORD PROCESSOR PAC™ and you will have the basis of an office computer system.

Features: ● Automatic text wrap ● Automatic checking of drastic commands ● Powerful search function ● Auto commands ● Macro programming – all this plus extensive user instructions.

Cat. X-3085 **$275.00**

SOFTWARE FOR SYSTEM 80
and also the TRS-80

TIME TREK
Hunt the Klingons through space and fight an intergalactic war. Has nine levels of play. (4K level I and II).

Cat. X-3650 ..... **$17.95**

STIMULATING SIMULATIONS
10 games on one cassette from monster chase to nautical navigation and lost treasure. (4K level I and II).

Cat. X-3652 ..... **$17.95**

ELECTRIC PAINTBRUSH
Create dazzling real time graphics. Commands let you draw lines, turn corners, change white to black, repeat previous steps or call other programs. (4K level I and II).

Cat. X-3654 ..... **$17.95**

BLOCKADE
Many variations whereby you and your opponent try and make each other collide with a wall. (4K level I and II).

Cat. X-3659 ..... **$17.95**

BRIDGE CHALLENGER
Practice and improve your game of Bridge. (16K level II).

Cat. X-3656 ..... **$17.95**

MICRO CHESS
The computer is programmed to beat you at chess and you are trying to beat it - absorbing & educational.

Cat. X-3658 ..... **$22.50**

SIMUTEK 1
Contains 5 games that would normally cost $19.50 each! Great fun for all the family and friends. (4K level I and II).

Cat. X-3685 ..... **$17.95**

C.ITOH BRAND DOT MATRIX PRINTER

The model 8300P dot matrix printer is a no-nonsense unit that can churn out the full 96 character ASCII at a brisk 125 characters per second on standard fan-fold paper. Character spacing of 80, 40 or 132 columns which are software selectable. A quality unit that costs less than $1,000!!

Cat. X-3255 **$970.00**

DYNAMIC EXPANSION KITS

These are top quality ICs that can expand your basic 16K Sorcerer to 32K or even 48K (expands the 8K to 16K etc). They can also be used with the TRS-80 level I and II and the Apple II computers to expand their on-board RAM. Superb value and complete with installation instructions.

SAVE $30.50 **NOW $79** Cat. X-1186

SOFTWARE FOR YOUR SORCERER

MARTIAN INVADERS
Similar to the very popular 'Space Invaders' you find in amusement parlors.

Cat. X-3626 ..... **$17.95**

NIKE II
Fight off bombing attacks with your missiles and protect the city from heavy casualties.

Cat. X-3627 ..... **$14.95**

TANK TRAP
Render the marauding tank harmless but watch out for slow drying cement and unarmed citizens!!!!

Cat. X-3628 ..... **$14.95**

2 PARALLEL & 2 SERIAL I/O BOARDS

Built unit Cat. X-3300 **$250.00**

Kit form Cat. X-3301 **$190.00**

MUSIC SYNTHESISER BOARD

Built unit Cat. X-3305 **$310.00**

Kit form Cat. X-3306 **$250.00**

8K & 16K PROGRAMMER & 4K/8K EPROM BOARD

Built unit Cat. X-3310 **$250.00**

Kit form Cat. X-3311 **$190.00**

FAMOUS 'BLUE BOARD' PLUG-IN CARD MODULES FOR THE S-100 BUS. . .

And now for the famous 'Blue Boards' from SSM in the US of A. Three boards available for your S-100 unit in ready built form or as kits with comprehensive instructions.

SORCERER BOOKS

A new series of books containing programs that will make your Sorcerer even more versatile!

Small Business	Cat. B-6110	**$49.95**
Educational & Scientific	Cat. B-6112	**$37.95**
Fun & Games No. 1	Cat. B-6114	**$17.95**
Fun & Games No. 2	Cat. B-6116	**$17.95**
Home & Economics	Cat. B-6118	**$27.95**

Fantastic value for anyone with a Sorcerer

JABEL COMPUTER MAINS FILTER

Having trouble with memory crashes? Then the answer is the Jabel Mains Filter – it will remove those annoying spikes from the 240V mains and thereby protect your memory!

Cat. M-9850 ..... **$75.00**

C10 COMPUTER CASSETTE

Dick Smith special grade cassette tape with 5 minutes per side and 38K capacity per side

Cat. X-3500 ..... **$1.95**

SKETCH 80
For the System 80 and TRS-80

A program tape that allows you to sketch on your VDU - the light pen becomes a real writing tool!! SEE LIGHT PEN ABOVE

Cat. X-3646 ..... **$17.95**

NEW NEW NEW
DUE IN SHORTLY

COGNIVOX™
VOICE INPUT & OUTPUT FOR THE SORCERER

★ Recognizes up to 16 words
★ 16 word voice response vocabulary
★ Easy two pass training
★ Up to 98% recognition accuracy
★ Generates music & sound effects
★ Excellent software support
★ Connects directly to Sorcerer

Cat. X-3150 ..... **$199**

SEE THE OTHER DICK SMITH ADVERTISEMENTS IN THIS PUBLICATION FOR STORE ADDRESSES AND PHONE NUMBERS

COLUMN EIGHTY

by JAMIESON ROWE

Technical Director, Dick Smith Electronics

Rumours & facts about the System 80

We knew it had to happen! . . After an absence of almost a year from the magazine, Jim Rowe's typing finger has started itching. The result is this new monthly column which Jim will write especially for EA readers, passing on all sorts of helpful hints and information on microcomputers in general. We'll let Jim take it from here. . .

What's this new column all about? Well, as the heading suggests, the idea is to have a regular place in the magazine where we can discuss all sorts of useful and (hopefully) interesting things about (a) microcomputers in the 1980's; and (b) the popular Z-80 based microcomputers, in particular. Things about hardware and software, notes on the little quirks and idiosyncrasies of various machines (they all have 'em!), and anything else I can come up with.

I'll need to refer to actual machines from time to time, to illustrate various points. Understandably, it will be easiest for me to choose machines for this from those marketed by the firm I work for, as these are most familiar and accessible to me. But I won't do this exclusively, and there'll be no hard sell – this is meant to be editorial material, not advertising.

Perhaps it would be a good idea in what's left of this first column to set the record straight about the System 80 computer. There have been some incredible rumours circulating, both about the machine itself and about supposed legal action over it. The facts may not be quite as interesting, but they do have the benefit of being true!

Basically the System 80 is a Z-80 based machine made in Hong Kong. The fact that it is made in Hong Kong and also uses the latest LSI devices contributes to its low cost. One of its main selling features is that it has been designed to be software compatible with the Tandy TRS-80 – to date the largest-selling computer ever. This means that it can run just about all of the enormous amount of software that has been written to date for the TRS-80 – thus avoiding the software availability problem that would otherwise face a new machine. (There are a few minor differences between the two machines, which affect some programs; I plan to discuss these in a later column.)

The System 80 also has an inbuilt cassette tape deck, which avoids at least some of the problems associated with external recorders and their adjustment. And there is a modulated RF output as well as the usual video output, so that users can save money by using an old TV set instead of a video monitor.

Is there any legal problem about the fact that the new machine is software compatible with an existing one? Not that we have been able to discover. In fact when you think about it, this shouldn't really pose any problems.

Nowadays just about every modern microcomputer uses the same CPU chip, the same memory chips and much the same combinations of support and interfacing chips. And there's really a limited number of ways in which these parts can be hooked together, so there tends to be quite a deal of similarity. Microcomputers are a bit like hifi sets now, and no-one screams for their lawyer just because a new hifi is designed to play the same records and cassettes as the established designs.

More accurately, I suppose, they're more like player pianos than hifi sets. So if a new machine is designed to "play the same rolls" as the most popular of the existing machines, this is scarcely a matter of legal concern. It's really an admission that the established machine has become a working standard.

What about the legal position regarding System-80's BASIC interpreter? Tandy's TRS-80 Level II interpreter was produced by the highly-respected US software house Microsoft. Did the Hong Kong manufacturer of the System 80 buy rights to a compatible interpreter, from the same firm? Needless to say, Dick Smith needed some assurance on this point too, before proceeding – but yes, everything is legal and above board. DSE has even seen a copy of the licensing agreement with Microsoft, to make sure.

But enough on non-technical matters. Next month, I'll start discussing some of the minor differences between the System-80 and the Tandy TRS-80, and how they affect operation.

DEVICE CONTROLLERS

Commodore Computers are being used extensively in Australia and Overseas for interfacing with Devices from Spectrum Analysers to Ham Radios.

Interfacing is achieved by using one or more of the I/O Ports which are built into this Micro-Computer. Standard I/O Ports are IEEE-488, 8 Bit parallel I/O, two Cassette Ports. All are memory mapped for easy user access via BASIC or Machine Language instructions. RS232 and Centronics Parallel Interfaces are also available.

The IEEE-488 Port is plug compatable with many devices manufactured by organisations such as Hewlett-Packard, Tektronix and Systron-Donner.

Commodore Computers are all integrated units, consisting of Keyboard, Video Screen and CPU, with up to 32K Bytes of Random Access Memory. Many peripherals are available, including cassette or disk storage, printers and plotters.

If you think you may have a use for a Commodore Computer, please contact us.

bankcard welcome here

- **SOFTWARE**
- **HARDWARE**
- **SERVICE**
- **SALES**

MICROCOMP

B.S. MICROCOMP,
4th Floor,
561 Bourke Street,
MELBOURNE, 3000.

Tel: 614 1433
614 1551

STOP PRESS: BASIC Programming Courses starting in September. Ring for further details.

Just off the presses!

MICROPROCESSORS & PERSONAL COMPUTERS

Microprocessors and personal computers, little more than a dream a few years ago, are now changing the face of electronics. This book introduces the basic concepts, describes a selection of microprocessor and personal computer systems, and details a build-it-yourself computer designed especially for beginners.

Available from "Electronics Australia", 57 Regent St. Sydney. **PRICE $5.00** OR buy mail order from "Electronics Australia". PO Box 163, Beaconsfield 2014. **PRICE $5.70.**

Order your copy now!

Microcomputer News & Products

Computer power in your pocket — a hand-held TRS-80

The TRS-80 Pocket Computer, featured on our cover, is a true hand-held computer. It can be programmed in Basic to perform complex mathematics and statistical analysis or handle information in alphabetic form. Programs and data are retained in memory even when the computer is turned off, opening up a range of applications such as a portable data bank.

With their new catalog, Tandy Electronics has announced the development of a "Pocket Computer" – a fully functioning computer, programmable in Basic, which is not much bigger than a calculator.

The TRS-80 Pocket Computer measures approximately 170mm x 85mm x 20mm deep and offers 1.9K of read/write memory and a powerful Basic language in Read Only Memory (ROM). Abbreviations and compact forms of all program statements are used automatically by the system to ensure that the limited memory is used as effectively as possible. These abbreviated forms of Basic will be familiar to anyone who has worked with the TRS-80 Level 1 system.

Only scant details are available at the time of writing but it is assumed that the "Pocket Computer" uses the Z-80 microprocessor, allowing Tandy to build on their experience with the larger TRS-80 systems. The computer is entirely battery powered, and automatically enters a stand-by mode when turned off, so that programs and data can be retained in memory when the machine is not in use. Special design techniques have been used to minimise the power consumption of the computer, giving a long operating life from batteries.

It is a measure of the remarkable advances in microelectronics that Tandy can advertise "Computer power that once filled a room can now be carried in your pocket." Even twenty years ago, a computer with the same capabilities as Tandy's pocket model would literally have filled a room. As Tandy says "The TRS-80 Pocket Computer brings yesterday's science fiction to life".

The tiny computer is programmed by means of a "qwerty" style alphabetic keyboard and a separate numeric keypad. Fifty-eight keys are provided, including a square root key, which allow quick entry of mathematical calculations when the computer is used in the immediate mode as an advanced scientific calculator. Entry of Basic programs is facilitated by cursor control keys and provisions for editing program lines.

Programs entered into the computer are read out one line at a time on a 24 character liquid crystal display. Editing control keys allow the insertion and deletion of characters and the cursor keys can be used to control the scrolling of the display, so that any line of a program can be accessed quickly and easily.

A version of Tandy's Basic is contained in ROM within the computer. The language includes mathematical functions, array manipulation and extensive string handling capabilities as well as the more standard features of Basic. Provi-

. . . continued on p123

Texas Instruments TI-99/4 computer

The TI-99/4 is not for everyone. It's not a business machine and it may not satisfy the hobbyist. What it is is a venturesome new concept in small computers; the first true "home computer", designed for those who know nothing about computers. As such, it will have to create its own market.

by PETER VERNON

The TI-99/4 Home Computer from Texas Instruments is an interesting development in the small computer field and writing this review was made more interesting by the arguments that raged loud and long in our office on the merits of the system.

It was noticeable that those most prejudiced against the Texas Instruments "Home Computer" were owners of other types of microcomputer systems, while those with the least previous experience of computers could more easily see the value of the TI approach. The controversy arises because of the nature of this approach.

The TI-99/4 is a total departure from previous small systems, with their emphasis on programming. Texas Instruments provide their computer with "Solid State Software" – small cartridges containing from 6K to 30K of Read Only Memory (ROM). The cartridges plug into a slot on the keyboard console and contain programs which enable the computer to perform specific functions.

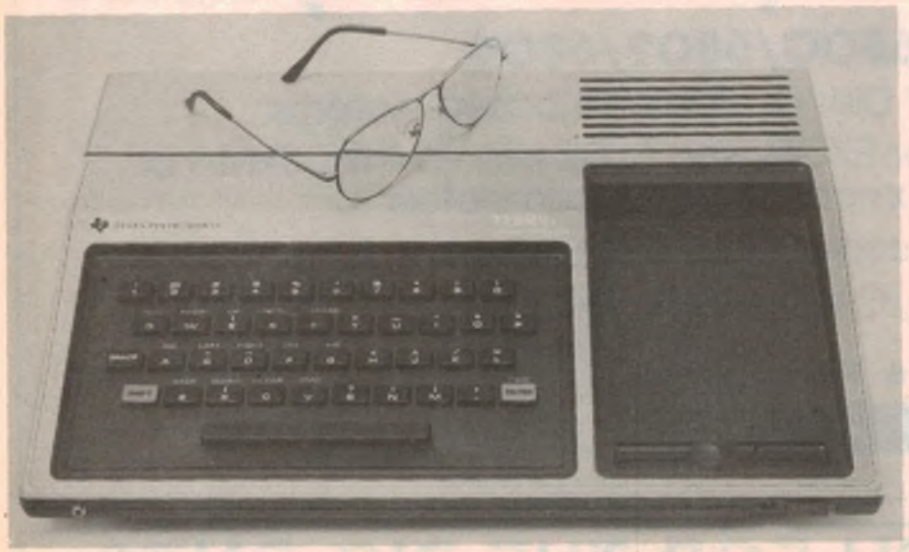
This approach contributes considerably to the ease of use of the system. Users need not be familiar with computers or programming in order to use the TI computer for a wide range of applications. To access a program all the user has to do is plug in a particular cartridge or "Command Module" as it is called, and press a few keys. In fact, it would be possible to use the TI-99/4 quite extensively without ever writing a program or having anything to do with the Basic programming capabilities of the machine.

"Command Modules" currently available include Household Budget Management, "Early Learning Fun", Physical Fitness, Video Games, and more. Texas Instruments plan to keep up a constant supply of new modules, so that software for the TI-99/4 should be no problem (in marked contrast to some other small systems). Of course, this approach has disadvantages. Each module must be purchased separately, at prices ranging from $32.95 to $77.50, and the programs cannot be modified to suit the particular requirements of the user. They must be used "as is" or not at all.

The concept is in line with Texas Instrument's stated aim of producing a computer for those who know nothing about computers. I feel that they have succeeded very well, and this is perhaps at the root of the controversy. For a computer hobbyist the TI computer has many deficiencies. There is no access to assembly language for example and the internal construction of the computer completely prohibits hardware modifications or additions. There is almost no information available on the technical aspects of the machine. In all the manuals there is not one circuit diagram.

But from the point of view of the user who is more concerned with what the computer can do rather than how it does it, the TI-99/4 is easy to use and very entertaining. The pre-packaged programs are well thought out, making full use of the sound and colour graphics capabilities of the computer. Each "Command Module" provides step-by-step instructions, leading the user through the application, and each module is accompanied by an instruction booklet and in most cases a keyboard overlay which fits over the keyboard and labels those keys which are given special functions by the particular program.

"Household Budget Management" is a program designed to help keep track of household income and expenses. The user can enter data under a number of different categories of income and expense, and store the information of cassette tape. The program will analyse the planned budget and display results in tabular or graphic form, indicating over-and-under-budget conditions. Instructions on the video display lead the user through the program, fully explaining the various options available. One indication that this is a computer for home use only is that the program calculates to the nearest dollar. Entries in cents are ignored.



Size of the keyboard console is evident in comparison to the spectacles on top. On the right side is the slot for software modules, and the volume control.

The education modules which are available are based on Texas Instruments' range of learning aids. They are designed to lead children through simple arithmetic and grammar, making learning fun by providing entertaining colour displays and sound. The general effect is reminiscent of "Sesame Street" but in addition the programs are interactive, fully involving the child in the process.

However, in this connection it should be remembered that the computer is manufactured in the United States, and uses American spelling throughout.

The basic system consists of a keyboard console, which contains the CPU, a five octave sound synthesiser, and the slot for the plug-in "Command Modules". A 34cm colour monitor is also required. Optional accessories available include joystick-type remote controllers, floppy disk drives, a printer, RS232C interface, and a speech synthesiser.

The keyboard console is small, measuring only 26cm x 38cm x 7cm and weighing less than 2.3kg. 40 pushbutton keys are provided, each with a second function activated by "shift".

A crystal oscillator and divider chain drive the TMS9900 16-bit processor at 3.5MHz. 16K of RAM is provided for user programs, while the operating system, sound and colour control software, and TI Basic reside in 26K of ROM. The RAM is not expandable on-board, and there are at present no plans to introduce an external RAM add-on.

A dual cassette interface is provided and two floppy disk drives can be added, each providing storage of 70K of data or programs.

From the moment it is switched on the differences between the TI-99/4 and other small computers is obvious. A "Title Screen" comes up, with the instruction "Press any key to continue". When a key is pressed a menu is displayed, "1" gives access to TI Basic, "2" gives access to the "Equation Calculator", a special feature of the TI machine, while "3" accesses whatever Command Module is in place.

The Equation Calculator is a feature unique to the TI-99/4. It allows the computer to be used as a calculator, without the need for entering any program. The Equation Calculator divides the video monitor screen into three parts; the lower section, where data is displayed as it is entered, an "equation memory area" which can be used to display the formula currently being worked on, and a "variable memory box" at the top of the screen which can display up to ten variables and the values assigned to them.

Data can be moved from the work area to the memory area and back again, and extensive editing facilities are provided. The full capabilities of TI Basic are available, without the need for line numbers or formal program syntax. In some ways the Equation Calculator is similar to the "immediate" mode of other Basic-speaking computers but its use is considerably simplified by the software TI provides. It can be used for anything from elementary arithmetic to advanced mathematical calculations.

The availability of pre-packaged programs turns attention away from the Basic language of the TI-99/4, which is comprehensive and well implemented. TI Basic is fully compatible with the American National Standards Institute requirements, but also includes special features for the control of colour graphics and sound. Twenty standard arithmetic and string functions are provided, 14 commands, and 24 statements, including IF ... THEN ... ELSE, automatic line numbering and renumbering commands, and debugging aids such as TRACE, BREAKPOINT setting, and editing commands.

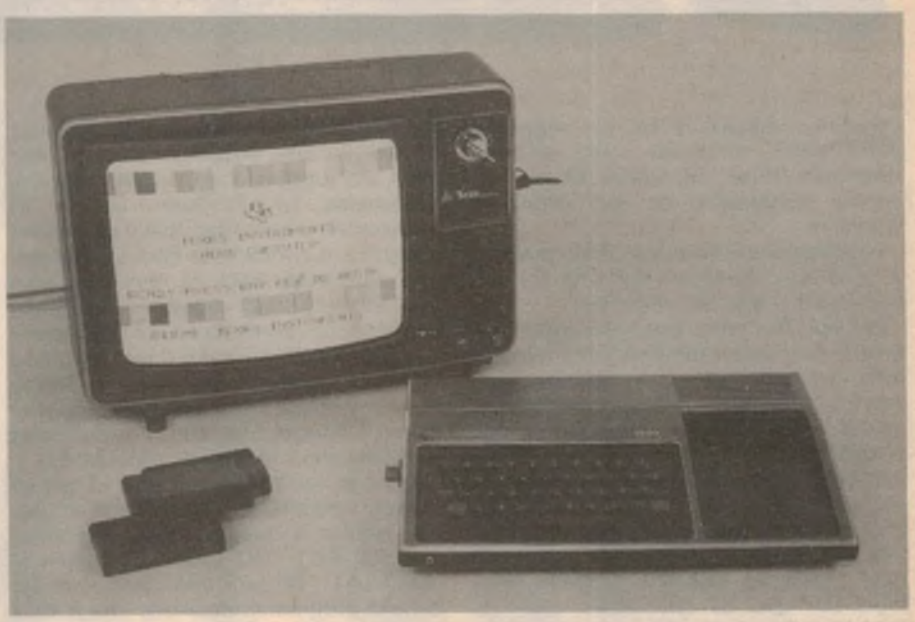
File handling statements are provided to control input and output to optional accessories such as the thermal printer, disk drives, and RS232C interface. Ten CALL statements are provided which include routines for manipulating screen and character colour, defining up to 128 new graphics, and controlling the built-in sound synthesiser. Other CALL statements access the add-on joystick and controller buttons for use in games and graphics.

TI Basic allows variable names up to 15 characters long, and scientific notation with a 5-digit mantissa and exponents in the range −128 to +127. If the exponent used is greater then 99, two asterisks will be printed in its place because of the way numbers are stored in the machine, but calculations will still be done to the same degree of precision. This is almost the only time that the use of a 16-bit microprocessor makes any difference at all to the computer user. Most 8-bit machines are limited to exponents in the range ±32. (Whether the average user needs this extended mathematical capability is another matter).

A comprenhensive range of error messages assists the user in developing his own programs. The error messages are reasonably self-explanatory and designed not to intimidate. Among others, error messages include "Bad Name", indicating that a variable name has more than 15 characters, and "Can't do that" following an attempt to use certain program statements as commands in the immediate mode. "Can't do that" can also relate to the OPTION statement, which allows arrays to be dimensioned with either 0 or 1 as the lowest subscript. More than one option statement in a program will result in the "Can't do that" message.

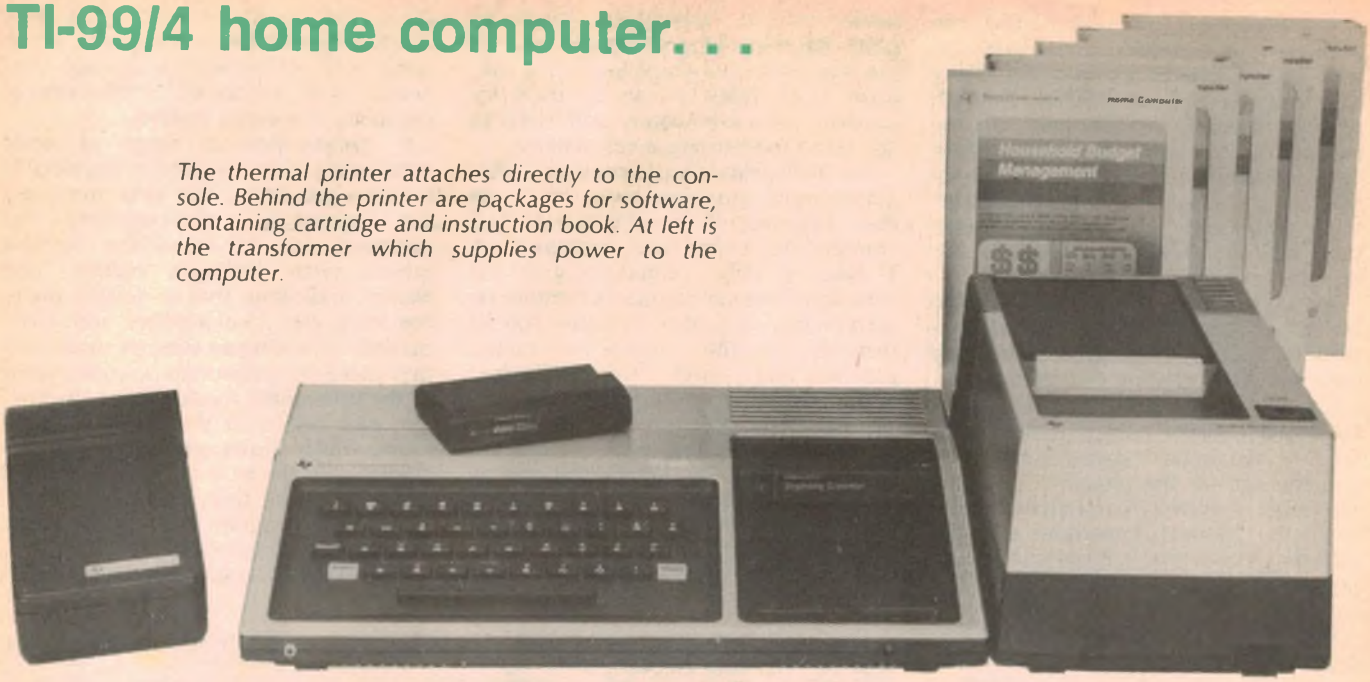
The TI Basic equivalent of a Syntax Error in other systems is the message "Incorrect Statement". These error messages may strike some users as a little "folksy" but this is largely a matter of taste. Altogether TI Basic is easy to come to grips with and quite powerful, although the lack of multiple statement lines may be felt by some to be a disadvantage.

The TI-99/4 displays 24 lines of 32 characters each, in 16 colours. The commands for manipulating colour allow programmable control of the colour of the character, the colour of the character background, and the overall colour of the screen. Characters are displayed in an 8 x 8 dot matrix (upper case only), and the CALL CHAR statement allows the user to define his own characters by determining which dots of the matrix will be on. The CALL HCHAR routine places a character anywhere on the screen and



Console with 34cm colour video monitor. The title shown on the monitor comes up whenever the computer is turned on. Software modules are shown at left.

TI-99/4 home computer. . .



The thermal printer attaches directly to the console. Behind the printer are packages for software, containing cartridge and instruction book. At left is the transformer which supplies power to the computer.

optionally allows it to be repeated horizontally, while the CALL VCHAR statement does the same thing, but allows characters to be repeated vertically.

Together these three routines provide a graphics resolution of 256 points horizontally and 192 vertically.

Perhaps the most annoying aspect of the TI computer is the keyboard, a fiddly little arrangement in a non-standard "qwerty" layout. The non-standard layout makes touch-typing almost impossible, and enforces a one finger "hunt and peck" style. The keys themselves are rectangular pushbuttons with flat tops, and are just slightly too close together. The small size of the console and the tight packaging within it probably prohibit the use of any other type of keyboard but on the plus side, the present keyboard is probably very easy for children to use.

A number of accessories are available for the TI-99/4, including a 32-column thermal printer, dual disk drives and last but not least, a speech synthesiser, with accompanying software modules. The speech synthesiser is based on the same chip set as TI's "Speak and Spell" and talking language translator but has a more extensive vocabulary, which can be expanded by the addition of more "Command Modules".

The Speech Editor software allows the user to simply type SAY "XXX" and as long as XXX is in the 250 word vocabulary of the synthesiser, the computer will speak. Perhaps not unexpectedly, the voice sounds like a robot from a science-fiction film, with a constant, mechanical inflection. The speech synthesiser costs $165 and the Speech Editor Software cartridge is a further $49.50.

The dual floppy disks available for the TI computer provide a storage capacity of 70K per disk, which is not large. The disks are supported by the file handling statements of TI Basic but a TI spokesman emphasised that they are not intended to convert the home computer into a business machine. If nothing else the relatively small capacity of the disks prevents this. Some means of permanent storage of data is required to fully utilise software modules such as the Home Budget Management package and the Home Financial Decisions module and the disks are intended to provide this.

Another accessory is the Thermal Printer, which is very convenient to use. The printer is referenced by the statement OPEN 1: "TP", OUTPUT. The command LIST "TP" will then print out the current program in memory. The printer is also used in conjunction with some of the Solid State Software modules to produce hard copy of the video display. Graphs, patterns, and line drawings can all be copied directly from the screen. In the "U" mode the printer will reproduce user-defined graphics, while the normal mode uses the printer's built-in character set, which allows printing in lower-case.

Also available separately is an RS232C interface, which is necessary to connect the computer to serial input devices such as modems and some printers. A dual cassette cable allows the connection of two cassette players for recording data and programs, and a pair of wired remote controllers (joysticks) which plug into a special port on the side of the keyboard console, can be added. There is no provision for a parallel output port, and no plans to produce such an accessory, which severely limits the TI-99/4's application as a controller of other devices. This seems a strange oversight in a "home computer".

With the exception of the cassettes and remote controllers, which have their own connectors on the rear panel, the accessories all connect to an expansion port on the right side of the keyboard console. For instance the Thermal Printer slots directly into this port, mating with an edge connector inside the console. Other accessories such as the disk drives then plug into an identical port on the other side of the printer. This means that there are no cables to become tangled, but it also means that there is only one configuration possible for the system – the keyboard, printer, and disks, all in one line and plugged firmly together.

At the rear of the keyboard console is the power connection, the cassette output port, and a 5-pin DIN connector which provides the video output and an audio output for connection to a separate amplifier if required.

In keeping with the home appliance approach, the TI computer will be sold through Canberra Television Services, together with a Thorn PAL-D colour receiver which is set up to accept the NTSC video signal output by the computer. While the need for a special monitor adds to the price of the system, the 34cm monitor can also be used as a television receiver by simply setting a switch at the rear and this may cushion the cost a little.

Leasing arrangements are also being negotiated, and leasing may be attractive to many people who wish to try out the system without committing themselves to outright purchase.

Recommended retail price for the keyboard console is $931 and the monitor a further $545. The optional thermal printer is $600 and the disk controller and dual drives total $1120.

For further information contact Canberra Television Services, 43-51 Nelson St, Annandale, NSW 2038.

Join the Bee Gees.

It's only natural that the Bee Gees – the world's most popular recording group – master their hit albums on the world's most popular professional recording tape – Ampex Grand Master. In fact, more hit albums, by more top stars, are mastered on Ampex tape than on all others combined.

Now there's a home version of Ampex Grand Master. So you can get the same star quality at home that top stars like the Bee Gees insist on in the studio.

You'll get the incredible signal-to-noise ratio and low distortion the Bees Gees get. And whether you choose normal or high bias cassette, you'll be recording on the one component that never needs upgrading. Ampex Grand Master tape.

AMPEX

The sound of the stars.

HP Desktop

Computer

features 3-D colour graphics

Hewlett-Packard's System 45C is designed for the display and manipulation of colour graphics, with software in ROM for generating the most used geometrical figures and three-dimensional projections. Seen by HP as "a faster way to focus on the facts," colour graphics opens up a wide range of applications in scientific analysis, management information and industrial monitoring and control.

The HP Series 9800 System 45C, recently introduced by Hewlett-Packard, is an integrated desktop computer system which features extensive graphics capabilities and is able to display results in up to 4913 colours. The System 45C is completely self-contained, with a 330mm colour CRT display, keyboard, dual tape drives, a thermal printer and a light pen all built into a single unit, making it one of the most compact and powerful systems in its price range.

Robert Dey, a systems engineer with Hewlett-Packard Australia Pty Ltd, says "The System 45C can solve complex graphics computation problems and, at the same time, provide three-dimensional representations in solid or wire-frame form. Results can be displayed in vivid colours coded to enhance interpretation of results."

Hewlett-Packard's graphics language, developed for the monochromatic System 45B, has been considerably expanded for use with the System 45C. A total of 70 graphics commands are provided, which relieve the user of many programming tasks such as generating geometric figures. Figures such as circles, rectangles and regular polygons can be drawn on the CRT with simple commands. A "FILL" parameter allows the user to quickly fill in any figure drawn. The colour commands allow the display of alphanumerics and lines in any of eight colours, while a total of 4913 different shades are available for area fill.

Screen resolution is 560 dots horizontally by 455 vertically and both alphanumeric and graphics can be displayed at the same time. The light pen, supplied as part of the standard System 45C, provides a convenient way for the user to select, move, and construct objects on the display. It is possible, for example, to select and move a single pixel (dot) on the screen. A predictive algorithm developed by Hewlett-Packard moves the cursor in the direction of the light pen motion, matching the speed of movement to the speed of the light pen.

Operating software for display, graphics, and control functions is contained in 152k bytes of ROM (Read Only Memory), leaving the read/write memory available for the user's programs. Other ROMs are available which can be plugged into the standard system to provide for I/O to various peripherals, mass storage, advanced programming routines, data communication, and database management. The standard system comes with 187k bytes of RAM (Random Access Memory), which can be expanded to a maximum of 449k bytes.

The System 45C uses Hewlett-Packard's enhanced Basic language, similar to that used in HP's desktop systems for the past few years. An optional, assembly language programming ROM is also available for special control and I/O functions requiring additional speed.

Two tape drives built into the system provide storage capability of 217k bytes per tape cartridge. The second tape drive also permits tape copying and data back-up operation. The System 45C is also designed to accommodate a wide selection of mass storage devices such as flexible and hard disc drives. With the addition of the Mass Storage ROM and change of a single statement in Basic programs, the data and programs stored on tape can also be used with large-capacity disc memory units.

Alphanumerics are displayed in 24 lines of 80 characters each. The system's built-in 80 column thermal printer contains the standard 128 character ASCII set. A single command, "Dump Graphics," reproduces the CRT display at speeds of up to 25mm/sec. Colour displays are produced in shades of grey, although HP's IEEE-488 interface enables the user to connect a colour plotter if required.

CRT/Edit control keys on the keyboard allow the user to interact directly with the CRT display. Program control and editing keys permit programs to be listed and variables changed while a program is running. Thirty-two special function keys are provided, eight of which are colour-coded to the eight basic colours of the system. These keys can be defined to represent a label, a mathematical expression, a numeric constant, or any other often-used parameter, saving many key strokes in the entry of programs.

The extensive colour and graphics capabilities of the System 45C are expected to intensify the rapidly growing use of graphical computation in a wide spectrum of scientific, engineering, data acquisition and management applications. Graphical computation can lead to substantial improvements in data interpretation and productivity in such diverse fields as management, process control, and computer aided design.

Presentation of data in a graphical format leads to quick interpretation. Uses range from bar charts and trend lines as seen in financial reports, to frequency response plots in electrical engineering, for example. Using the computer to automate design and development work via graphics is a second major benefit. Significant gains in productivity can be made, especially where repetitive work is being performed or where existing drawings must be modified. A third benefit arises from using the computer's graphics capabilities to simulate and solve complex problems. Realistic simulation studies and three dimensional "wire-frame" analysis are examples.

In process monitoring and control, colour can be used as a variable to show changes in conditions, highlighting them for the operator's attention.

A basic configuration of the System 45C is available with 56k of RAM, one tape drive, no internal printer, and no light pen for $US35,280. The standard System 45C, with 187k of RAM, dual tape drives, internal printer and light pen costs $US44,240.

NDK S4000

$3105 + TAX

For all bulk wordprocessing applications where reliability, speed and sustained print quality are of prime importance.

Introduction

The NDK S-4000 is supplied with a heavy duty 16 wire head producing single pass high quality 17 x 16 matrix characters at 75 characters/second for wordprocessing quality and 150-200 characters/second for drafts.

Four fonts (dot matrix, wordprocessing, super/subscript and Mathematics) are supplied as standard. The fonts can be intermixed as bold faced, enlarged (5 CPI, 17 x 23 matrix), reduced (12 CPI) or normal (10 CPI). Other fonts can be specified by the user. Each dot on the 16 x 16 matrix can be programmed by the host computer to produce special graphic effects (such as letterheads and trade marks). John F. Rose Computer Services Pty Ltd will be supplying software to enable the user to specify and print special characters for any row/column position. The special patterns can be printed at the rate of 900 dot columns/second at a resolution of 4.7 dots/mm (120 dots per inch) both horizontally and vertically. A horizontal dot resolution of 240 dots per inch can be produced using half dot timing.

Superscripts and subscripts are produced by the superposition method enabling complicated mathematical formulae to be produced quickly and easily. The subscripts and superscripts are half normal size and the printing pitch is half that of the PICA (see specification).

Dot (or Graphics) Mode

The Dot (or Graphics) mode can be entered by software instruction or by pulling the MODE signal pin of the interface low.

Dot Mode by MODE signal

The MODE signal should only be changed between the ACK and DSTB signals. MODE signal changes are limited to 40 times per line. When the MODE is pulled low, the first data byte sent after the change controls print needles 1 to 8 and the second byte controls pins 9 to 16. The third byte controls pins 1 to 8 of the next dot column to be printed and so on. The character mode is re-entered when the MODE signal is pulled high.

SPECIFICATIONS *Available RS232 or Centronics Parallel*

Printing method: Dot Matrix impact
Serial printing by 16 wire head

Printing direction: Bi-directional printing with logic seeking and 762 mm/second (max.) space skipping function.

Printing Characteristics

Character Mode (Normal/Enlarged)	Regular Mode		Draft Mode		Sub/Superscript	
	Pica	Elite	Pica	Elite	Pica	Elite
Printing Speed (char/sec)	75/37.5	90/45	150/75	180/90	150/75	180/90
Pitch (CPI)	10/5	12/6	10/5	12/6	20/10	24/12
Line length (char/line)	136/68	163/81	136/68	163/81	272/136	326/163

Dot Density: 4.7 dots per mm.

Character set: 160 codes (JIS c6220, 8 bit)
2 modes (regular and draft)

Line Feed: 6 lines per inch or 12 lines per inch
45 lines/second (slew rate 6 lines per inch)
40 ms max. (single feed)

Control Codes and their functions

BEL	(07)hex	2 Khz alarm noise produced for 1 second.
LFH	(08)hex	Half line feed (1/12").
LF	(0A)hex	Line feed (1/6").
VT	(0B)hex	Vertical Tab.
FF	(0C)hex	Form Feed.
CR	(0D)hex	Carriage Return.
SO	(0E)hex	Initiate elongated characters.
SI	(0F)hex	Cancel elongated characters.
SLT	(11)hex	Enable operation from an external device.
DSL	(13)hex	Disengage operation from an external device.
CAN	(18)hex	Cancel data stored in line buffer.
ESC	R	Select Regular mode.
ESC	D	Select Draft mode.

		Regular or Draft	Sub or Superscript
ESC	P	10 (5) CPI	20 (10) CPI
ESC	E	12 (6) CPI	24 (12) CPI

( ) = Elongated.

ESC	I	Start Underline.
ESC	O	Cancel Underline.
ESC	<	Expand dot mode data.
ESC	>	Cancel expansion of dot mode data.
ESC	L	Print following data as subscripts.
ESC	U	Print following data as superscripts.
ESC	N	Change back to previous mode.
ESC	S	n Spacing is 1/60 x n where 0 < n < 256.
ESC	M	LhLl Activate Dot Mode.

The printer has a built-in test mode and the following STATUS signals are displayed on the control console:

0	Out of paper.
1	Over-run.
2	VFU Over-run (no punched hole found).
3	Sensor Alarm — failure or timing sensor or carriage locked.
4	Head drive Protect — failure of drive circuit of printhead.
5	Motor drive protect.
6	Failure of 30 volt DC supply.
7	RAM error.
8	ROM error.
9.	Input error (more than 20 software mode changes/line).
A	Firmware failure.
B	5V supply failure.

Prices and specifications subject to change without notice.

JOHN F. ROSE
COMPUTER SERVICES PTY. LTD.

33-35 ATCHISON STREET, ST. LEONARDS, N.S.W., 2065, AUSTRALIA.
TELEPHONE: (02) 439 1220 TELEX: AA 27901

Send $1.00 for our 130 page comprehensive catalogue and to join our mailing list.

Microcomputer News & Products

sion is also made for multiple program statements on a single line, contributing further to efficient memory use.

An optional cassette interface is available for use with Tandy's Minisette-9 cassette recorder to load and save programs and data. The cassette interface is battery powered and is designed to interlock with the Pocket Computer to form a single compact unit. Pre-recorded software for the system is under development, with programs covering real estate and financial analysis, civil engineering and aviation calculations, and maths drill and games. These programs will be available on the miniature cassettes used by the Minisette-9.

The Pocket Computer neatly fills the gap between programmable scientific calculators and small computer systems.

The reservable key system allows the user to reserve a particular key to represent a mathematical function, and enter the selected function in a single operation. In fact the Pocket Computer can be used for many of the tasks currently handled by its larger cousins, with the exception of course of driving a video display.

Unfortunately the Pocket Computer provides no expansion facilities other than the cassette interface. A serial communication port would have been a big asset, allowing the computer to communicate with larger systems either directly or via a modem, or to drive a printer for added versatility.

Selling price is quoted in the new catalog as $249 for the Pocket Computer with carrying case and batteries included. The cassette interface is a further $49, and the Minisette-9 miniature cassette recorder for use with the interface costs $89.95. Cost of the prerecorded software tapes is not yet known.

The TRS-80 Pocket Computer should be available from Tandy stores later this year.

Commodore Users Group in Victoria

The recently formed Commodore Computer Users Association of Victoria will meet at 7.30pm on the last Tuesday of each month at the North Melbourne Football Club Social Club, Fogarty Street, North Melbourne. The Association aims to support users of Commodore microcomputers with regular meetings, conferences and seminars. A newsletter will also be published. Secretary Nicki Saunders may be contacted during business hours on (03) 614 1433, or (03) 614 1551.

Tasmanian Computer Group

The Tasmanian Small Computer Users Group meets at the Elizabeth Matriculation College, North Hobart, at 7.30pm on the first Tuesday of each month. Enquiries can be made by phoning Steve on 23 2211, or writing to PO Box 474, Sandy Bay, Tasmania, 7005.

Computer Interest Group formed at Gosford

A meeting of 21 people interested in minicomputers and microprocessors was held recently in Gosford, NSW. The meeting was organised by Tomorrow's Electronics and Hi Fi to enable those interested to exchange notes and plan for the future. Activities now include regular meetings with demonstrations and lectures and program development and exchange. The pro tem secretary can be contacted through PO Box 525 Gosford, 2250, and a stamped addressed envelope will ensure notification of the next meeting.

MICRONEWS CONTINUED

Microcomputer News & Products

6MHz Z80 from Zilog

The Z80B, a faster version of the popular 8-bit Z80 microprocessor, is now being produced by Zilog Inc. The new device, made possible by refinements in process technology, runs at a 6MHz clock rate, compared to the Z80A's 4MHz clock and the 2.5MHz clock rate of the original Z80. The Z80B is completely pin-compatible with the Z80 and Z80A, and will allow systems based on the slower processors to be upgraded to a significantly faster CPU.

At the same time Zilog announced details of a microcomputer board based on the Z8000 16-bit microprocessor. The Z8000-MPU board can function either as a stand alone single board microcomputer or as the processing unit in a set of several peripheral boards. Stand alone performance is made possible by 32K bytes of on-board RAM, 8K bytes of additional ROM or PROM space, two flexible communication channels and a real time clock for managing multi tasking operations.

Other members of the Z8000 microcomputer board family will be introduced later this year. Boards will include RAM, a single board terminal, a floppy disk controller, and digital and analog input and output boards. A 96 pin high density pin and socket connector will allow each board to interface with a bus structure developed by Zilog specifically for the board family.

Zilog products are distributed in Australia by ZAP Systems Pty Ltd, 51-53 Chandos St, St Leonards, NSW, 2065.

Eighth World Computer Conference in Melbourne

The Eighth World Computer Conference (IFIP Congress 80) will be held in Tokyo from October 6-9th and in Melbourne from October 14-17th this year. The theme of the Conference is "Challenges of a Computer Presence," and over 110 papers will be presented, covering all areas of information processing, together with 31 panel discussion sessions and numerous displays and exhibitions.

The Congress Secretariat should be contacted for details of travel arrangements, bookings and conference registration. The address is GPO Box 880G, Melbourne, 3001.

MICRONEWS CONTINUED

Microcomputer News & Products

12V impact printer

Daneva Control Pty Ltd now have available the Duoprint II, an economical 21 column impact printer. A single board microprocessor controller provides the character generation, buffer store and hammer drivers for the printer, and interface can be by a parallel port with data strobe or an asynchronous serial communication port, with programmable baud rates.

The full 96 character upper and lower case ASCII character set is standard. Characters are printed in a 7 × 5 dot matrix format, and reverse line, inverted characters, double width characters and bold characters can all be selected by non-printing ASCII control characters. The Duoprint II measures only 110mm × 175mm, and runs from 12V DC, making it ideal for battery operation.

Further information can be obtained from Daneva Control Pty Ltd, 66 Bay Rd, Sandringham, 3191.

IBM add-ons from Natsemi

If you want to expand your IBM System 370 or 3033 processor complex, or lease an equivalent mainframe computer, Natsemi Advanced Systems Pty Ltd may be the place to go. National Advanced Systems recently announced that it will offer a 12 month lease on its AS/5000, a medium scale IBM-compatible general purpose computer, in addition to the 24 and 36 month leases already offered.

Natsemi Advanced Systems are also offering add-on memory modules for IBM's range of 303X computer systems which enable users to build up main storage beyond the capacity set by IBM for these machines.

The addition of main memory is seen by Natsemi as a way of improving throughput at a relatively small cost compared with the cost of installing a larger system. Two new products are available; the NAS 8031, which provides up to 6 megabytes of external storage for the IBM 3031 processor complex, and the NAS 8033B, which provides up to 12 megabytes of add-on storage for the IBM system 370 and 3033 processor complex. The memory units are cheaper than IBM equivalents, costing around $40,000 per megabyte, compared with $65,000 per megabyte for IBM add-ons.

Natsemi Advanced Systems is a subsidiary of National Semiconductor Corporation. The address is 23 Clegg St, Artarmon, NSW, 2064.

Programma software

A new 1980 catalog from Programma International Inc lists many programs for the Apple II, Sorcerer, TRS-80, PET/CBM and Atari microcomputers. Games, business applications, word processing and personal finance packages are included.

The catalogue provides a listing of all software available for each computer system, and a short description of each program.

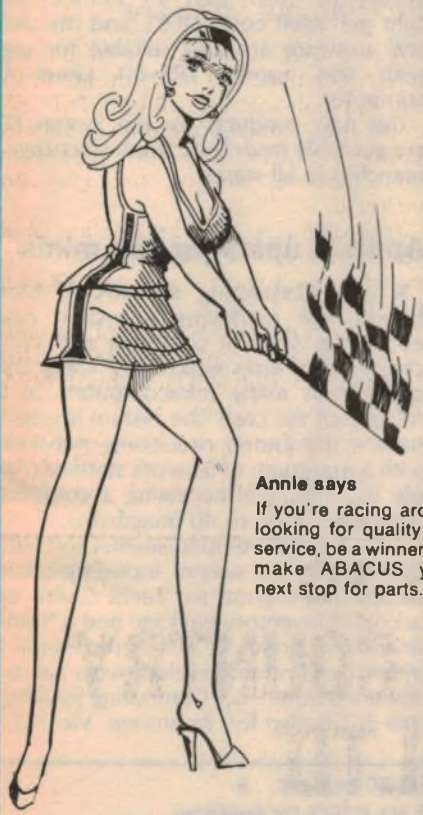
The catalog and Programma software are available from Paris Radio Electronics, 7a Burton St, Darlinghurst, NSW, 2010.

MICRONEWS CONTINUED

abacus

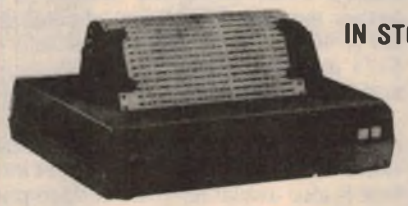
The new force in components

Due to the closing down of the Richmond Silicon Valley Store, Abacus has now been appointed a Silicon Valley Agent. We are stocking all Silicon Valley products and offering the full range of Cema Electronics products.



Annie says
If you're racing around looking for quality and service, be a winner and make ABACUS your next stop for parts.

BASE 2 MODEL 800 PRINTER



IN STOCK **$745**
ALL OPTIONS INCLUDED

OPTIONS: "M" — 2K RAM buffer, "S" — high speed paper advance and graphics "T" — tractor feed.

PRINT AREA: 8.0 inches (203mm)
THROUGHPUT SPEED: 60 lines per minute
LINE SPACING: 6 lines per inch
COLUMN CAPACITY: 72,80,96,120 or 132. Switch or program selectable
INPUT/OUTPUT PROVISIONS: a) RS-232, b) 20 ma current loop, c) IEEE — 488 type, d) Centronics parallel.

COMPUCOLOR II

Model 3, 8K $1995
Model 4, 16K $2295
Model 5, 32K $2595
Prices include colour monitor, computer and one disc drive.

In Sydney get your BASE 2 MODEL 800 from ALLIANCE DIGITAL CORPORATION PTY. LTD. 26th Floor, 100 Miller St, Nth Sydney (02) 436-1600.

PET COMPUTER

With 8K & monitor, $999 inc. tax plus $150 free software.

S100 BOARDS

- CPU CARDS
- MEMORY
- DISK CONTROLLER
- SERIAL & PARALLEL
- S100 FRONT PANEL

CONSUMABLES

in any quantity.
FLOPPY DISCS 5" $3.75 ea.
FLOPPY DISCS 8" $3.95 ea.

SORD M100 ACE 1

$2850

Price includes:
- 48KB Memory
- 1 x 143KB Disc
- Monitor
- Printer Port
- Serial Port

SOROC IQ120

- Cursor control keys
- Numeric key pad
- Line and page erase
- Addressable cursor
- Switch selectable transmission from 75 to 19,200 bps
- Communication mode HDX/FDX/Block
- Interfaces: Printer Interface/RS232 Extension
- RS232C Interface
- Non-glare read out screen
- Protect mode
- Tab

$1295

All quoted prices are exclusive of 15 percent sales tax.
Prices valid to 31st July 1980.

bankcard welcome here

Give name, number, expiry date and signature for mail order sales.

abacus

ABACUS COMPUTER STORE
512 Bridge Road, Richmond, Victoria 3121.
Phone (03) 429-5844 429-4780.

Microcomputer News & Products

New products for the System-80

The recently introduced System-80 computer from Dick Smith Electronics is proving very popular, and a range of new releases from DSE is likely to further enhance its appeal. Just announced is an Expansion Interface unit which plugs directly into the expansion connector of the basic System-80 and provides all the interfacing necessary to provide the computer with up to four mini-floppy disk drives, a Centronics-type parallel printer interface, and serial communication via an RS-232C asynchronous port.

The unit also provides full interfacing to the standard S-100 bus, and two vacant sockets which allow the system to be further expanded. Designated catalogue No X-4010, the Expansion Unit sells for $575 including an inbuilt power supply and the required interconnection cables.

For users who require a printer but do not need the full facilities of the expansion unit, a low cost parallel printer interface is also available. The interface plugs into the expansion connector and provides all the interfacing logic necessary to drive a Centronics-type parallel printer. The interface (Cat No X-4012) costs $89.50, and comes complete with instructions and a printer interconnection cable terminated in the standard 57N-26 connector used with most Centronics type printers.

No special software is required in order to use the X-4012 interface and a printer with the System-80 computer, as the machine's inbuilt Level II Microsoft Basic interpreter already provides the necessary LLIST command and LPRINT statements.

Also from Dick Smith Electronics is a new light pen and software designed for use with the System-80. The light pen replaces an earlier imported model which has become unavailable. The new

pen is assembled locally, and is being sold separately from the software so that users who wish to develop their own software drivers do not need to buy the demonstration programs.

Two demonstration software programs are available on cassette tape as a separate product. One program is a "Noughts and Crosses" game, while the other provides a sample "Menu Selection" routine. The two come together on a cassette which sells for $11.95. The light pen itself costs $9.95, and the pen and software are also suitable for use with the Tandy TRS-80 Level II computer.

The new products for the System-80 are available from Dick Smith Electronics branches in all states.

Apple II upstages the minis

K & L Computing Systems of Melbourne are marketing a system based on the Apple II computer and Winchester hard disks which they claim will outperform many minicomputers at a fraction of the cost. The system is essentially a distributed processing network, with a maximum of 64 work stations (Apple II computers) accessing a common data base of up to 40 megabytes.

K & L have developed several software packages for the system, including a handicapping program for Yacht Clubs, an accounts/inventory package and a home finance program. Details of the Apple II system and other developments can be obtained from K & L Computing Systems, 385-387 Bridge Rd, Richmond, Vic 3121.

¼ million people made their first computer purchase from us.

We are ComputerLand, the number one retailer of small computers in the world.

Why did so many people join the ComputerLand team? Because, like you, they wanted to buy their first computer from a specialist; from someone who cared about their satisfaction.

We at ComputerLand carry the widest selection of small computer equipment available in Australia.

Micro•computers, printers, V.D.U.'s, synthesisers and software, all at prices you can afford too.

Our courteous sales and service staff can configure a computer system to your specifications, and in many cases deliver it to you that same day.

So, don't limit your options. Come to ComputerLand today and join the number one team. We're expanding the way your world thinks.

Adelaide — 131 PIRIE STREET PHONE 2235083
Brisbane — 127 CREEK STREET PHONE 221 9777
Melbourne — 555 COLLINS STREET PHONE 625581
Perth — 197 ST. GEORGES TERRACE PHONE 321 4671
Sydney — 55 CLARENCE STREET PHONE 29 3753

ComputerLand®

INFORMATION CENTRE

PLAYMASTER SPEAKER SYSTEM: Would the Playmaster 3-26L speaker system be suitable for use with the Playmaster Twin 25 stereo amplifier? Could you please tell me the RMS power handling capacity of the 3-26L speaker system and the RMS power output of the Playmaster Twin 25 stereo amplifier with both channels driven. (R. P., Stirling, WA).

● The Playmaster 3-26L speaker system is specified for use with amplifiers with a power rating of 10-25W (RMS) per channel. The Playmaster Twin 25 amplifier provides 22W (RMS) into 8 ohms with both channels operating. This is well within the rating of the speakers, so no problems should be experienced at normal listening levels. It should be remembered that these ratings are based on normal musical material and care will be required when running the speakers at high levels for a prolonged time, as with any other system.

ALL WAVE THREE: I have recently attempted to build the All Wave Three receiver (File No. 5/TR3/7), but have found that the LM380 audio IC is a 14-pin device and will thus not fit onto the circuit board as the pattern has provision for an 8-pin device. Could you please advise me on how to modify the board to accommodate the 14-pin package. I have noted that six of the 14 pins are used to heatsink the device. Generally, congratulations on putting out a brilliant electronics magazine. (A. vH. Salisbury Park, SA).

● The LM380 is available in both 8-pin and 14-pin packages which are, unfortunately, incompatible. It is not practical to modify the PCB.

MASTHEAD AMPLIFIER: In recent months I have constructed several of your TV masthead amplifiers (August 1979, File 6/MS/5). There are several points I would like to mention.
(1) I have found it better to use only BAW62 silicon signal diodes as the 1N4148's are too lossy even on Channel 3 (around 90MHz).
(2) It has been necessary to drill a small hole in the bottom of the box to prevent internal condensation. Several coats of clear lacquer were sprayed on the PCB as protection against corrosion.

On the higher channels (5A and 6) there is a pronounced modulation bar about 5cm high present on the picture. This tends to drift slowly up the screen, to recommence on the bottom again. The picture beneath the bar is normal except lighter in colour. Altering the supply voltage (ie, the value of the 150 ohm resistor) varies the height of the bar. Could you suggest a solution to remove this bar please. (B. D., Gunnedah, NSW).

● From your description, we assume that mains interference is breaking in via the power supply for the masthead amplifier. You could verify this by temporarily operating the circuit from a battery to check the performance. If this proves to be the case, the solution would involve improving the filtering of the DC supply. This could be done by increasing the 100uF capacitor to, say, 2200uF/25VW and perhaps using a three-terminal regulator such as the LM340T-12 together with adequate output bypassing, instead of the 150-ohm resistor and zener diode.

DIGITAL CAPACITANCE METER: I have recently completed the above project as described in the March 1980 issue. On all three ranges, the "g" segments of all four FND 500 displays do not extinguish and remain alight when the displays should be showing 0, 1 or 7.

The voltage across the 27-ohm resistor connected to pin 4 of the 74C926 IC (which is connected to the "g" segments of the displays) is about 0.7 volts. The voltage across each of the remaining 27-ohm resistors ranges between 1.6 and 2 volts. Substituting another 74C926 produced no improvement. That IC also runs quite hot to the touch. I hope you can help with this problem. (M. C., East St Kilda, Vic).

● Since you state that you have replaced the 74C926 there are only two possible ways for the "g" segments to be alight constantly. First, the "g" line may be shorted to the positive supply. This is unlikely because of the layout of the PCB. The more likely cause is a short between the "g" and the "b" or "c" segment lines. The best way to find this fault is to use a multimeter switched to a low "ohms" range.

PLAYMASTER 760 ORGAN: I am writing in regard to the Playmaster electronic organ project which appeared in the March '76 issue of EA. I have never been able to get the thing working properly. To begin with, Dick Smith Electronics was unable to supply the kit although I waited several months for it, so I ended up buying a keyboard from the Electronic Organ Co of Australia, in Pymble. This keyboard, unlike the one described

Playmaster AM-FM Stereo Tuner

STEREO TUNER: I have recently constructed the Playmaster AM-FM Stereo Tuner and am very pleased with the result. However, 9kHz whistle is a problem. I intend to also construct the 9kHz whistle filter described in your February 1979 issue. Could you please provide me with details regarding the installation of this module into the tuner. I would appreciate it if you could indicate the "P" numbers to which it should be connected; whether any PC tracks need be cut; and whether the 100k resistor between P21 and P22 is required. Also, is it possible to accurately adjust the clock with the aid of a frequency meter. (P. K., Frankston, Vic).

● The 9kHz whistle filter is installed in the Playmaster AM-FM tuner between the output of the AM detector stage and the AM-FM select switch S1d. Connections are made between P21 and P22, after the 100k resistor between these points is removed. A wiring diagram which accompanies the tuner module gives details of these P numbers. P22 is the connection to the selection switch and P21 is the output of the AM detector. No PC tracks need to be cut. A photograph of the whistle filter installed in the Playmaster tuner was published in the article describing the filter.

The AY-3-8112 Counter/Clock chip requires a crystal and capacitor network between pins 7 and 8 for the MOS inverter oscillator on the chip. A 2.304MHz crystal is specified, and this frequency is divided by the clock chip to provide the frequency counter timebase, the display multiplexing frequency and the one second pulses for the clock counter. A trimmer capacitor in this network allows the frequency to be adjusted in a very small range around the crystal frequency. A frequency meter could be used to ensure that the oscillator frequency at pin 7 or 8 is exactly 2.304MHz, but this would only be of slight use considering the limits of accuracy of most frequency meters.

in the article, does not have the single changeover contact but has a simple make or break type of connection for each of the keys.

This resulted in the output lines being left floating, but I overcame this problem by pulling each of the lines down to earth via a 1M resistor.

When I play chords on the organ (that is more than one note at a time) distortion results, so the only way to get satisfactory performance is to play it as a monophonic instrument. (R. W., Queanbean, NSW).

● We are at a loss to explain why distortion should result when more than one note is played simultaneously since, in effect, all the note mixing is passive. Possible causes are inherent intermodulation distortion in the amplifier. This could be verified by feeding music into the amplifier and listening for distortion.

EPROM PROGRAMMER PROBLEM: I have just finished building the 2650 computer (May 1978, File No. 2/CC/26) complete with the Video Display Unit (February 1978, File No. 2/CC/23). The problem lies with the Eprom Programmer (February 1979, 2/CC/35) which insists on changing the contents of 3D20 to 08 when it should be 18. Enclosed are listings which demonstrate this problem. I feel it is a software fault but there lies my weak spot. I have now to learn how to program. (W. B., Invercargill, NZ).

● We are of the opinion that the fault does not lie in the software but in one of the RAMs of the computer. This could be easily verified by swapping over the RAMS and running the program again.

PLAYMASTER STEREO TUNER: I have built the unit and when I applied power to the tuner module, the zener diode associated with P12 turned red in the centre and the choke connected to the zener started smoking. So I turned the selector switch and the FM was working. Then I turned off the power at the mains and left it for a while. When I turned it on again the same thing happened but the FM was dead and when the AM is on the signal meter is pinned on ten, whenever a station is tuned. Can you tell me what is wrong? (A. J., Glen Waverley, Vic).

● Our guess is that the series regulator transistor (marked 2SA1383 on the circuit on page 47 of the November 1978 issue) has a short between base and collector. This has applied the full supply voltage across the zener diode which has responded by going red in the face.

EXHAUST ANALYSIS: The test equipment used by garages to measure hydrocarbons and CO in exhaust gas looks very useful for vehicle tuning, apart from the fuel saving which should result from their use. Would some form of hydrocarbon/CO tester be feasible for the home constructor, and if so would you consider publishing a circuit for one as an EA project? (K. S., Palmerston North, NZ).

● We published a circuit for an electronic Gas Detector in the June, 1974 issue. Although fairly basic, this circuit could be used as the starting point for an exhaust gas analyser. The main problem is that of calibration of the unit.

TRANSISTOR ASSISTED IGNITION: I have recently built one of your Transistor Assisted Ignition systems (File No. 3/TI/15) and installed it with a 302 V8 engine using a standard ignition coil. After a short period of time I noticed a deposit left on the points associated with slight burning. This problem impaired the performance of the engine by causing it to misfire. New points and condenser were fitted when the unit was installed.

I would appreciate some advice on how to overcome this problem, and also whether the use of a GT coil would be of advantage with this system. (I. S. Collie W.A.)

● It seems unlikely that the TAI is causing the slight burning that you have mentiond. The points current with the TAI is much less than usual and there is no inductive load and hence no high voltage arcing.

The misfiring that you have observed is therefore not associated with burnt points. The actual problem is probably due to points bounce. This is normally taken care of by the points bounce suppression circuit included in the TAI but in extreme cases of points bounce there may still be a problem.

One solution is to increase the value of the 0.1uF bounce suppression capacitor which is connected to diode D1 in the circuit diagram. A suitable value might be 0.18uF but if this does not provide the cure then use higher value capacitors until the problem disappears.

Alternatively, it is possible that the problem is due to fouling of the points because of insufficient "wetting" current. In this case, you could try increasing the points current. This could be done by adding another 150-ohm/1W resistor to the points network.

RADIO CONTROL RECEIVER: I have assembled a remote control system consisting of the following:

1. Transmitter – crystal controlled f = 27.125MHz, 400mW input;
2. Airborne system consisting of receiver, interface, decoder, and servos.

The receiver is built in accordance with Electronics Australia, Feb 1970 p54, except that I have used a 14-pin DIL package version of the LM372. The design output of this receiver is stated as 4V p-p, but my measured output using an oscilloscope is less than 0.1V p-p.

Playmaster Graphic Analyser

GRAPHIC ANALYSER: I have built the Playmaster Graphic Analyser and it worked right from switch on. However, I feel that your instructions for using it are a bit hard to follow. You say that in the Analyser mode, when the LED is lit, the response is too high, and when the LED is out, the response is too low. There appears to be no in-between of being lit and unlit. Also I cannot get the 1kHz bottom LED to go out, despite full depression of the appropriate slider on the Analyser.

I have a Sony VFET 30W amplifier and efficient speakers, which are used in a medium sized room. When I turn up the volume to what I consider a pleasant maximum, the LEDs do not light up past 4W; even during the cannon in the Tchaikovsky record, the LEDs do not exceed this. This all seems to question the super amplifiers of 100 and 200W. I believe harmonics come into it. Is there any way of estimating the power from the LED display of the Analyser?

I feel that the Analyser has more functions than admitted. How about a future article which expands the facilities of the Analyser such as a discussion of the correlation with test records? (R. L., Merimbula, NSW).

● Adjustment of a Graphic Equaliser, using the Graphic Analyser, should be as follows: with pink noise sent through the amplifier and speakers at a reasonably high level, Equaliser adjustments are made for each band such that the top row of LEDs are off and the bottom row all on. This will give a flat response to within 3dB with the aperture set to 3dB. Consequently the fact that you cannot extinguish the lower LED is of no consequence. Most systems would require considerable cut in this middle frequency region.

With this method of adjustment there is no abrupt LED on to LED off situation, but a 3dB range before the response is either too high or too low.

Regarding the maximum power reading on the Analyser of only 4W, unfortunately an error in the circuit values has rendered the calibration of the Analyser incorrect. The resistors located on the rotary switch S2b and S2c need to be changed. Both the 2.2M resistors should be 180k and both 220k ohm, 56k. Notes & Errata to this effect were published last month. With these values the Analyser will faithfully display the true peak power.

We have noted your comments referring to another article on the Analyser.

L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

RESISTORS

150 ohm, 5W 20c
10 ohm, 5W 20c
47 ohm, 5W 20c
12 ohm, 3W 20c
2.5 ohm, 3W 20c
33 ohm, 3W 20c
8 ohm, 10W 25c
4000 ohm, 10W 25c
100 ohm, 5W 20c
330 ohm, 10W 25c
220 ohm, 5W 20c
5 ohm, 5W 20c
220 ohm, 10W 25c
950 ohm, 3W 20c
115 ohm, 5W 20c
10 ohm, 5W 20c
1k ohm, 5W 20c
5000 ohm, 5W 20c
6.8k ohm, 3W 20c
330 ohm, 10W 25c
6800 ohm, 10W 25c
1500 ohm DUAL, 21W 50c
50 ohm, 5W 20c
330 ohm, 5W 20c
1k ohm, 5W 20c
820 ohm, 5W 20c
12 ohm, 10W 25c
470 ohm, 7W 20c
4700 ohm, 4.5W 20c
5000 ohm, 10W 25c

ELECTROS

470uF, 25V ..... 5 for $1
400uF, 10V ..... 5 for $1
47uF, 63V ..... 5 for $1
350uF, 16V ..... 2 for $1
27uF, 160V ..... 5 for $1
25uF, 63V ..... 10 for $1
22uF, 160V ..... 10 for $1
47uF, 16V ..... 5 for $1
47uF, 200V ..... 5 for $1
220uF, 10V ..... 10 for $1
68uF, 16V ..... 10 for $1

CAPACITORS

0.0039uF, 1500V ..... 20c ea.
6N8, 1500V ..... 20c ea.
0.0068uF, 1500V ..... 20c ea.
1200PF, 400V ..... 10 for $1
0.068uF, 400V ..... 5 for $1
2200PF, 630V ..... 10 for $1
0.47uF, 250V ..... 10 for $1
0.10uF, 400V ..... 5 for $1
0.082uF, 160V ..... 10 for $1
26k, 250V ..... 10 for $1
0.041uF, 400V ..... 10 for $1
0.033uF, 250V ..... 5 for $1
0.027uF, 100V ..... 20 for $1
220uF, 10V ..... 10 for $1

Power leads 240 volt, suit most tape recorders, radios, etc. $1 each.

TV Stick Rectifiers 20SC, $1.00.

Philips Colour TV Convergence Boards, $3 each.

455KC IF Transformers for valve radios, $1 each. Also aerial and OSC coils, 75 cents each.

Slide Pots
250K-500K ..... 3 for $1
Dual 500K ..... 3 for $1
1 Meg ..... 3 for $1
2 Meg ..... 3 for $1
Including Fancy Gold Knobs.
25K dual ..... 2 for $1

SPECIAL
100 mixed resistors, all useful ..... $2.
100 mixed capacitors, fresh stock ..... $2.

AUDIO LEADS
3.5m to 3.5m, 7ft 75c
3.5m to 6.5m, 7ft 75c
6.5, 7ft 50c

MICRO SWITCH
5A, 250V AC ..... 75c ea.

TUNING CAPS
2 and 3 gang ..... $1 ea.
Min 2 gang 50c

FUSES
0.5A, 2A, 3.25 ..... 10 for $1
In line fuse holders 30c
RCA jack plugs and sockets ..... 40c pair

SPECIAL TRANSISTORS

AD161-162 ..... $2.50 pr
BSC 901A ..... $1.50 ea.
BC 548 ..... 10 for $1
AD 149 ..... $3 pr

POWER TRANSFORMERS

240V pri; two x 25V, 117V & 6.3V sec. windings, $7. P&P NSW $1.50, interstate $2.50.

- Telescopic aerials, $1.50
- Top quality, low impedance microphones, $3.50
- 6 inch ferrite rods, 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers, 600 ohm, to 15 ohm, 20 watts, $5
- Line output transformers, 1200 to 3/ohm, 5 watt, $1
- Power supply units, filtered, 240 to 20 volt, $12
- 240 to 15 volt transformers, $3.50.

DIODES

OA 626 ..... 4 for $1.00
OA 662 ..... 4 for $1.00
EM 410C ..... 4 for $1.00
DS 150A 50c
DSY 130YO 50c
OA 636 ..... 50c
HR 15 ..... 50c

POTS ROTARY

½ Meg 30c
1 Meg 30c
100K 30c
100K Switch 50c
50K Double Pole Switch 50c
7.500 ..... 30c
10K Switch 50c
250K 30c
50K 30c
20K 30c
10K Min Pots 25c
50/Ohm 50c
½ or 1 Meg Switch 50c

BSR Record Changer or manual, cuing device, 4 pole motor, magnetic cartridge, diamond stylus $48
Perspex Base, top to suit $22.50
PP NSW $2, interstate $3, WA $4.

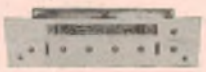
HOR Drive 3021 transformers for colour TV $2
TV Colour Convergence Units 11270 44 x 6 ..... $3

PILOT LIGHTS
Screw In 6.3V ..... 10 for $10.50
24V ..... 10 for $1.00

- Car radio suppressors, 3 for $1
- 3 position slide switch, 50c
- Toggle switches, 25c
- 2 position push button switch, 50c
- 6 position push button switch, $1
- 4 position push button switch, 75c
- Transistor ear plugs & leads, 3 for $1
- In-line fuse holders, 4 for $1
- 4 pole 2 position rotary switches, 50c

Pick up Cartridges BSR universal type Ceramic Stereo $5
Audio Technica AT6 diamond stylus stereo $12

STEREO AMPLYFIER TUNER AM SOLID STATE 12 watts per Channel RMS $45



PP NSW $2
Interstate $3
WA TAS $4

STEREO AMPLYFIER SOLID STATE 5 watts RMS per Channel $25

PP NSW $1.50
Interstate $2.50
WA TAS $3.50

Special: 100 mixed capacitors, fresh stock, all useful. **$2.00**

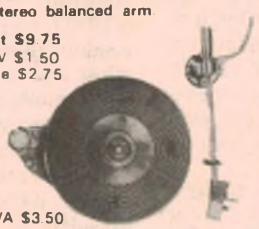
RECORDING LEVEL METERS

$2.50

SUPER SPECIAL

GRAMOPHONE motor and pickup 3 speed stereo balanced arm.

240 volt $9.75
PP NSW $1.50
Interstate $2.75
WA $4



$250 WA $3.50

Miniature speaker and drive output transformers ..... $1 pr

Special mixed tag strips ..... 10 for $1

24V MOTORS

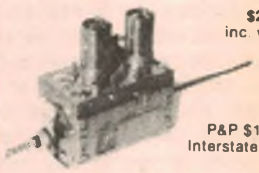
Reversible

Only $2.50 ea.

SPEAKER SYSTEMS

Inc two 5 x3 speakers, 5W RMS, $4.75 ea. P&P NSW $1.75, Interstate $3.00, WA $4. (For singles or pairs).

TV TUNER VALVE TYPE

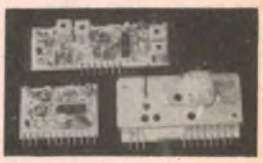


$2.50 inc valves.

P&P $1.00
Interstate $2.50

SUPER SPECIALS

FM STEREO TUNER KITS



Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

ONLY $18.00
P&P $1.00

VU & BALANCE METERS

STEREO VU **$3.00**

12Kn 100uA **$2.00**

PHILIPS TV TUNERS

Transistor NT3024, NT3030, NT3032, Colour — P&P $1.

$10 ea.

I have established that the local oscillator is working correctly and that the output transistor is working. Replacing the IC with an identical new unit makes no difference. (P.S., Collaroy, NSW).

● From the specifications for the LM372 the audio output voltage is approximately 0.8V p-p for an input between 50uV and 50mV. Since you state that the output transistor is working correctly, the problem must be the level of the input signal. This level can be affected by the coupling of the transmitter signal into the receiver by the tuned circuit to the base of T1. Directions for tuning this coupling circuit are given on p63 of the original article, but it is worth pointing out again that it is necessary to have a weak signal when tuning the receiver so that the automatic gain control of the LM372 will not flatten the signal peak as the tuning is adjusted.

You should also be aware of the changes in the pin-outs between the 8 pin T05 version of the LM372 and the 14 pin DIL version. In particular, the RF input of the DIL version is pin 3, not pin 2 as in the T05 version, and the other pin-outs are altered accordingly.

SW RECEIVER: A friend recently asked me to advise him on the purchase of a Shortwave receiver. I could find nothing between a communications receiver at more than $300 and a converter to add on to a medium wave broadcast band receiver. The former was too expensive and the latter unsatisfactory because of poor image rejection and too fast a tuning rate.

Perhaps a project along the following lines could be considered. (a) Tuning frequencies 9MHz to 22MHz in steps, not continuous. (b) Double conversion with the first IF turntable 2MHz to 2.5MHz, or 2MHz and a second IF of 455kHz. (c) Front end with a first mixer and local oscillator, tuned in steps, with a wave change switch to cover the main SW broadcast bands. (d) "S" meter. (e) Simple noise limiter. (f) Optional extras, such as a 500kHz crystal calibrator, additional bands, such as 14MHz amateur band, a BFO for CW and SSB reception. (J. E., Bull Creek, WA).

● In replying to such a long list, first it may be well to point out that the converter ahead of a broadcast receiver is not a bad compromise. It does have a good tuning rate, covering about 1MHz per sweep of the dial and although the image rejection would not be as good as for somewhat higher frequency tunable IF, it does five a useful measure of image rejection.

We have described a number of receivers in the past which would meet all or most of the requirements laid down. Starting from the top, the Solid State Deltahet was described in February, March, April and May, 1971, then there was the 240 Communications Receiver which was described in January, February and March, 1970. Both of these receivers were quite advanced and comprehensive in design and the cost to build today would be commensurate with the price of a commercial communications receiver.

In August, 1970, we described the 110 SW receiver which would meet most of the above requirements, except that the tunable IF covered 4MHz per sweep of the dial. This was considered to be a good compromise and this would be still our most economical receiver design. A successor to the 110, was the 160 SSB receiver, which was the basic 110 receiver with a ceramic BFO, amplified AGC with variable time constants, S meter, fine tuning and an RF stage.

However, before embarking on the construction of any of these receivers, it would be well to check the cost of such a project against the price of a near equivalent commercially available unit. We will keep your request in mind as the basis of a possible future project.

HIFI MANUFACTURERS: I have been an avid reader of your magazine for quite some time now, and I would like to congratulate you on what a good magazine it is. Could you please supply me with the addresses of the following companies or their agents so that I can obtain some information from them: Cerwin-Vega, Wharfedale, Bose and Apex Acoustics. My interest stems from reading HIFI topics in the April '80 issue. I am especially interested in the Cerwin-Vega DM-2 mixer and the Wharfedale TSR-110 speakers. I would also appreciate it if you could tell me what the prices of these items are. (T. M. Gladstone, Qld).

● Thank you for your kind remarks in regard to Electronics Australia. The addresses you seek are as follows: CERWIN-VEGA: Graham Audio, 144 Brodham Street, Kings Cross 2011. WHARFEDALE: Rank Australia, 12 Barcoo Street, East Roseville 2069. BOSE: Bose Australia Inc, 11 Muriel Avenue, Rydalmere 2116. APEX ACOUSTICS: Apex Acoustics P/L, 7 Victoria Ave, Castle Hill 2154.

In regard to all the items in which you are interested, price and availability would have to be checked with the firms concerned.

RHYTHM UNIT: I have used your excellent metronome for some years — have you ever published or thought to develop a circuit for a rhythm unit? On another subject, I am horrified to see that you have published a regenerative receiver for shortwave and SSB/CW reception without an RF stage. I do quite a lot of shortwave listening and I thought that the days of tuning whistles were over. Anyway, what about such a receiver? (W. J., Walkerville, SA 5081).

● We are pleased to know that you have found the metronome so useful. Yes, we have published details for a rhythm unit. It was described in October, November and December, 1976. Copies of each article may be obtained from our Information Service, for $3.00 each. The small regenerative type of receiver has been with us for many years as you indicate. However, its popularity has never waned and the one which we described in April, 1980 is no exception. We understand that large numbers have been built. Your suggestion that we produce a small receiver with an added RF stage will be considered.

Want something? Read this!

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $3 per part where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

CHASSIS DIAGRAMS: for the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" and/or submitted without fee may be answered in these pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value. Seven months and older, if available, $2 (includes storage fee). Post and packing 70c per issue extra.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

MARKETPLACE

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $12 per col cm.

Please state classification: For Sale, Wanted, Reader Service, Position Vacant, Position Wanted, Business For Sale, etc . . .

CLASSIFIED RATES $3 per line per insertion payable in advance. Minimum two lines.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Monday of each month.

ADDRESS all classified orders, copy, enquiries, etc. to: The Advertising Manager, **ELECTRONICS AUSTRALIA**, Box 162, Beaconsfield 2014.

FOR SALE

SORCERER SOFTWARE. Statistical, educational, file manipulation, home management. New catalogue $1. I. Gray, 9 Kelly Pl, Higgins, ACT 2615.

FREE . . . List of bargain electronic components, ideal for hobbyists, servicemen, Radio Clubs, etc. Send 9" x 4" SAE. Now!! MICRONICS, PO Box 175, Randwick. NSW 2031.

EXCITING RANGE of software for use by all owners of popular brand computers. Write for our catalogue to Supersoftware c/o Lane Cove PO Lane Cove 2066.

AMIDON CORES Iron-powder and Ferrite. Enlarged range available for turned, wideband and suppression applications in Rx and Tx. Large SASE for data/price list. R.J. & U.S. Imports, Box 157, Mortdale, NSW 2223.

FREE 10 unmarked transistors plus catalogue of cheap electronic components. Send SASE — ELECTROMANIA, 382 Glenferrie Rd., Malvern 3144 VIC.

NEGATIVE ION GENERATORS full range from personal to commercial sizes. Send 9" x 4" SAE for information and prices to K & M TRADING, PO BOX 78, Lindfield 2070.

TRS-80 RACING SYSTEM level 1 4k. Let your computer select winners! Guaranteed TAB profit. Full documentation, program tape, certified data tape. Send $45 cheque money order to Softsell, Box 1173, Dubbo, NSW 2830.

"SWLs & DXERs do you know what the Australian Radio DX Club is? The largest shortwave club in Australia with over 15 years of service and a full range of special publications. Comprehensive new member kit upon joining. Special membership fee for people under 18. Australian DX news averages over 23 pages every month. ADXN contains up to the minute news on shortwave, mediumwave and utility Dxing. Branches establishing around Australia. For a sample copy of ADXN send a 22c stamp to ARDXC PO Box 79 Narrabeen NSW 2101 mentioning this ad.

HARDCOPY TERMINAL with tape reader and punch. Suitable for microprocessor terminal. $250. (03) 758 9441.

SORCEROR SOFTWARE AID. Create, edit, and save graphics in seconds with GRAPHIC-ED. (½K) Z80 Code. Second $12 cassette or $6 listing to SYNAPSE SOFTWARE 42 Bay View Tce, Mosman Park WA 6012.

16KRAM CARD, S-100 BUSS $250. Video RAM card, S-100 BUSS $350. Logic Analyser $700. All professionaly made products. Call (02) 358 1806 if you want a catalogue, write to Clifford Kobayashi 205/76 Roslyn Gardens, Elizabeth Bay, NSW 2011.

MICROPOLIS DUAL DRIVES Quad Density 630k Model 1053 as new with manuals/software 30 Day warranty, suit Sorcerer or other S100 $1500 (02) 4501716.

FOR HIRE

MICRO RENTAL Microcomputer systems of the most popular models are available for hire. Minimum period, one month. DORF MICROCOMPUTER. Sydney Ph 960 1808 bus. & ah.

WANTED

OLD RADIOS and components for historical and display pre-1930 (02) 89 0337.

BUSINESS FOR SALE

ELECTRONIC AND APPLIANCE REPAIR business for sale. Ideal for audio & TV technician. Long lease includes main road show room & large fitting bay. Gross from repairs approx. $15,000. Car audio sales brings gross to approx. $80,000. Price $8,000 ONO plus SAV. Phone (02) 80 3128. ah (02) 888 6894, (02) 629 1021.

PORT MACQUARIE: Retail Hi-Fi, Colour TV, Video, Records and cassettes, GMI. Reduced to sell at $25,000 plus SAV. Owner has accepted position with Electronics company. Looking for responsible, experienced people with $45,000 to invest to take over this 7½ yrs well-established business in beautiful Port Macquarie. Phone (065) 83 3433 (bus) or 83 2972 (ah) for details.

BRASS SHIPS CLOCKS
SMITHS 8 DAY 7 INCH DIAMETER $110

Post A $1.75; B $3.00; C $3.60

GENUINE EX ARMY WRIST WATCHES

Complete with nylon band $19.50
Post $1.10

CHASSIS PUNCH SET

For perfect holes in metal
Cuts holes ⅜" ¾" ⅞" 1" 1⅛"
With tapered reamer size
3-14mm
$37.95
P + P A$1.95 B$3.25
C$3.65 D$3.65

RECEIVER No. 210

2-16 M/cs $75
Transmitter No. 11 suits 210 $35
24 volt Power supply to suit above $15
Or complete station with Headphones, Mic. $110

EX ABC MAGNETIC RECORDING TAPES ¼"

PROFESSIONAL QUALITY

5" x 600'	$1.50
7" x 1200'	$2.75

P + P $1.30
10½" x 2400' $7.95
P + P A$1.65 B$2.75 C$3.10

COLLINS INDEPENDENT SIDEBAND TRANSCEIVER TRC/75

Fully synthesised transceiver with am, upper, lower and independent sideband operation. 1KHz steps from 2MHz to 29.999MHz. 1 microvolt sensitivity. 2.5KHz bandwidth ssb. 6KHz bandwidth AM. 1 RW. PEP max output. Fully automatic tuning of both transmitter and receiver from remote control unit. Complete with automatic aerial coupling unit, mic, headset, etc. 400Hz supply.
Ideal for amateur use
PRICE $750

COLLINS SYNTHESISED 1 SB RECEIVER

TRC/75 receiver section of transceiver specification as above.
PRICE $400

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army Don 8 perfect condition **$45.00** per drum. **$5.00** cartage to rail freight payable at destination.

20X to 60X ZOOM TELESCOPE

With Tripod. $115.50
Post A$2.25. B$4.10. C$6.10

NIBBLING TOOL

Cuts sheet metal like a punch and die up to 18 G.A. Cuts Trims Notches $14.95 P + P $1.45

AERIAL CAMERAS

WITH 8" FL 3" DIAM. LENS F24 MARK IV 2.9 LENS STOPS 11, 8, 5.6, 4, 2.9 — **$75**
$2 cartage to rail freight. Payable to nearest attended railway station.

PENTAC LENSES

3" DIAM. 8" FL WITH DIAPHRAGM STOPS 11, 8, 5.6, 4, 2.9. MOUNTED IN METAL HOUSING — $65
POST: A. $1.85. B. $3.25. C. $4.10

PRISMS

4" SQUARE FACED RIGHT ANGLE PRISMS TOP QUALITY EX AIR FORCE — **$65**; OR LENS & PRISM FOR **$120**
POST: A. $1.75 B. $3.00 C. $3.60

SOLENOIDS

200 MA 24 volt, ⅛in push movement.
$2.50 P+P 80c

NIFE CELLS

1.2 volt, fully charged. 4in x 3in x 1in 4 AH.
$1.50 each. P&P 80c

CENTRE DRILLS

15/64 x 15/64
Carbon steel **$4.00** doz. Post 60c

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360? 5½" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens. F.L. 10" with cross hairs, eyepiece ½" right angle prism — height 10" — weight 3½kgs. With leather carrying case. Original cost $300.
Our Special only **$27.50**
P&P A $2.25 B $4.00 C $6.00

POSTAGE KEY:

A. NSW
B. Vic. Qld. SA. Tas.
C. NT.
D. WA

VALVES

BRAND NEW

6SN7	$1.95	6BM8	$1.95
5U4	$1.95	6GV8	$1.95
EF50	$1.50	6AK5	$1.95
		1H6	$1.50
2x2	$1.50	832	$5.00

P+P 80c

6x4	$1.95
VR65	$1.50

STC HIGH IMPEDANCE HEADPHONES

3400 ohms, brand new, only **$5.95** pair
P&P. A. $1.65. B. $2.75. C. $3.10.

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb
$32.50

45 x 40
Length: 16in
Height: 10in
Weight: 2lb
$49.50

High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.
POST: A. $1.75. B. $3.00. C. $3.60

TELESCOPES

25 x 30 $13.50
P&P A. $1.30

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only **$8.95** each, post 60c.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

8 x 30	$42.00		
7 x 50	$48.95	P&P	
10 x 50	$51.00	A	$1.75
12 x 50	$53.00	B	$3.00
20 x 50	$65.00	C	$3.10
20 x 65	$125.00		

SMALL CLIP-ON POCKET TELESCOPE

15X **$7.00**. P+P 80c

THEODOLITE

Kern Swuisse Switzerland DK2 Two minute can be estimated down to one minuted. Tested in good working order. **$750.00**

C42 set 36 to 60M/Hz with 24 volt power supply headphone mic. leads etc. **$95**.
Or 42 set separate **$65**.

AIRCRAFT INSTRUMENTS

Directional Gyros
AN5735-1 Air Operated
$35
Sperry Artificial Horizon
AN5736-1 Air Operated
$45
Slip and Turn Indicators
$17.50
P&P
A. $1.65. B. $2.75. C. $3.10

MAGNESIUM DRY CELL BATTERIES. Suits PRC25 and dozens of other uses. 15 volts long life.
Only **$1.50** each. P & P A **$1.35**. B **$2.75**. C **$3.60**.

ANEROID BAROMETERS

In brass case, made in London. **$39.50**
P&P A $1.65
B. $2.75
C. $3.10

CONDENSER LENS

2" diam. 2" F.L. **$1.50** each or **$2.50** per pair. P&P 80c.

IMPELLER PUMPS

New gunmetal body. Stainless Steel Shaft. Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx. size 8" x 5"
⅜" **$35.75**, ½" **$51.00**, ¾" **$56.60**.
P+P. A. $1.95. B. $3.50. C. $4.60

Liquid filled compass

With magnified lens sight and degree reader.
Only **$7.95** each. Post $1.30

POLARITY & CURRENT CHECKER

3 volt to 400 volt. Simple leads and prods quickly determines positive or negative with illuminated indicators. also checks AC current and intensity. fully insulated only **$4.95**. pp $1.30.

COLLINS COMMUNICATIONS RECEIVERS

500Khz to 30Mhz
Type R/391
$500

WRIST WATCHES SWISS JAEGER

Le Coultre ex RAAF rated one of the world's best in smart chrome case with black dial. Original cost $250.

SPECIAL **$49.50**
Post **$1.30**

PRISMATIC TELESCOPES

15 x 50 Ex RAN — black enamelled brass. Length 16", weight 5kg. Price **$39.50**.

$2 cartage to rail, freight payable at nearest attended railway station.

ZOOM FOCUSING MICROSCOPES

Zoom focusing microscopes. 750X battery and mirror illuminated. Zoom.

$31.75

P&P A $1.65. B $2.75. C$3.10.

DIRECTOR LEVELS

Ex Army No 9 with azimuth horizontal circle and vertical adjustment suits all types of levelling. In leather case.

$95

P A$1.75 B$3 C$3.60.

CLINOMETER MK6 0° TO 45°

Precision calibrations set in solid gunmetal frame spring ratchet adjustment. Approx size 7" x 6". Complete in wooden case
$37.50
P + P A $2.15, B $3.85, C $4.85, D $4.85

SWISS ARMY TYPE POCKET KNIFE WITH 11 COMBINATIONS

BLADES, SAW, SCISSORS, BOTTLE OPENER ETC
ONLY **$5.95**
POST **$1.30**

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated complete with Speaker and Amplifier.

BELL & HOWELL **$195**
$1 Cartage to Rail. Freight payable at nearest attended Railway Station.

SELSYN MOTORS MAGSLIP

TRANSMITTER 3" MK2 $17.50

Post Packing A. $1.75. B. $3.00. C. $3.10

MAGNIFYING GLASSES

4" Magnifier suspends from neck and rests on chest, leaves hands free ideal for mum or gran, sewing, etc
$6.30

4" Hand held	$5.95
3" Hand held	$3.80
2½" Hand held	$2.65
3¼" Rectangular	$4.25
4" Magnifier on stand leaves hands free	$10.75
Illuminated 10 x power magnifier	$6.60

Postages $1.30 extra

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C.O.D.

Just Off The Presses

MICROPROCESSORS & PERSONAL COMPUTERS

Microprocessors and personal computers, little more than a dream a few years ago, are now changing the face of electronics. This book introduces the basic concepts, describes a selection of microprocessor and personal computer systems, and details a build-it-yourself computer designed especially for beginners.

Order your copy now!

Available from "Electronics Australia", 57 Regent St. Sydney. **PRICE $5.00** OR buy mail order from "Electronics Australia". PO Box 163, Beaconsfield 2014. **PRICE $5.70.**

ELECTRONICS AUSTRALIA

PRINTED CIRCUIT BOARDS AND FRONT PANELS

Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

N.S.W.

Dick Smith Electronics,
PO Box 321,
North Ryde, NSW 2113.

Electronic Agencies,
115-117 Parramatta Road,
Concord, NSW 2137.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.

Radio Despatch Service,
869 George Street,
Sydney, NSW 2000.

VIC.

Kalextronics,
4 Burgundy Plaza,
101 Burgundy Street,
Heidelberg, Vic. 3084

Rod Irving Electronics,
425 High Street,
Northcote, Vic. 3070.

S.A.

James Phototronics,
522 Grange Road,
Fulham Gardens, 5024.

W.A.

Jemal products,
8/120 Briggs Street,
Welshpool, WA 6106.

N.Z.

E. H. Earl Ltd,
PO Box 834,
Wellington, NZ.

Marday Services,
PO Box 19 189,
Avondale,
Auckland, NZ.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket, NZ.

Printed Circuits Limited,
PO Box 4248,
Christchurch, NZ.

SUBSCRIPTION SERVICE

Subscription Rates

$21.00 per year within Australia
$25.00 per year elsewhere.

Make sure you receive every copy of the magazine by ordering it from your newsagent or the publisher. For publisher subscriptions post this coupon, with your remittance, to Electronics Australia Subscription Dept., John Fairfax & Sons Ltd, GPO Box 506, Sydney, 2001. Subscription will start with first available issue.

Name . . . . . .

Address . . . . . .

Postcode . . . . . **Enclosed is** . . . . . **for** . . . . . **years**

ADVERTISING INDEX

The revolutionary Honeycomb Disc Speaker System!

Another Technics 'first' that brings... Sounds Alive

Cross Sectional View of the SB-10

The most obvious difference... between the new Technics honeycomb disc speaker system and conventional speaker systems is that the speaker units are flat instead of conical. This flat sound radiating surface at last puts an end to all of the distortions inherent in the traditional cone-shaped design. Cone shaped drivers suffer from something called the 'cavity effect' which causes peaks and dips in the upper end of the driver's frequency range.

But cone shaped drivers do have their advantages, namely a combination of low mass and high rigidity which contributes to pistonic motion. In designing this new Technics honeycomb speaker system we were faced with the problem of retaining or improving upon the cone-shaped speaker's low-mass, high-rigidity characteristics while developing a flat speaker surface. We found the answer in the 'axially symmetric honeycomb diaphragm.' It is well known that honeycomb structures are very light and strong, which is why they are extensively used in aircraft construction. In spite of the honeycomb's low mass, it is very rigid and difficult to bend.

Technics

When it comes to speaker design, JVC goes 2969 times further.

Traditionally, speaker systems have been designed by a tedious trial and error proccess, by which individual combinations of speaker, crossover and enclosure combinations are analyzed—one at a time—until the desired sonic results are achieved.

JVC has put an end to these time-consuming and archaic procedures, with a revolutionary new system called Phase Moire (Mor-ay) Propagation Technology, that uses a specially-constructed device to move a test microphone in a way that creates and preserves, via computers, video and high-speed filming, a field of nearly 3000 sound testing positions.

By viewing the film, our engineers can actually see what a speaker will sound like before they get too far into the design process.

The initial result of our unique Phase Moire Technology, combined with a great deal of human engineering, is the SK-1000. This unusually-efficient, extraordinary-sounding three-way speaker system delivers truly magnificent, rock-solid bass from its 12" free-edge woofer and heavy magnet structure. Capable of handling up to 170-watt peaks (85 watts RMS), the SK-1000 reproduces vocals and midrange with unusual smoothness, thanks to our specially-designed 5" midrange driver. Clear, crisp, brilliant highs are dispersed evenly within the listening area from a 1" soft-dome tweeter.

We also give you complete control over midrange and tweeter response with a pair of front-panel level controls.

But all the technology in the world can't fool two of the most sophisticated testing devices known: your ears. And all the words in the world can't tell you what the SK-1000 (and its two smaller companions, the SK-700 and SK-500) really sound like.

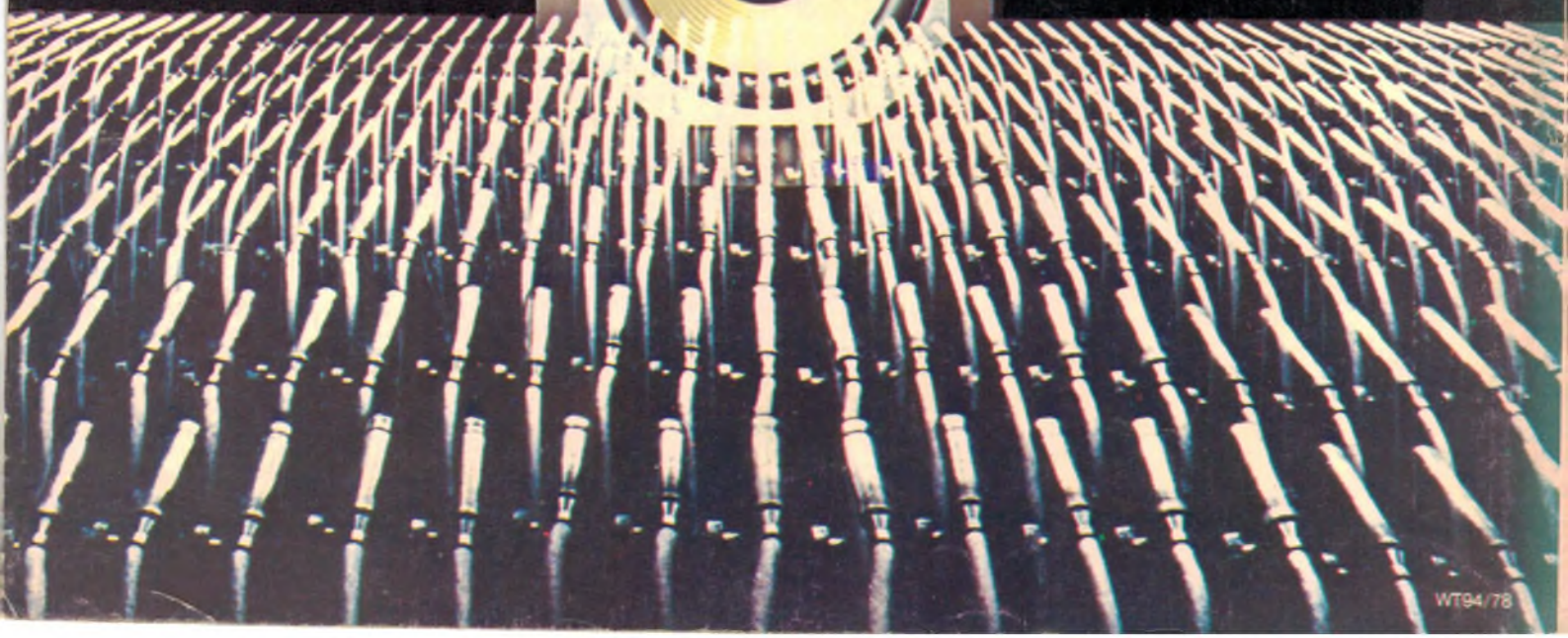
So we suggest that you hear what we've been talking about at a JVC dealer.

For details on all JVC Hi-Fi Equipment, write to JVC Advisory Service, P.O. Box 307, North Ryde, New South Wales 2113.

For pure Hi-Fi entertainment!

JVC

the right choice



WT94/78