ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

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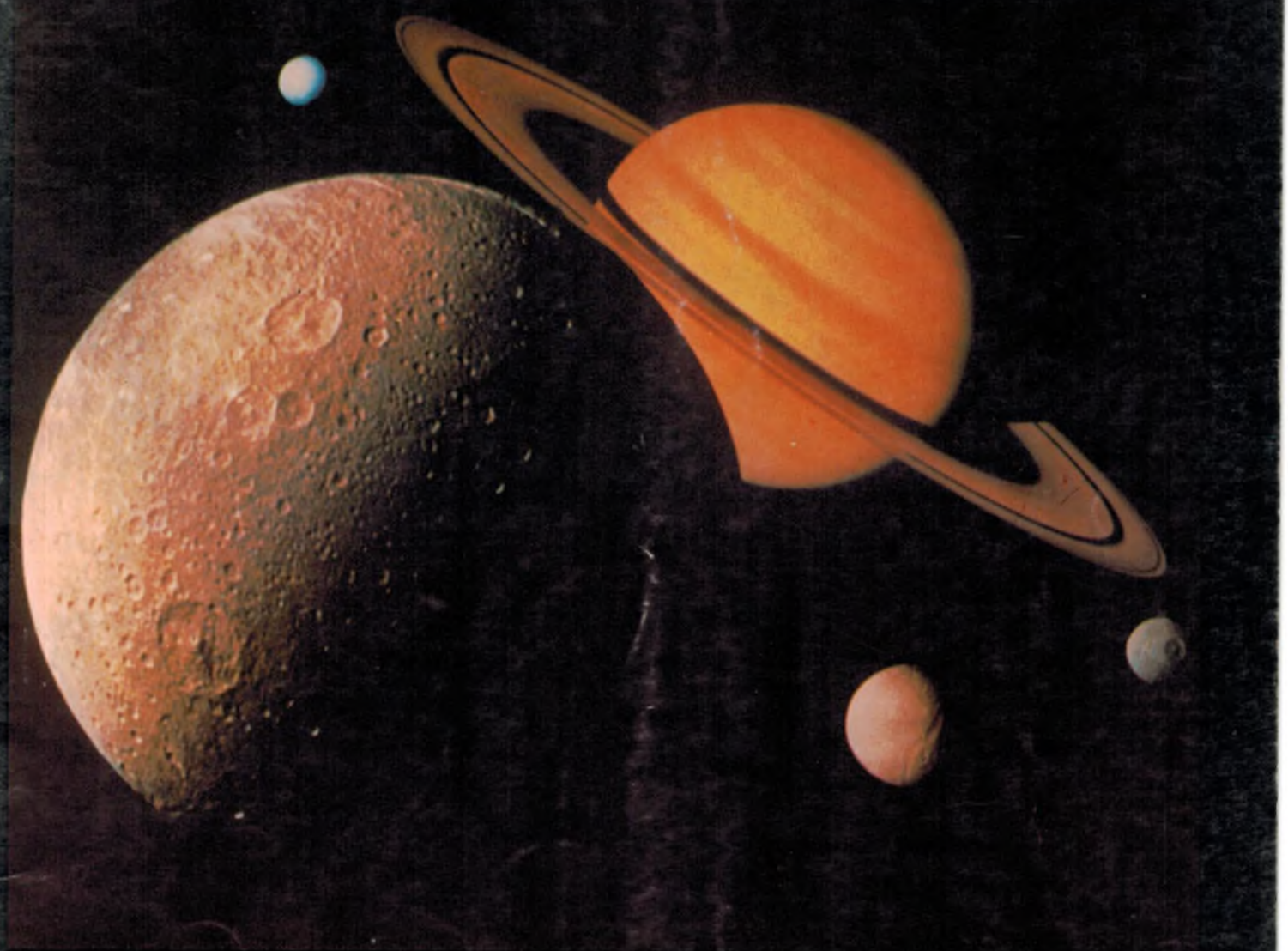

They're close to deciding THE FATE OF THE UNIVERSE

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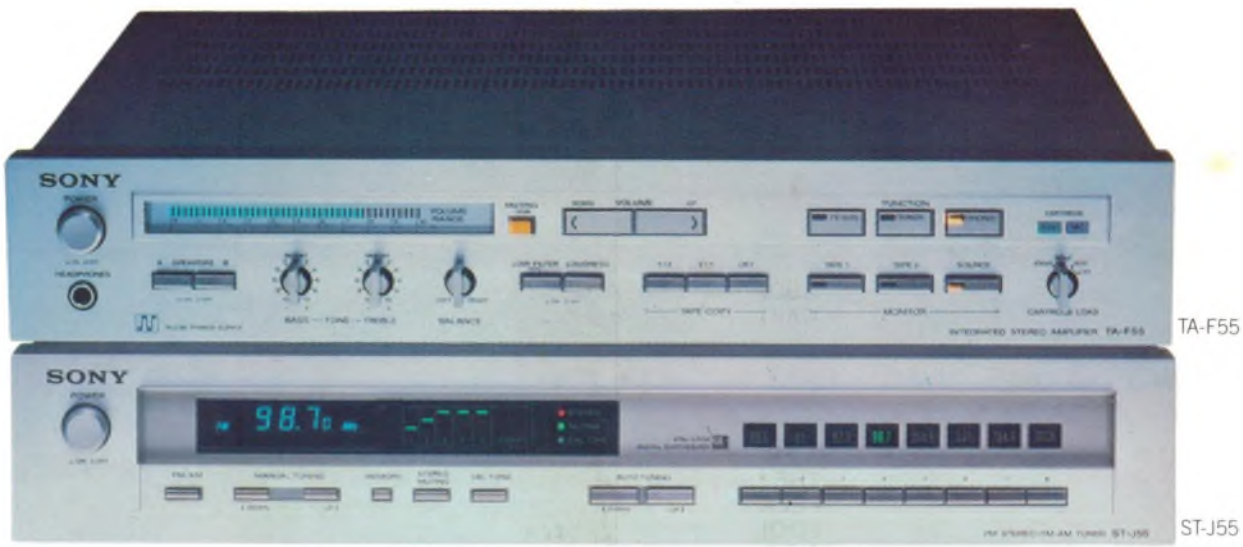
Steam Whistle ● MC Cartridge Preamplifier

Sony's inseparable separates.

Sony's new ST-J55 tuner and TA-F55 amplifier come in elegant matching designs. Separately, they're outstanding. Together, they're out on their own, both in appearance and performance.



The J-55's tuner is frequency synthesized and quartz locked. A neat line of feather-touch switches gives a choice of Memory, Auto, or manual tuning.

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You won't find better engineering than these. Not even from Sony.

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ELECTRONICS AUSTRALIA

Volume 43, No. 7
July, 1981

AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE

Moving coil cartridge preamp.

Prefer the sound of moving coil cartridges? This preamplifier has performance equal to or better than most commercial designs, but can be built for a fraction of the cost. Details p44

"Electrochune" is a fun name for a fun project. We believe that readers will really enjoy building and playing this 23-note keyless organ with special effects. See p52.

COMING NEXT MONTH! – Find out what's coming by turning to p91.

On the cover

This spectacular view of the planet Saturn and its moons was assembled from individual images taken by Voyager 1 as it sailed through the solar system last year. What will be the ultimate fate of the universe? Incredibly, scientists think they may soon know the answer as our article on p12 reveals.

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Editorial Viewpoint

Looking back & looking forward

Some weeks ago I visited the Lithgow (NSW) Zig Zag Railway which, in its time, was a marvel of engineering with its impressive viaducts and switchbacks. I was even lucky enough to ride on the footplate of the loco with my young daughter. As we clung to the clanking beast and thrilled to the blasts of its sonorous whistle, I could not help thinking of it as an eloquent symbol of the passing industrial age.

Not so long ago, steam whistles, often beautifully turned in solid brass, sounded the pace of our whole society. They highlighted the arrival and departure of trains and they signalled the start and finish of work at the local factory or colliery. Every kid in the district, every person who could hear, reacted to the sound of the "knock-off" whistle which signalled the home-coming of weary fathers and husbands, the change from work to rest, and the end of another day.

In a sense, whole towns and communities could be seen to be regulated by the machines of the steam era.

These days, we live by another kind of "clock", not turned in brass and not powered by steam. They are crystal-controlled, with CMOS circuitry, in computers or wristwatches. Even the kids at school have them and they can let their teachers know the end of class period by setting their watch alarms to go off in unison. And such is the precision of these cheap timepieces that the alarms do all go off in unison, within a split second. With that, who needs to listen out for the sound of the now-defunct factory siren? Most of the kids' fathers don't work in factories anyway!

Whereas community life in the industrial age was regulated by machines, today we are increasingly attuned to the products of high technology — to computers, to colour television and to satellite communications.

Each of us reacts individually to our own precision timepiece and to the demands placed on us by a high technology society. Our pace of life is frenetic and our society is becoming fragmented and unstable.

As I took that nostalgic ride on the Lithgow Zig Zag, it also struck me that while the Industrial Age had lasted around 150 years or so, the Computer Age may be much shorter; such is the rate of its progress.

After the Computer Age, what then?

Clearly, while science and technology have in the past provided us with countless benefits, there have been many drawbacks to balance the scales. In the future, man will have to base his society on the needs of individuals and the community at large and not on the requirements of technology.

Can we hope that this next "age" will be the Age of Man?

Leo Simpson

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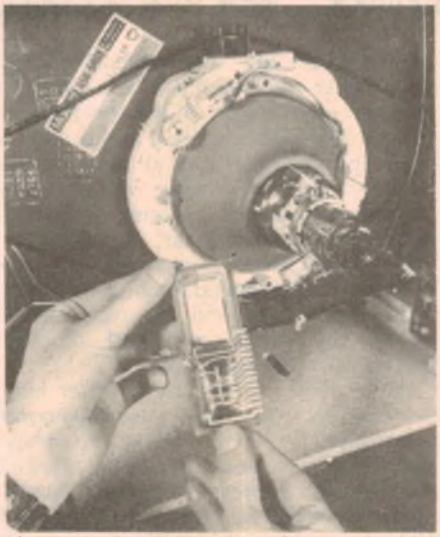
News Highlights

Sinclair "flat-screen" TV tube bends beam through 90 degrees

Shown at right is the tube of a new miniaturised television receiver from Britian in comparison to a conventional television CRT. The unit shown here will eventually be incorporated into a combined FM radio and TV set small enough to fit into a pocket . . . but the design may also lead to a giant 130cm wall-mounted projection television system.

The Sinclair Microvision is three times brighter than conventional cathode ray tubes of the same screen size, and uses a fraction of the power. It consists of an electron gun mounted parallel to a flat phosphor screen in a vacuum-formed glass body. Deflection plates in the gun assembly give horizontal and vertical scanning, and a further set of deflection plates between the screen and the front face bend the beam onto the screen.

The Microvision is exceptionally bright because the image is viewed from the same side as the electrons strike. This also allows the other side of the screen to be connected to a heatsink to prevent



damage to the phosphor coating from overheating. The basic tube can be readily modified for projection TV systems since it is both small and bright.

Computer translates Chinese to English

The use of computers for language translation has moved a step closer as a result of a research project by a Cambridge, UK linguist.

Mr Peter Nancarrow, of the Literary and Linguistics Computer Centre at Cambridge University is a physicist, Chinese linguist and qualified patent attorney. He worked for four years to compile a Chinese-English glossary. After connecting a Chinese character encoder, which he developed, to the University's mainframe computer, he began to develop the processing needed to computerise the glossary.

Language translation experiments have been going on for almost 25 years. The general approach has been to reduce language and its grammatical constructions to a mathematical form which can be handled by the computer. Inevitably it has been found that language is much too subtle and fluid to enable grammatical analysis to be performed easily.

Mr Nancarrow approached the problem from the other side. He decided to write a program which would enable him to store Chinese dictionary items in the computer and check any new text against that store. He found early on that the "automated dictionary" developed into a system which could actually produce continuous text output understandable to the technical reader. The pro-

Continued on p2.

Defence contract to Philips

The Salisbury-based EMI Electronics division of EMI Australia has awarded a contract to Philips Electronic Components and Materials for the production of a large quantity of hybrid circuits to be used in the Mulloka Sonar System being fitted in ships of the RAN. Production will be undertaken by the Philips microelectronics factory at Hendon, South Australia.

Liquid-crystal shutter gives colour display

Researchers at the British Royal Signals and Radar Establishment have developed a liquid-crystal shutter which allows scenes from black and white television to be viewed in colour.

The device relies on the fact that a carefully selected mixture of liquid crystals can switch rapidly from one state to another under the influence of a high-frequency electric field. Normally a liquid crystal's electric dipole moment (or anisotropy) causes it to align with an applied electric field. When the field is removed the crystal returns to its normal state. By applying a high-frequency burst after the low-frequency turn-on signal to the LCD, it is possible to switch it between the two states at rates of up to 100Hz.

The British device consists of a 20cm square LCD shutter between two polarising screens. The screen closest to the CRT transmits green light in a vertical plane and red light in a horizontal plane, while the screen nearer the viewer transmits only vertically polarised light, red or green.

With no electric field applied, the liquid crystal molecules are aligned so that they twist the plane of the polarised light through 90° so that only a red image is passed to the screen nearest the viewer. Application of a low-frequency electric field causes the molecules to align with the field, passing the polarised light with no rotation, so that a green image is shown.

The application of a second electric field at a high frequency abruptly switches the molecules to their rest state, so that red and green images can be presented in a sequence of rapidly alternating frames. The overall result is a display of two well-defined red and green colours and any colour mix of the two, since the alternation of colours is fast enough to integrate the two.

The shutter is synchronised with the TV frame frequency, and the persistence of vision human vision gives the impression of a colour display. The sutter-based colour display is not intended to rival conventional shadow-mask CRTs, but it could be used in test instruments and instrument display systems which require a rugged miniature, display.

Magazine transmitted via satellite

Using a combination of computers and telecommunications, the publishers of Time Magazine are now able to get weekly issues onto the newstands of Australia up to two days earlier than previously possible. An international data circuit linking the USA and Australia, leased from the Overseas Telecommunications Commission (Australia), allows complete editorial material to be transmitted to printers in Australia via satellite.

Previously, editorial material from Time's New York office was sent by air-freight to the magazine's printers in Melbourne. Now the material, complete pages including text, photographs and illustrations, are converted into digital data and transmitted from USA to OTC's Moree earth station at 9600bps via the Intelsat Pacific satellite. From there it is sent by landline to the premises of Leigh-Marden in Melbourne. It currently takes about 16 hours to transmit the full contents of the magazine, excluding advertisements.

Leigh-Marden operates the only computerised International Graphics System in the southern hemisphere. Digital data codes are recorded on magnetic tape which is fed into the graphics system to produce high quality facsimiles of the magazine copy on page-size film, ready for delivery to the printer.

Reading the press release, itself sent by Telex, prompts the question: How long before the intermediate stage, the printer, is cut out, and the magazine delivered directly to the subscriber's home television set?

The film processor in action.

Escargot ā la computer . . .

Engineers at the Munich-based Components division of Siemens AG have put together a system which allows a restaurant waiter to key a customer's order into a hand-held terminal which transmits the order to the kitchen. In the kitchen a small microcomputer displays the order for the chef, files it, and calculates the bill.

The waiter's terminal is battery powered, and slightly smaller than a pocket calculator. An order is coded as a series of nine digit numbers plus the number of the table, and these numbers are modulated onto an infrared light beam and sent to a relay station mounted on the ceiling of the restaurant. At the relay, infrared detectors and preamplifiers drive a line to a modem which transmits the order to the kitchen computer. If the kitchen has run out of a particular item the waiter can be informed via his terminal.

Transmission in both directions takes place at either 2400bps or 4800bps, and at the 2400bps rate it takes only 280ms for the device to transmit an order for seven different dishes, the table number and the waiter's identification code and receive an acknowledgement from the kitchen.

Restaurant owners have already shown considerable interest in the system. In addition to reducing the time that customers must wait for their meals, the electronic ordering system reduces the amount of walking a waiter must do, allowing them to serve more customers in the same time, hence saving labour costs.

The system is relatively inexpensive, depending on the type of computer it is used with. A complete set up is expected to sell for around $10,000. A prototype system is now being tested in a restaurant in Munich.

Tandy's TRS-80 — made in Japan!

It may be a bit like hauling coals to Newcastle, but the Tandy TRS-80 Model 1 and Model 2 computers are to be manufactured in Japan. Tandy will not be directly involved, however – Tokyo Electric Co (TEC), an affiliate of Toshiba, is to manufacture and market the computers under licence to Tandy.

Tandy describes the agreement as a way to meet the quickly growing demand for personal computers in Japan, but some observers see the move as essentially defensive. Four years ago, the TRS-80 accounted for almost 40% of the personal computer market in Japan. Today that share is under 10% and falling as Japanese manufacturers take over.

Over 100,000 personal computers were sold in Japan last year, with Sharp Corporation supplying 30% of the market and Nippon Electric Co almost 50%. Sharp estimates that its Japanese sales this year will increase to around 70,000 and NEC is expecting to sell at least 110,000. Japanese consumers prefer products made in Japan because they feel that both quality and service will be better. This preference has worked in favour of Sharp and NEC, and Tandy is seeking the same advantage.

Tokyo Electric Co will sell the TRS-80 directly to businessmen through its new small-business computer department, leaving its existing sales network free to market the low-priced personal computer expected to be launched by its parent Toshiba. Its goal is to sell 2000 TRS-80s this year. Combined with sales from the present seven Radio Shack stores and 100 authorised dealers in Japan, the TRS-80 may make a tiny dent in the huge Japanese market.

Chinese/English translator . . . ctd from p4

gram broke down the input text on the basis of its meaning and content rather than its grammar.

"Semi-English", as Mr Nancarrow prefers to call the output, could have far-reaching effects in the scientific field. Huge amounts of technical material written in Chinese characters comes out of China every year, and the average western scientist has no access to it because he cannot read Chinese and there is a very limited supply of skilled Chinese translators.

Translations the other way, from English to Chinese, can also be made. The process which turns English into Chinese actually works better from the user's point of view. In fact, "semi-Chinese" is closer to real Chinese than "semi-English" is to English.

According to Mr Nancarrow the process will never translate Shakespeare fluently, but it could help the English-speaking reader and the Chinese-speaking reader to understand whether or not the document he is looking at is relevant to his work, and provide a partial translation which conveys the meaning of the original text.

NEWS HIGHLIGHTS

Satellite navigation for yachtsmen

Oceangoing yachtsmen can obtain a satellite navigation "fix" using a new microprocessor based instrument from Britain. Called SATNAV 801, the equipment comes in two parts – an antenna and preamplifier unit linked by cable to a combined receiver, computer and display unit.

In use, the estimated position, speed, heading and time must be fed into the receiver using the keypad beside the display panel. A row of X's on the display indicates a passing satellite, and the instrument will then compute the relative positions of the vessel and satellite, giving latitude and longitude with an accuracy to within 400 metres.

The estimated position is updated between fixes and errors are eliminated on the succeeding pass of the satellite. The system uses the five satellites of the US Navy's Navigational Satellite Systems (NSS), and can give navigation readings

between 35 and 100 minute intervals, depending on the vessel's latitude. When not showing a fix the equipment can give details of time, position, and the type of satellite to pass next.

SATNAV 801 is manufactured by Thomas Walker and Son, 58 Oxford St, Birmingham, UK.

New industry association formed

The formation of a new electronics industry association was announced recently by its President, Mr A. T. Deegan. The new body, the Australian Electronics Industry Association (AEIA), results from the amalgamation of three industry Associations, the Australian Telecommunications Development Association, the Electrical Components Manufacturing Association, and the Australian Electronics Industry Council.

Formation of the AEIA was approved at a meeting of the three groups in Sydney recently. The group has 34 member companies which together employ some 18,000 workers, and includes many of the major names in Australian electronics manufacturing.

The President of the Association, Mr Deegan, is also Chairman and Chief Executive of Standard Telephone and Cables, a wholly-owned subsidiary of the United States ITT Corporation. Vice-President is Mr Bruce Goddard, Managing Director of Plessey Pacific Pty Ltd.

According to Mr Deegan, the formation of the AEIA is aimed at consolidating the fragmented local electronics industry by establishing a united body which is equipped to represent the total industry and to plan its development in the future.

One of the first steps for the new association is an intensive recruiting drive, aimed at bringing the many small electronics companies and growing number of computer companies into the group.

Business Briefs

- Anderson Digital Equipment has recently appointed Mr Jim Grossett as General Manager — Finance. Jim is 38-years-old and is an accountant by background. He will take up positions as company secretary to the Group companies, including ADE, Computer Decisions, Logic Shop and Electromedical Engineering.

- Mr Denis Fanna, previously of the kit section of Dick Smith Electronics, has moved to Bill Edge Electronic Agencies to take charge of the newly formed kit department.

- EMI Electronics, a division of EMI Australia, has been awarded a $600,000 contract by the Royal Australian Navy to design, manufacture and install an electronic instrumentation system for the land based magnetic test range complex at Kingswood, NSW. The range will be commissioned in 1982 and will enable the Navy to measure the magnetic components of equipment used in mine warfare and mine countermeasure operations.

British & French power grids to link

Work is expected to start soon on a giant converter station that will complete the link between the British and French electricity systems. The British government recently approved a site for the station at Sellindge near the south-east coast of England. A 2000MW link will be built between the two countries, superseding the existing 160MW line that has been feeding power between France and England for the past 20 years.

Until 1961, the electricity system in Britain operated in complete isolation from those on the European mainland. The sea dividing the UK from France could not be bridged by the same relatively simple links which interconnect the power grids of the continental countries.

In 1961 however, a prototype link was made across the Channel by laying direct current cables on the sea-bed and building converter stations at either end. The link enabled up to 160MW of power to be transferred in either direction and demonstrated the benefits of the scheme. France has been able to import electricity from Britain at night when it is cheapest, while Britain found that French production is cheaper during the daytime.

The new 2000MW cable, to cost around $1000 million, will be built in two 1000MW stages, and is expected to be ready for use in 1985 and 1986. Electricity will be carried across the Channel by cable laid in a seabed trench as direct current. The English converter station will change this into AC for use in the British grid system. The process will be reversed when the UK is exporting electricity.

New hearing aid has no earpiece

Matsushita Communications Inc has commenced production of two versions of its "Ear Glass" Wh-8050, a bone conduction hearing aid.

Conventional hearing aids use a microphone that picks up sound and transmits it via an amplifier to an earpiece. In the "Ear Glass" the microphone is built into the lens frame of a pair of spectacles. The sound is amplified and fed to an electromechanical vibrator set in the tip of the bows. The vibrations are directly transmitted through the mastoid area, located just behind the ear.

It is impossible to see that a hearing aid is being worn, and the device has other advantages. Because of the front facing microphone, the "Ear Glass" does not catch surrounding noise – only sound from the direction the wearer is facing.

The sound quality can be controlled, as can the volume, and a single mercury cell powers the Ear Glass for about 105 hours with 100dB sound output, or about 65 hours at 120dB.

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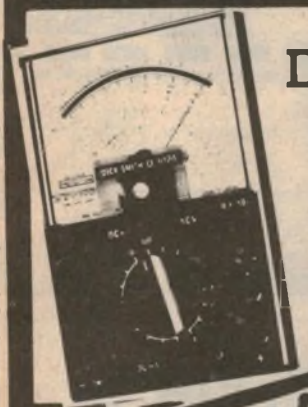

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PAS 60	10" 3 way 90W (60L)	$214.00 pr
PAS 25	8¼" 2 way 60W (25L)	$166.00 pr

Includes drivers, crossover, wiring and instructions.

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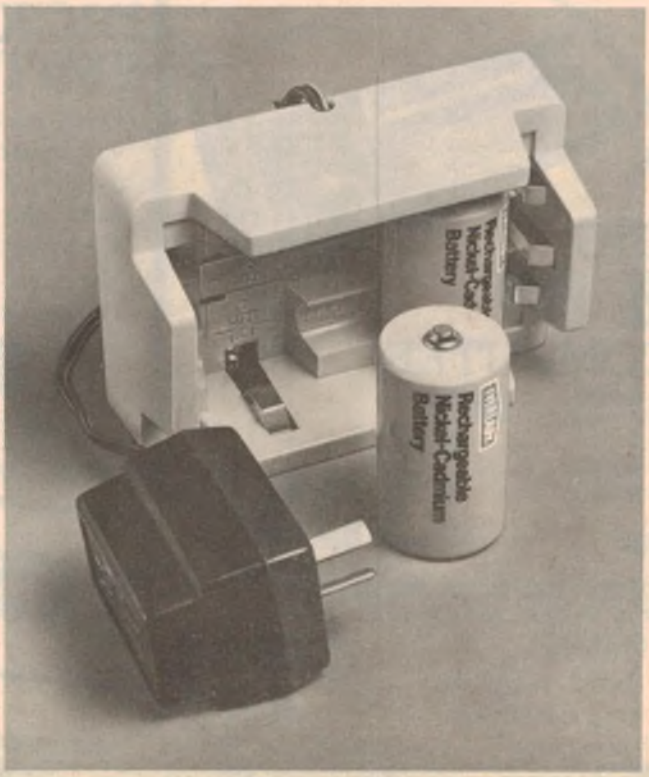

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The Official Line

— from the Department of Communications

Background to the Department

Radio and television, together with other means of telecommunications, make a profound social and economic impact on our community.

The Department of Communications is responsible for a wide variety of policy, planning and monitoring matters in the communications field which affect all Australians in very practical ways. These include:

- managing the radio frequency spectrum;
- planning, developing and helping maintain broadcasting services (both radio and television) throughout Australia; and
- advising the Government on broad policy issues concerned with the provision of postal services and overseas and domestic telecommunications services.

There have been many new developments in technology in recent years such as satellites, cable television and data transmission facilities which have had a major impact on communications. And, at the same time, public interest and involvement in many aspects of broadcasting and communications have also grown rapidly.

This situation has resulted in a great increase in demand for space in the radio frequency spectrum and in the need to examine the types of services which may become available in the near future.

Services now catered for include AM and FM radio, television, amateur and CB radio, all navigation, marine and land mobile radio services, and data broadcasting services.

New services will become available with the advent of the national Communications Satellite System and with the possible application of cable television in Australia and further extensions of data broadcast information.

The Department of Communications has to assess the technical implications of new developments in communications to ensure that the radio frequency spectrum is used in the best interests of all Australians. In doing this, it advises the Minister on policies needed for the planning and development of broadcasting services in Australia.

A Division is devoted to administering the use of the radio frequency spectrum in Australia and in its overseas territories.

Many radiocommunications services are authorised and regulated by the Department. They range from simple handheld equipment for short-range communications through to satellite services.

Regional offices are maintained in each capital city and in 17 major provincial centres, to undertake work relating to the radio frequency spectrum. A number of services are provided for the public from these offices, including licensing and inspection of radiocommunications services.

As well as this, investigations are carried out to identify the causes of interference in the reception or transmission of broadcasting services and to rectify problems. These investigations take place under both the Wireless and Telegraphy Act and the Broadcasting and Television Act.

The planning, operation, licensing and regulation of all public, national and commercial radio and television services is a major area in which the Department has to advise the Minister. Licensing and maintenance of regulations is carried out by the Australian Broadcasting Tribunal.

The Department is also responsible for determining and maintaining the technical standards of equipment involved in the transmission of broadcasting services.

Responsibilities in the broadcasting area are administered by two Divisions – the Broadcasting Planning and Operations Division and the Broadcasting Development Division.

Establishment of a national Communications Satellite System for Australia is another major task in which the Department is actively involved.

The Communications Department provides policy advice to the Minister on the national communications satellite system and this work is the responsibility of the Satellite Policy and Co-ordination Division.

Another significant Departmental responsibility includes provision of advice to the Minister on major policy matters involving postal and telecommunications services in Australia. This work is carried out by the Department's Policy Division.

The Administration and operation of the postal and telecommunications services are, however, the responsibility of three Commissions – the Australian Postal Commission, the Australian Telecommunications Commission and the Overseas Telecommunications Commission.

Statutory Authorities

There are six statutory authorities which fall within the portfolio of the Minister for Communications. Such authorities operate independently of the Department. They are: The Australian Postal Commission; The Australian Telecommunications Commission; The Overseas Telecommunications Commission (Australia); The Australian Broadcasting Commission; The Australian Broadcasting Tribunal; and The Special Broadcasting Service.

R. B. Lansdown, Secretary,
Department of Communications.

Amateur satellite to broadcast TV pictures

Britian's next amateur satellite, due to be launched later this year by a NASA Delta rocket, will be the first to send back pictures in a form that can be displayed on a domestic television set. It will also carry a voice synthesiser which will give information on the performance of the satellite and the experiments that it carries. Amateur radio enthusiasts will be able to listen in to the satellite on standard VHF receivers fitted with a simple fixed antenna.

The 48kg spacecraft, known as UOSAT – University of Surrey Satellite – will carry experiments to study the Earth's magnetic field, solar activity and the aurora. It will make possible a detailed study of how solar activity affects the transmission of radio signals. Also on board is a camera which will cover a 500 × 500km area of the Earth's surface. The image will be formed on a charge-coupled device and stored on board the satellite until transmitted to the ground, where it can be displayed on a domestic television set equipped with a receiver expected to cost around $300.

UOSAT will be put into a polar orbit at a height of 530km, and is expected to have a life of around five years. Its orbit over the Earth's poles will cover almost every part of the world each day.

Surrey University's Department of Electronic and Electrical Engineering, which is responsible for 85% of the work on the craft, is being backed by the UK, US and West German sections of the Amateur Satellite Corporation.

CORRECTIONS:

- On p28 of the May issue and p114 of the June issue, the phone number for Christie Rand Pty Ltd is incorrectly listed. The correct phone number is 477 5494.
- In the news item on the Exidy Disc System from Dick Smith, p130 of the June issue, the text reads in part "No S-100 expansion unit is required". This should read: "No S-100 expansion unit is required".

JAYCAR KITS · FOR THE

What makes a Jaycar Kit different? We think that our kits have a finish which sets them apart. Every day people call in to buy our panels and metalwork. They have tried the others and found them wanting.

Lets face it, anyone, repeat anyone can put a few components in a bag and call it a "kit". The difference of course is when "hard parts" are needed. Things like metalwork, brackets, fittings, etc., are not so easy to come by, so many suppliers conveniently leave them out and sell you a "short form" kit. But it's not only the "hard parts" that make a Jaycar kit.

✱ IT'S THE FINISH ✱

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Remember, Jaycar kits for the PROFESSIONAL ENTHUSIAST!

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(Refer ETI Jan — April '81)

How else do you describe this amplifier except by saying the "ultimate". Truly a magnificent device. Capable of 100W RMS × 2 with 0.0005% distortion!

We have all the parts to make the amp at the best prices in town.

Mosfet Module: All parts including high voltage Hitachi Mosfets, fibreglass p.c.b. prewound coil, etc. only $59.00 ea.

Special ETI Heatsink front panel	$39.50
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COMPLETE KIT	$289.00

ETI 5000 PREAMP.
(Refer ETI June — August '81).

And the ultimate preamp to go with above. A moving coil input, two moving Magnet Cartridge inputs, two tape inputs, LED peak reading level meters — the works!

Complete list of parts including quality 1¾" rack cabinet, specially imported NES534AN preamp I.C.'s 2 × LED meter kits, etc. P.O.A.

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This unique 88 note piano is fully touch sensitive and offers 4 selectable piano tonal qualities plus tremolo, "honky tonk" and "phasing" effects. Complete with high quality sustain and soft pedal mechanism, it is undoubtedly the best value electronic piano available.

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- **Realistic sustain and soft pedals.**
- **Mellow, normal and bright piano as well as harpsichord sound.**
- **All timberwork done for you.**
- **Compact and lightweight.**
- **Power Amp can be built in.**

The piano kit comes complete with a magnificent 32-page assembly manual which includes comprehensive circuit descriptions, component overlands and parts check lists!

This unit is remarkable for its tonal similarity to an acoustic piano. If you don't believe us send $5.00 for a copy of the demo tape!!

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This unit will synthesise a string section of an orchestra (i.e. Chorus); Single stringed instruments; brass, e.g. Trumpet; Organ; Piano Accordion, 'Wurlitzer", etc.

✱ $445

Kit includes 49 note keyboard, all timber cabinetry, all components, etc., a 35-page instruction and assembly manual is included.

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Massive "Celestion" (U.K. made) 18" 200 W (RMS) driver in a compact bass-reflex cabinet fitted with 2 x Motorola KSN-102SA horns.

Box measures 590W x 390D x 730 high. Will fit on the back seat of most cars.

Ideal for mobile discos, rock groups or heavy HI-FI. Ideal unit for the JAYCAR 300 x 2 P.A. Amp.

(See product reviews in EA/ETI June for more info).

Kit price includes all cabinetry, handles, Cannon connector, feet, corner pieces, steel grill, etc.

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RUGGED 100 WRMS GUITAR AMP KIT

We have designed a special heavy-gauge cabinet complete with solid handles to house the well-proven ETI 480 amp module and power supply. The unit is capable of 100WRMS into 4 ohms. It may be operated as a slave or main amp.

Kit includes all components down to the last screw and washer.

Don't confuse this kit with inferior copies.

$130

PREAMP FOR GUITAR P.A. $30

This preamp is designed to fit into the 100W amp cabinet between the handles (see photo). It provides 2 × guitar inputs (or 1 × mic 1 × guitar), separate level controls for each input, Bass & Treble controls and master volume. An attractive Anodised and Silk-screened front panel is also provided.

✱ OTHER KITS ✱

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ETI 466 — 300 watt Amp Kit (Module)	$70.00
3002SP — 2-channel Speaker Protector	$13.00
3002PM — 2-channel Power Meter 5-300 Watts Can be used as "VU"	$18.00
ETI 473 — Moving Coil Pre-Amp Absolutely complete inc. Power Supply, etc.	$95.00
ETI 729 — VHF Masthead Amp Complete	$35.00

"ELECTRONICS AUST"

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EA — "P.C. Birdies" (5/81) Complete	$14.95
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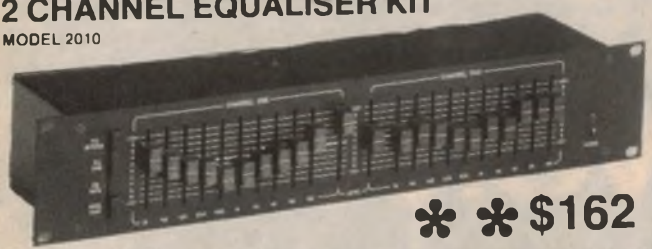
EA — "Sound Level Meter" (5/81) Complete	$39.50

2 CHANNEL EQUALISER KIT

MODEL 2010



✱ ✱ $162

The 2010 is a two channel graphic equaliser featuring ten adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to ± 14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of adjustment of ± 14dB.

The functional versatility of the 2010 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel.

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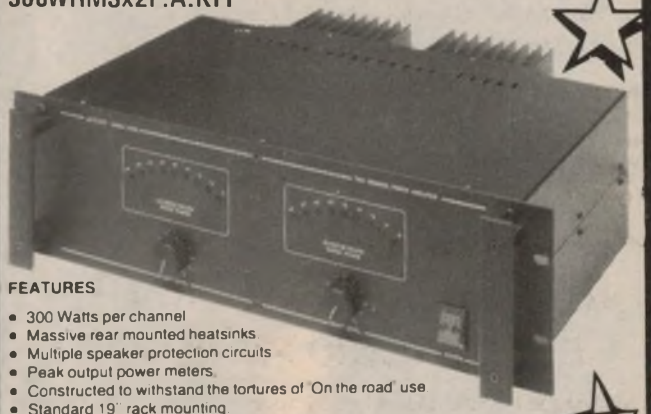
2 CHANNEL POWER AMPLIFIER KIT

MODEL 3002

300WRMSx2P.A.KIT



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⅓ OCTAVE EQUALISER KIT

MODEL 2801 ✱

✱ ✱ ✱

The 2801 is a single channel graphic equaliser that divides the audio spectrum into twenty-eight one third octave bands. Each frequency segment is controlled by a slider that provides up to ± 10 dB of adjustment in standard ISO steps.

The 2801 was designed primarily to compensate for any deficiencies in the linearity of speaker systems, acoustic peculiarities of the hall or listening room, and inadequacies of program source quality. In P.A. application the equaliser may be used to improve sound quality and increase intelligibility by attentuating problem frequencies that cause ringing, boominess, or other disruptive resonances that occur in acoustically difficult rooms. The 2801 allows sound systems to be "tuned" according to the special acoustics of a room, to maximise output and minimise feedback. As a creative tool in sound recording or re-recording the 2801 allows complete freedom in contouring response over the complete audio spectrum from 31.5 Hz to 16 KHz.

✱ ✱ ONLY $198.00 ✱ ✱ ✱

They're close to deciding the fate of the universe

Using instruments that peer billions of years into the past and scan the remotest recesses of the cosmos, astronomers prepare to answer the ultimate question.

by PETER GWYNNE

How will the universe end? Will it sputter out in a realm of ice, cooling continually as it expands until it reaches the absolute zero of temperature throughout its vast expanse? Will it die in a fiery blast as its component parts rush together faster and faster until they all meet in an enormous fireball? Or will the cosmos live on forever, expanding and contracting in relentless succession? It is the ultimate question that man can ask, and it carries striking overtones of theology and philosophy. Yet, incredibly, astronomers think they will soon know the answer.

Their confidence stems from their success in answering, through a combination of observations and theoretical advances, a host of related questions over the past two decades. Did the universe begin in a spectacular explosion (the "big bang" theory) or was it simply always there, constantly renewing itself (the steady-state theory)? How did matter collect into the giant assemblages of stars we call galaxies? What is the nature of such bizarre entities as quasars and black holes? And what evidence do they contribute toward solving the ultimate puzzle?

The search for the answers to such questions has produced a picture of the universe fundamentally different from the one that existed before. Where cosmologists – the astronomers who make a specialty of understanding the nature of the universe – once thought that it was unchanging and serene,

Cosmologists debate the ultimate question . . .

they now see it as dynamic, violent, and wracked by explosions on a scale too vast for human minds to comprehend.

Strange, almost incredible objects populate the cosmos of today: cosmic vacuum cleaners named black holes, so dense that even beams of light cannot escape from them; tiny beacons of energy called quasars, no larger than the solar system, that emit more energy than millions of stars; and galaxies so vast that it would take an intrepid space traveller literally millions of years to cross them. Just as amazing as these objects is the fact that cosmologists think they can understand what roles the objects play in the life of the universe. "Rarely in the history of science has there been an equivalent period in which the boundaries of our understanding have been enlarged so dramatically", declares Vera Rubin of the Carnegie Institution of Washington.

Cosmologists have argued about the development of the universe since 1930. In that year, a young astronomer named Edwin Hubble of Hale Observatories published a startling paper. Hubble had been studying the spectra of galaxies – the huge clusters of stars that populate the universe, most of them incredibly distant from Earth.

Spectral analysis of stars, galaxies, and other objects produces charts that show the exact frequencies of light and other radiation emitted by individual targets of astronomers' curiosity. Scientists use the spectra in two ways. First, they obtain accurate information about the chemicals that exist inside a particular star or galaxy. Just as important, the experts can use the data to discover how fast the objects are moving relative to Earth.

When Hubble analysed the pattern of red shifts, he discovered an astonishing thing: The galaxies, without exception, show a red shift – meaning that they are travelling away from us. Further, the more distant they are, the faster they are receding. The picture adds up irrevocably to a cosmos that is expanding. The expanding universe has almost become a cliche today, but it amazed astronomers of previous years who had learned to accept the universe as static and immovable.

Measurements of speed rely on the Doppler effect, named for Austrian physicist Christian Doppler who discovered it in the 1840s. It results when relative motion produces an apparent shift in frequency. The Doppler shift affects light, radio waves, and other types of radiation emitted by the stars or galaxies in the general direction of Earth. If a galaxy is approaching Earth, its light appears bluer than normal. If it is receding, the light looks redder than normal in a telescope.

How it all began

Careful studies over a half-century have convinced all but a few maverick astronomers that the Doppler effect holds the key to the nature of the universe. But the results could be interpreted in two different ways. The arguments were published within a few months of each other in 1948. One, advanced by Briton's Fred Hoyle, Thomas Gold, and Hermann Bondi, posited that the universe is infinite, without beginning or end. It expands, they argued, because matter is continually being created within the galaxies. American astronomers George Gamow and Ralph Alpher took a different view. They contended that the universe started with a big bang – a fireball that exploded in the beginning and flung all the pieces of the universe outward with a force that has kept the cosmos expanding ever since. Because of the enormous distances and times involved – the big bang certainly happened billions of years ago, according to the calculations of Gamow and Alpher – few astronomers had high hopes of deciding among the two theories. Then, in 1965, came a find that revolutionised cosmology.

It started with embarrassment for radio astronomers Arno Penzias and Robert Wilson of Bell Telephone Laboratories in Holmdel, N. J. They couldn't get rid of a faint hiss in a radio antenna that they planned to use to study stars. The two men cleared a couple of nesting pigeons out of the instrument, scrubbed it thoroughly, took it apart and reassembled it, but to no avail. The faint interference continued, coming in at exactly the same volume from every direction in which they pointed the antenna. "It was" said Penzias, "like cigar smoke in a room with no cigar".

Then a chance meeting aboard an airplane steered the two astronomers to Princeton theorist P.J.E. Peebles, who had been studying the theory of the big bang. Radiation produced by the bang wouldn't just disappear, Peebles reasoned. It would continue to permeate the universe, weakening in intensity but still remaining detectable eons after the big bang. It was that radiation, now known as the cosmic microwave background, that Bell Labs' apparently balky antenna had detected. Two years ago, Penzias and Wilson won the Nobel Prize in physics for their discovery. To celebrate, they coined a twist on the old T. S. Eliot line: "This is the way the world began, not with a whimper but a bang".

> "Will the universe continue to expand and cool until it is dark, desolate, and frigid? Or will mutual gravitational attraction cause it to fall back together?"

While the apparent triumph of the big bang over the steady-state theory now seems clear, there are still a lot of unanswered questions. For example, will the universe continue to expand and cool forever until it is dark, desolate, and frigid? Or will mutual gravitational attraction cause the galaxies to fall back together, only to explode again in a new cycle similar to the one we are now a part of? The prospects of a universe that expands forever, of one that contracts back and ends in a mighty reversal of the big bang, and of a cyclic universe bouncing back and forth might all seem equally unappetising. Certainly no one has to worry about which will happen; the contraction, if it ever occurs, will not start for about a hundred billion years. But the issue is vital to astronomers because the fate of the universe is intertwined with its very nature.

The shape that space is in

In the universe, geometry is destiny. Cosmologists recognise that the universe can exist in one of two possible shapes. One can be pictured as the three-dimensional equivalent of the surface of a balloon that is being blown up. The surface has no recognisable edges or centre, but it does have limited dimensions. A space traveller embarking on a long-distance trip in such a "closed" universe would eventually return home after circumnavigating the cosmos. He wouldn't do so in the other type – the "open" universe. An open universe is shaped rather like a saddle that stretches away to infinity on all sides; the traveller would never return because such a cosmos is truly infinite. Mathematics tells cosmologists that an open universe will expand forever, while a closed one will eventually contract. Thus, by figuring out the eventual fate of the cosmos, experts can, in a roundabout way, determine its shape.

There are three different ways to tell whether the universe is open or closed. One involves measuring its total mass. If there is enough mass, natural gravitational attraction will eventually pull the galaxies back together. If not, expansion will go on forever. A second method is indirect. By measuring how much of the heavy form of hydrogen known as deuterium was produced in the young universe, astronomers expect to calculate its density at that time – and the power of its gravitational pull ever since. A third method requires measuring the rate at which the expansion is slowing down, by measuring the

Is this the way the universe ends? . . .

speeds of nearby galaxies and comparing them with the speeds of more remote objects that were embarked on their journeys early in the life of the universe.

The first method – measuring the mass of the universe – seems at first glance to resemble one of the labours of Hercules. Certainly it is complex, but astronomers can follow a few rules that simplify the task slightly. The key is the force of gravity. By observing the effect that enormous objects such as galaxies and clusters of galaxies have on each other through their gravitational attraction, astronomers can estimate their masses. Measurements of galaxies and galactic clusters suggest that the universe does not have nearly enough mass to be closed; it seems to contain only about one-third the required amount. However, a recent discovery could alter that picture considerably.

> "Cosmologists caution that their science is hardly an exact one, that conventional wisdom can be wrong — and that new discoveries can alter the picture entirely"

Earlier this year Dr Frederick Reines, heading a team of physicists from the University of California, Irvine, announced a startling and still controversial find about the tiny subatomic particles known as neutrinos. Physicists had generally assumed that these elusive particles, theorised in 1932 but not actually identified until 1956, possess no mass. But the Irvine team, working at a nuclear reactor in South Carolina, decided otherwise. Neutrinos do, after all, have a tiny mass, they announced.

If their conclusion holds up, it could tip the balance between an ever-expanding universe and one that will eventually contract. According to current atomic theory, each thimbleful of space in the cosmos contains about 100 neutrinos. The mass of all the neutrinos in the universe could more than double the total mass, and perhaps provide enough gravitational pull to cause an eventual contraction. If that happens, Reines thinks that the universe will bounce back and forth between contraction and expansion. "There was no beginning and will be no end", he prophesied when he announced his results at a physics meeting. "The consequences are theological."

The deuterium technique also yields uncertain evidence. But measurements to date of the amount of the isotope in the heavens, combined with current nuclear theory, point emphatically toward an open, infinite universe. Cosmologists caution that their science is hardly an exact one, that the conventional wisdom can easily be wrong – and that new discoveries can alter the picture entirely. "There is little doubt that other major components within our universe remain unknown to us today", warns Vera Rubin.

One of the most important clues to the nature and destiny of the Universe came in 1960. While Allen Sandage of Hale Observatories was using the Mount Palomar telescope, he discovered a series of strange-looking points of light. Astronomers called them quasars – for "quasi-stellar objects" – but nobody had any idea what they were until three years later. Sandage's colleague, Maarten Schmidt, was looking at the spectrum of a quasar when he had a flash of inspiration. The extraordinary spectrum could be explained if it came from an object so violently red-shifted that the object was more than one billion light-years away. That find gave cosmologists their first hint that they could look back extraordinarily far into the history of the universe and hope to see something there. "Quasars fascinate me", Schmidt declares. "It's amazing that the universe manages to make itself known to us over such distances".

For years now, Sandage, a cosmologist so reclusive that he recently had the telephone taken out of his office at Hale Observatories, has been making careful measurements in the attempt to see whether the differing velocities of the galaxies relatively near Earth (thus seen as they were in the relatively recent past) and the quasars (so distant that they are seen as they were near the beginning of the universe) give any hint to the cosmos' ultimate fate. To date, Sandage's calculations, based on relatively close galaxies, give a figure suggesting that gravitational attraction will never quote catch up with the outward force that the universe acquired from the big bang, and that expansion will go on forever – in other words, an open universe.

Sandage's conservative view has recently been challenged by a series of experimenters who think the figures point more dramatically to an open universe. Researchers at the University of Texas and a combined team from the University of Arizona, Kitt Peak National Observatory, and Harvard-Smithsonian Centre for Astrophysics have looked at some distant galaxies, and concluded that Sandage's measurements are not typical of the universe as a whole. The reason: Our own galaxy is being pulled so rapidly toward the centre of a supercluster that its movement relative to the rest of the sky makes all measurements in our galactic neighborhood unreliable. The controversy affects the past as well as the future. Sandage's figures indicate that the big bang happened about 20 billion years ago. But if the new measurements are correct, the universe is only 10 billion years old.

As often happens in science, progress in one area spawns problems in another. The discovery almost two decades ago of the immense distances of quasars left astronomers with an embarrassing question for which an answer may be just now appearing.

The problem revolves around the fact that the light from most galaxies is not powerful enough to be spotted at distances of more than a few hundred million light-years. Quasars are many times that distance. Therefore they must possess sources of energy far more powerful than that responsible for starlight. The sources must also be extremely compressed. Meticulous observations of hundreds of quasars show that the mysterious objects are apparently no larger than our solar system. Until recently, physicists have been able to offer no explanations – even theoretical – as to how such an incredibly large amount of energy could be generated in such a relatively limited volume of space.

> "In a way, black holes are as mysterious as quasars. They don't seem to obey the rules of physics; they are, for instance, inherently invisible"

But now, the theorists have a strong candidate: the black hole. Many are now convinced that a black hole lurks deep inside each quasar, providing those objects with their penetrating power. In a way, black holes are as mysterious as quasars. They don't seem to obey the normal rules of physics; they are, for instance, inherently invisible. Yet most astronomers accept that they exist, even though no one has found fully convincing evidence for one yet. "It is fascinating that black holes can be so bizarre and yet probably real", says Kip Thorne of the California Institute of Technology, a foremost black hole expert.

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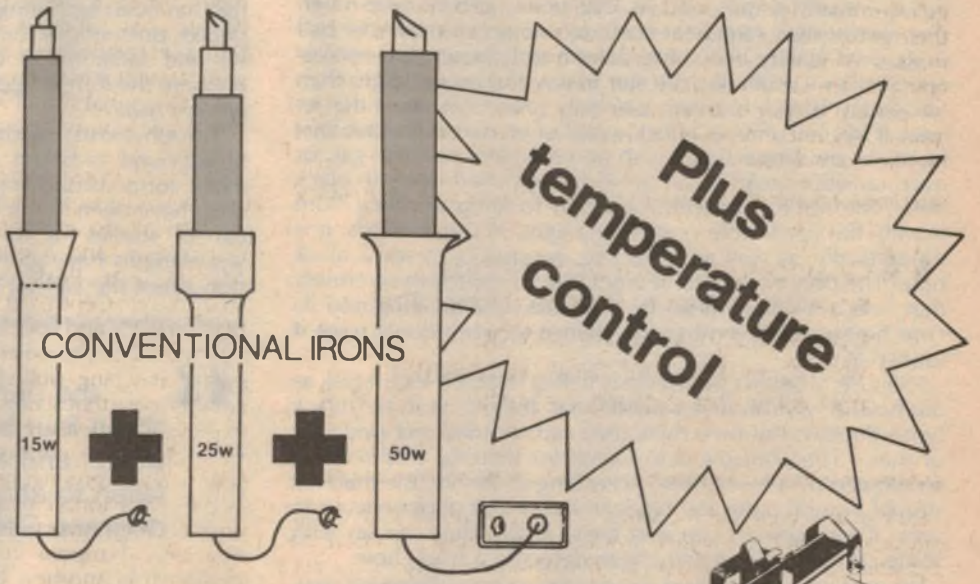

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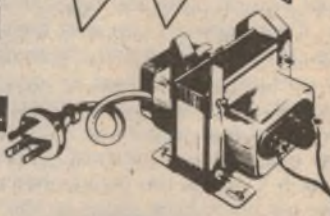

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The earliest happenings in creation

Hydrogen bows to gravity

As theorists first presented it, a black hole represents the death throes of a large star weighing perhaps three times as much as our sun. Stars usually obtain their energy from nuclear fusion, the conversion of atomic nuclei of hydrogen into nuclei of helium (fusion powers the awesome hydrogen bomb). The hydrogen lasts for billions of years in most stars, but eventually it runs out. At that point, gravity takes over. The monstrously large star starts to compress under the pull of its own gravity becoming denser and denser and smaller and smaller. Eventually, the star might end up no larger than Manhattan Island, but with a density billions of times that of lead. It has become, in effect, a ball of immense gravitational force. Its gravitational pull is so powerful that no dust, gas, or even radiation nearby can avoid being pulled into the black hole. The force is powerful enough to keep anything from leaving the black hole – including light. In other words, it is theoretically, as well as physically, impossible to see a black hole. The only way to do it would be to approach so closely that one is swallowed up by the hole, disappearing into its core before one even has the chance to write down what it looked like.

Scientists wouldn't be scientists if they rejected such a task as impossible. Astronomers admit that they cannot see black holes directly, but they think they can spot indirect evidence of them. The principle is to watch for material that is being swallowed by a black hole. According to theory, the material should give off particular types of X-rays as it disappears from view. If astronomers can spot those X-rays, they can say with some confidence that they have detected a black hole.

No one has yet claimed for certain to have achieved that, but astronomers using X-ray telescopes have found fairly firm evidence of four regions of X-ray emissions that appear to indicate black holes. The most promising is a region in the constellation Cygnus, the Swan, that was first spotted as a candidate for black hole status in 1967 by Riccardo Giacconi, an X-ray astronomer now at the Harvard-Smithsonian Centre for Astrophysics. More precise measurements of the X-rays should eventually prove whether the source, known as Cygnus X-1, really represents a black hole.

The deep space tracking station at Tidbinbilla, near Canberra, assists in the exploration of the universe.

Quasar experts certainly hope that the proof comes soon. By understanding more about black holes, the experts think that they will be able to learn more about the mystery of quasars.

It now also turns out that a better understanding of black holes may lead to the answer to another perplexing question that has been bothering astronomers. When the big bang happened, presumably there was a smooth, uniform mix of matter and radiation at high temperatures. How did it ever become the lumpy aggregation of planets, stars, and galaxies we see today?

Astrophysicists studying this question have used the background radiation detected by Penzias and Wilson to make some astonishing discoveries about what the universe must have been like right back to its very first seconds. In fact, careful studies of the microwave background at various wavelengths have given cosmologists a plethora of information about the earliest happenings in creation. To begin with,

> "... the density of the cosmos was about four billion times that of water, and the temperature had fallen to about one hundred billion degrees Celsius"

they have established that the big bang was very different from a conventional explosion, which sends material out from a single centre. The event that started the universe happened everywhere at the same time – a mighty, uniform fireball that caused everything in the cosmos to expand at precisely the same rate in all directions. It is because of the immense power of that conflagaration that the universe continues to expand today. But as it has grown larger, the cosmos has also cooled down, rapidly at first, then increasingly slowly.

Physicists cannot even image what conditions were like in the first few millionths of a second after the big bang. The cosmos was so dense and hot that current theories cannot deal with it. Amazingly, though, a combination of established theories and precise observations allows the experts to plot the subsequent history of the universe with a good deal of confidence.

About one-tenth of a second after the big bang, the density of the cosmos was about four billion times that of water, and the temperature had fallen to about one hundred billion degrees Celsius. That's hot by most standards – far hotter than the interiors of stars, and much too hot for ordinary atoms and molecules to survive – but it is still cool enough for theoretical physicists to understand. Guided by experiments in particle accelerators, cosmologists speculate that the still expanding universe consisted of radiation – such as light – and elementary particles of matter, notably electrons, neutrinos, and positrons, which are identical to electrons except for the fact that they carry a positive charge. In addition, a few protons and neutrons, the building blocks of atomic nuclei, had started to emerge in the cosmic goo.

About three minutes later, the universe had become a little more comfortable. It had cooled to one billion degrees, low enough to permit some protons and neutrons to combine to form atomic nuclei of hydrogen and helium. In fact, the ratio of those two elements that was established three minutes after the big bang – 73% hydrogen and 27% helium – foreshadowed the atomic constitution of all eras in the universe to come.

Matter and radiation continued to intermingle for a few hundred thousand years. During that time, the cosmos cooled to about 3000°, the temperature at which the nuclei of hydrogen and helium could pick up electrons and form into conventional atoms. As free electrons disappeared in this way, matter and radiation separated from each other. The radiation became the microwave background, while the atoms of hydrogen and helium provided the raw material for the stars and galaxies.

Finding the centre

How did the lumpy galaxies form from this homogeneous mixture? Most theories rely on some kind of small nucleus that attracted large amounts of hydrogen and helium to it, just as a speck of dust in a glass full of water cooled to its freezing point acts as the nucleus for ice to form. And one striking candidate for the nucleus emerges from the work of a young astrophysicist named Stephen Hawking. Hawking's career is almost as fascinating as the subject of his research. Just 38 years old, he suffers from amyotrophic lateral sclerosis (better known as Lou Gehrig's disease). The neuromuscular condition has left him an almost helpless invalid. He moves in a wheelchair, cannot write, can only talk in a mumble, and needs help to feed himself. But what Hawking can do, probably better than anyone since Einstein, is think. He composes long trains of complex mathematical equations in his head, and then dictates them, very slowly, to a specially trained assistant.

Since 1971, Hawking's thoughts have focussed on black holes. In particular he has pursued the idea that early in the universe, a great many miniature black holes, no larger than the diameter of a subatomic particle, were formed. These, perhaps, were the nuclei about which the galaxies coalesced.

Is there any way to test this revolutionary theory? Perhaps. As Hawking probed more deeply, he came up with an astonishing result: Black holes are not entirely black; they actually leak a little. At the time, Hawking admits, he was "rather annoyed" by the find. It seemed impossible. But further calculations in his head convinced him that he was right. What happens, he explains, is that the enormous energy in the neighbourhood of a black hole can create pairs of particles spontaneously out of empty space. One of them, Hawking calculated, is likely to fall into the black hole, but the other may be able to fly away, giving the illusion that it has escaped from the black hole itself. Eventually, the entire mass of the black hole could dwindle away in this way, ending up with a spectacular explosion. The smallest black holes, Hawking calculates, might even be exploding about now.

The evolution of galaxies and their scheme in the design of the cosmos present yet other puzzles. Why are all known quasars at incredible distances – thus far back in the history of the universe? Many astronomers now suspect that quasars are actually galaxies in the process of formation. Perhaps they had their day of dominance at an early stage of the universe, and then largely disappeared. The disappearance could be explained if quasars changed into conventional galaxies soon after they were created. So far this picture is just a hunch, but new observations of more distant galaxies may settle it.

New devices may be the breakthrough

The observations accumulate, the theories proliferate, some mysteries even yield a bit. But the fundamental question as to the fate of the universe remains undecided, the evidence confusing. "One of the most amazing things is that the universe should be so close to the dividing line between collapsing and expanding", says Stephen Hawking. But new instruments promise to settle the dispute. "We're right on the brink of getting hard answers, and these instruments will push us over", predicts Jerome Kristian of the California Institute of Technology.

Kristian refers to, among other things, tiny computer controlled chips called charge-coupled devices, which astronomers are now attaching to their telescopes. They can detect spots of light with a precision previously undreamed of.

The Crab Nebula, a supernova remnant discovered by X-ray astronomy.

Another approach is to make observations from outside the atmosphere. A 220cm diameter telescope to be launched aboard the Space Shuttle in 1984 will do precisely that.

Within the past decade, astronomers have exploited another powerful means of identifying stars and galaxies. Using high-altitude balloons, rockets, and unmanned orbiting satellites, the experts search the skies for the X-rays emitted by many objects in outer space. These X-ray observations yield new information on complex processes going on within such objects, and thus help astronomers to deduce new facts about their history and eventual fate.

> "One of the most amazing things is that the universe should be so close to the dividing line between collapsing and expanding"

Although the fundamental question remains unresolved, the evidence that does exist points – how strongly is debatable toward an open universe. However, a number of astronomers remain unconvinced that the universe is open on philosophical grounds. They have put their doubts in the form of what they call the anthropic principle. It states, simply, that the type of universe we can observe is a universe that allows human life to be created and survive. If the universe is open, it is presumably the only one that has ever existed. Given the chances against a cosmos that would be hospitable to man, our existence is at least as remarkable as winning at roulette with the same number 10 or more times in a row. On the other hand, if the universe is closed, it could perhaps keep bouncing back and fourth in a cycle of different universes. If that is the case, the universe that we inhabit would be just one of many.

That type of philosophilising doesn't appeal to many astronomers. They prefer to use their instruments to aquire new knowledge that will decide whether our cosmos is open or closed – and will add a multitude of other questions about creation. "We certainly do not understand cosmology, press reports notwithstanding", says Philip Morrison of the Massachusetts Institute of Technology. Nevertheless, the fact that cosmologists can seriously try to solve the problem of the fate of the universe attests to their progress in recent years, and to exciting prospects for new achievements in years to come.

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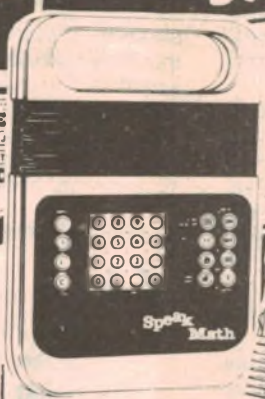

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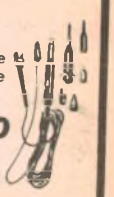

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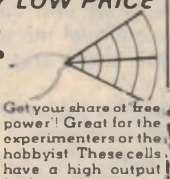

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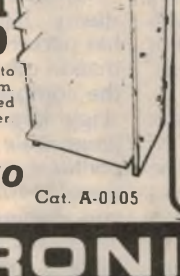

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Semiconductors are on the

Japan has emerged as a world leader in the application of semiconductor technology and the development of new devices such as Very Large Scale Integration (VLSI) chips. The reasons for this are not hard to find.

by
GENE GREGORY

During the 70s, the Japanese semiconductor industry emerged as a second force of technological innovation in a global microelectronics revolution, and won worldwide recognition for its productive capability. In the next decade, microchip manufacture will be one of Japan's most rapidly growing sectors and a major force in the transformation of both the Japanese and international industrial structures.

Propelled by rapid changes in microcircuit technology, the electronics industry will be the most dynamic sector of the Japanese economy during the next two decades. In 1979, the gross product of the electronics industry in Japan was less than half that of the steel industry and only about 40% of that of the automotive sector. By 1990, total output of electronic products will surpass US $100 million, not accounting for inflation, and exceed that of steel by a considerable margin.

Only the automobile industry is likely to remain larger in terms of total output, and it will itself become a major consumer and producer of electronic devices.

If, as this forecast assumes, the output of electronic products grows at an average 10% per year throughout the 1980s, industry planners expect semiconductor production to grow at an appreciably higher 16% a year. Most of this growth will be in integrated circuits (ICs), with output of discrete semiconductors (mainly transistors and diodes) remaining constant or declining.

During the four years from 1975 to 1979, the annual growth of IC production averaged almost 34%, exceeding the total production of discrete semiconductors for the first time in 1978. In August 1979, also for the first time, Japan became a net exporter of ICs, marking a significant strengthening of the Japanese position in world markets.

There are good prospects that, despite a rapid growth in the home market, the Japanese industry will remain a net exporter in the future, substantially increasing its share in world marketplaces. Estimates by Nomura Securities, (which past performance would indicate are quite conservative) predict that domestic demand for ICs will expand more than 2.5-fold during the first half of the 1980s.

As a result of the combined growth of domestic demand and exports, according to BA Asia's 1980 report on the industry, Japanese manufacturers could account for one-third of the US$20 billion world semiconductor market by 1985.

Such a substantial improvement over the present 26% share of world markets does not reflect simply, or mainly, anticipated increase in Japanese exports of ICs, however. Rather it is the expected result of a rapid and pervasive diffusion of semiconductor technology through the broad spectrum of industrial production in Japan.

Electronics and industry in Japan

Applications of ICs by Japanese industry has been more varied and has occurred at a remarkably faster pace than in other advanced countries. While the computer industry has provided the single largest market for advanced LSIs (large-scale integrated circuits), and will continue to do so in the future, it accounted for only 25% of the 364 billion yen domestic consumption of ICs in 1979. Audio-video equipment took as large a share of available ICs, assuring Japanese makers a leading position in world markets for home entertainment equipment.

Likewise, cameras, watches and calculators have evolved through successive product generations in pace with advances in semiconductor technology. And the diffusion has followed the same rapid pace in telecommunications, office machines, automobiles, home appliances, and toys.

Perhaps most outstanding of all, however, has been the rate at which semiconductors are applied to machinery in Japan. The expanding pack of industrial robots which "man" Japanese factories around the clock exemplifies the special zeal with which semiconductor technology has been adopted in Japanese industry.

The zeal is not applied haphazardly, however. In Japan, the application of advances in semiconductor technology and successive generations of ICs has been the subject of careful study.

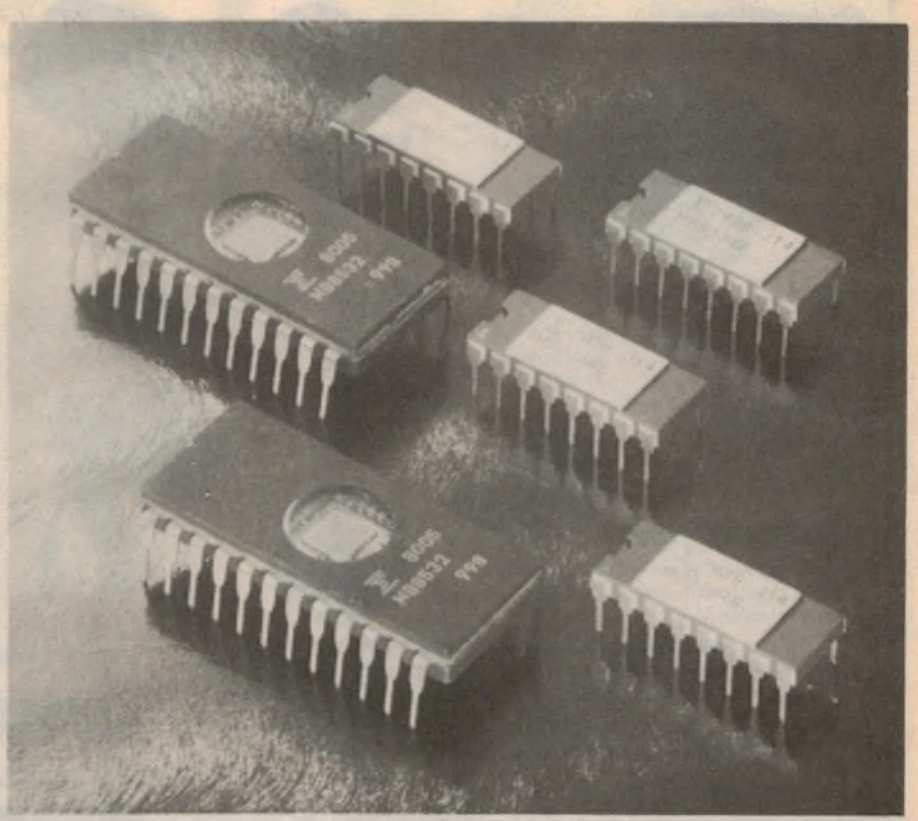
The object is to combine mechanics and electronics to assure that the two technologies are optimally used in each new product. The practice is not new, of course, but the development of the microcomputer and other semiconductor devices has accelerated the process. Public policies and corporate strategies have been developed to encourage and direct the process of change in a systematic way.

The result has been to speed the process of semiconductor application in Japan. Conventional mechanical devices such as calculators and watches have been almost totally replaced by electronic equivalents. Electronic devices are continually being substituted for mechanical functions in equipment such as sewing machines and cameras, and added to conventional numerically controlled machine tools and automobile engines.

This has created a high-growth market for ICs. But the dynamics of the process do not stop there. The substitution of electronic for mechanical products also stimulates demand for the whole product.

The electronic watch well illustrates this dynamic interaction of semiconductor technology, market and production. From 1964 to 1972, shipments of watches in Japan increased at an average annual rate of just under 2%. After the introduction of the electronic watch in 1972, however, the growth rate has been over 7% a year. IC makers and watch manufacturers have been benefitted from this trend, not only from in-

— the Japanese move



creased volume, but also from higher value added per unit of production.

Semiconductor manufacturers have a special advantage, however. As systematic planning increases domestic consumption of ICs, the resultant higher volume production hastens the learning curve advantages of the latest product generation, making it possible to reduce production costs accordingly, with all the advantages this creates in highly competitive world markets.

This process is expedited not so much by massive government subsidies or special tax advantages, but by an efficient financial system which makes possible the high rates of investment which the capital and technology intensive semiconductor industry requires. Japanese manufacturers in such high-growth, high–value sectors have access to capital on a sustained basis as required by advanced and rapidly changing technologies.

Equally important, the vertical and horizontal integration of large-sized, highly-diversified Japanese manufacturers of electrical and electronic products provides a special advantage in the allocation and use of resources for rapid application of semiconductor technology. This explains in part why semiconductors were first applied to consumer electronics and calculators in Japan, rather than in the US where the basic technology was originally developed. American IC manufacturers began as semiconductor manufacturers and merchandisers producing a broad range of devices to cover as large a market segment as possible.

This structural efficiency in the application of new semiconductor technology by Japanese manufacturers has been both the cause and the effect of a remarkably higher degree of specialisation in semiconductor production than is found in leading American semiconductor makers. Specialisation to meet in-house product requirements tends to assure greater economics of scale and learning – both critical to semiconductor manufacture.

The next stage in the evolution of this industry was entirely predictable. It is an immutable law of techno-economic behaviour that basic technology flows to the point of most efficient application and production

During the first 30 years of the microelectronics revolution, the basic technology was developed in the United States and transferred to Japan and other Asian countries where the technology was more readily and economically applied. Now, in the second stage of the microelectronics revolution, the lead in the development of basic technology itself is shifting to the point of application and production, where organisational, financial and human resources are available in the necessary combinations for continuing innovation.

Developments in VLSI

The 1980s have begun with the significant lead taken by Japanese manufacturers in the 16K RAM (random access memory) marketplace. Fujitsu's lead in the fielding of 64K RAMS, ushering in the VLSI era, was even more remarkable, signalling Japanese technological advantage in the crucial big volume memory segment of the market. And, as a recent Daiwa Securities study notes, Nippon Telephone & Telegraph, Fujitsu and NEC succeeded collectively in developing the world's first 128K RAM, which has since been followed with the announcement by Japanese manufacturers of 256K bit VLSI chips.

In VLSI development, Japan has clearly taken the lead. And once more, Japanese industry is best equipped to take advantage of the new technology in new product development.

But those spectacular changes in the industry, although momentous, are by no means the whole story. As BA Asia's 1980 report points out, Japanese applications for IC patents have been growing steadily in recent years, while foreign patent applications in Japan have stagnated. The dimensions of the trend are important: total semiconductor patent applications in Japan increased from 4406 in 1974 to 6397 in 1977, while foreign applications dropped from 10% to 7% of the total.

Most new technologies developed in Japan have been in assembly processes and manufacturing rather than inventions of new devices. As a result, however, Japanese mass production and automation technology is generally agreed to be the best in the world, assuring better production yields and greater product reliability.

Sony's recent perfection of a method to grow better silicon crystals under the influence of a magnetic field, increasing IC production yields by up to 20%, is a case in point. Reduction of imperfections in silicon wafers becomes especially crtical in the production of VLSI chips, Sony claims.

Even less visible than such breakthroughs by manufacturers has been the emergence of a number of smaller firms in semiconductor materials and processing equipment technology:

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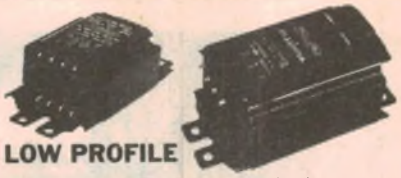

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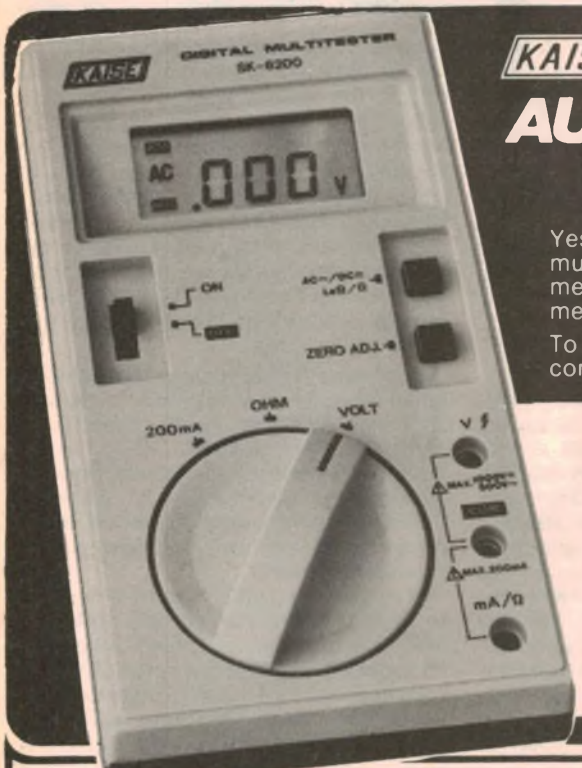

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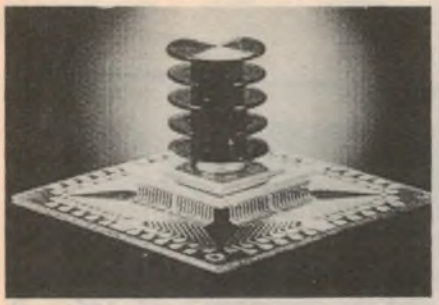
• Kyoto Ceramic is the largest maker of ceramic packages for ICs and LSIs, accounting for 70-80% of the world market.
• Dai Nippon Printing, Toppan Printing, Sumitomo Metal Mining, Sumitomo Special Metals, Tamagawa Metal & Machinery, and Mitsui Manufacturing have developed technological strength in the production of IC lead frames of highly efficient conductors such as ferronickel, cobalt alloy, and silver-stripped phosphor bronze.
• Dai Nippon and Toppan are also leaders in the production of photo masks – glass plates used to print circuit designs on silicon wafers.



Multi-chip carriers increase LSI packing density. Each disk on the carrier is an LSI (Large Scale Integration) chip.

• Shin-Etsu Semiconductor has grown to become one of the world's largest single-crystal silicon makers, with production facilities in Singapore and the US.
• Kokusai Electric is a leading manufacturer of single-crystal silicon production apparatus, diffusion furnaces, ion implantation apparatus and other equipment used in IC production.

In addition the government-sponsored VLSI Technology Development Union has already applied for over 1000 patents, and has developed revolutionary electron beam exposure equipment and high-speed electron beam drawing equipment. The latter will enable the Japanese semiconductor industry to produce VLSIs quickly and efficiently.

As demand for ICs is expected to increase at approximately 22% annually through 1985, the outlook for production materials and apparatus is as bright if not brighter than the semiconductor industry as a whole. Demand for production apparatus will be supported not only by growth of the industry as a whole, but also in large part by an unusually fast replacement cycle which is accelerated by ever more frequent innovations.

At the same time, internationalisation of production, as the industry establishes plants in major markets of North America and Europe in response to protectionist pressures, will increase the demand for equipment and materials. Although this demand will be met in many instances by foreign suppliers, Japanese equipment and materials manufacturers will undoubtedly be important beneficiaries of the move to production outside Japan.

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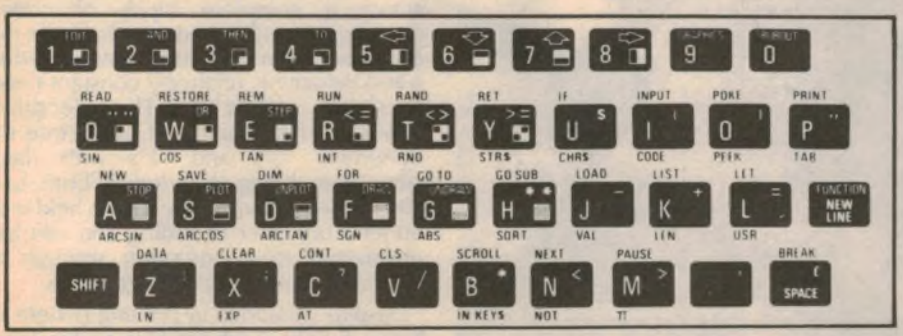
ZX80 8K BASIC ROM



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ET5

Bar code readers have many uses

Bar code readers are taking over in supermarkets, but the technology involved has many other uses. Information printed in the form of wide and narrow bars and read by an optical scanner can be used anywhere a label or a written list is used.

If you have walked down a supermarket aisle recently, you will have seen many products marked with a panel of narrow and wide bars. This is the most common form of bar coded information and is used to uniquely identify a product.

Because the code can be read by an optical transducer known as a wand or scanner and the data processed by a computer, it is possible to control inventory and speed up the check out procedure with an accuracy much greater than a manual system.

A typical system in a supermarket would have a hand-held wand or laser scanner built into each check-out and counter. As each product passes the cashier, the code is scanned and the product number is decoded. A computer look-up table has all products listed with their stock level, re-order cost point and selling prices, supplier and any other information needed by the store.

At the cashier station, the computer displays the product identification and selling price and would add the price to the printed total. The store's stock records for that item are reduced by one so that an up-to-the-second inventory report is always available.

The code used on retail articles is known as APN, which stands for Australian Product Number. The country code, 93 Australia, is allocated by international agreement while the manufacturer's code is allocated by the Australian Product Number Association. Each manufacturer then allocates a number to each individual product made and these three numbers combine to form the APN Symbol.

Many other codes are in use. A simple bar code uses a narrow bar to represent a "0" with a wide bar representing a "1". In fact, most codes are based on this simple system with additional steps to improve the density of the code and to provide some form of self-checking. For instance, wide and narrow bars may be separated by wide and narrow spaces, giving four levels of data in the code.

More complex codes use a discrete number of bar/space transitions and a set ratio of wide and narrow bars for each character. This allows the decoder to identify each character in a block. A special start and stop character and parity check is also available to improve the confidence level of the entire system.

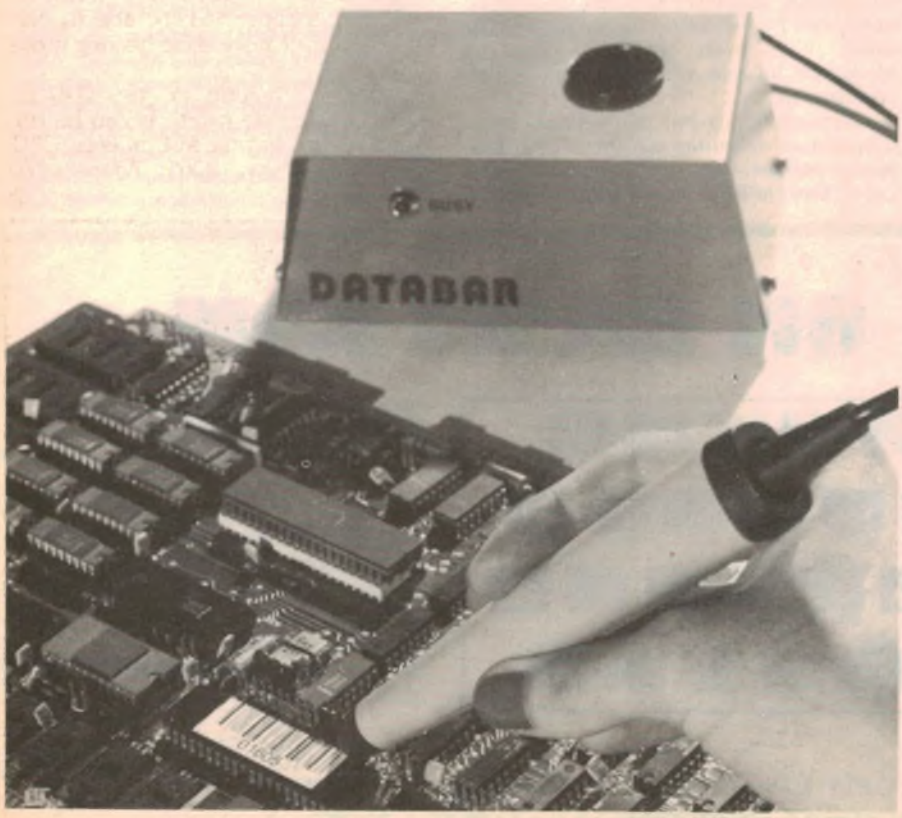
The code is read by illuminating the bars and spaces and measuring the reflected light as the wand or scanner passes across the code. As the narrow bars and spaces can be less than 0.2mm wide, a high resolution optical system is called for. A laser can provide a very small spot of light rapidly moving along a slot, allowing the code to be simply moved across the slot to be scanned.

Hand-held wands are relatively inexpensive and generally include a light source such as an LED with a photodetector to pick up the reflected light. Various means are used to achieve the small spot size needed, including a fibre optic light pipe, acting as a lens, or a bifurcated lens to project the light from a LED on to the code and to project the reflected light on to a photodiode.

From the wand or scanner a series pulse train is produced with bars being one state and spaces being the other state. The width of the pulses is determined by the width of the bars and spaces. However, the speed of scanning also affects the pulse width.

Because the pulse width may vary across a complete block of code, decoding is generally done character by character. Even with hand scanning, the wand velocity is relatively constant over a single character. The decoder measures the duration of each state to determine "0"s and "1"s with data sometimes being included in both bar and space durations. The data is held in a buffer store after decoding and can be transferred to a computer through a standard communications interface.

Despite variations in printing (where a heavy supply of ink tends to widen bars and reduce spaces), variations in scan velocity of a hand-held wand and the wide variations in reflectivity of the background medium, bar codes offer an



Bar code reader used to keep track of products through the manufacturing process.

excellent medium for accurate and fast data entry.

One measure of a data entry system is the "first read" rate – simply the frequency that code is read correctly on the first try. Bar code systems regularly achieve 99% accuracy as the code is highly redundant; ie there are literally hundreds of paths across a code block that will give a valid read.

Of much greater importance, however, is the frequency of making an error and decoding the wrong character. Here, the substitution error rate in a bar code system is regularly better than one error in 10 million characters. Even this can be improved by including check digits and parity checking in the code.

Bar codes and bar code readers have many applications outside the supermarket. One of the earliest uses was to speed the check out of books at libraries. A bar code reader attached to a computer can instantly scan and record the book's title and catalogue number, and the borrower's number taken from a bar coded library card.

Large offices with thousands of files to keep track of can also use the bar code principle. Each file would carry a unique bar coded number, and any transaction involving the file could be recorded by simply passing a scanning wand over the code. A central computer could use this information to determine where any file was at any time and what procedure was being carried out on it.

The tracking of products through a manufacturing process can also be made more effective by using a bar coded product identification system. In fact an Australian manufacturer, Nortronic Instruments, produces a range of bar code readers specially designed for this application.

The readers, designed and manufactured in Australia, are known as the Databar series. Single and multiple work station models are available, and all of the readers have the same standard data output for connection to a host computer.

Movement of sensitive documents and files can be monitored by bar code readers.

A typical application would be tracking the progress of manufactured products through the assembly process. Each product would be accompanied by a job card printed with the model number, serial number and works order number in both human readable form and bar code symbols. Each process requiring recording, such as an inspection or quality test, would also be bar coded on the job card.

As the product moves through the assembly process, and each listed procedure is completed, the operator scans the relevant code with a hand-held wand. Identification of each work station is automatic, so the host computer is able to record what is happening to each product at each location and the time the procedure was carried out. An entire manufacturing operation can be supervised in this way.

Bar codes represent an excellent example of opto-electronic technology. Applications have been found in laboratories, production control, libraries and supermarkets, and its certainly a subject we will be hearing more about.

Further information on the Databar Series of bar code products can be obtained from Nortronic Instruments, GPO Box 995, Sydney, 2001, Phone: (02) 290 2844.

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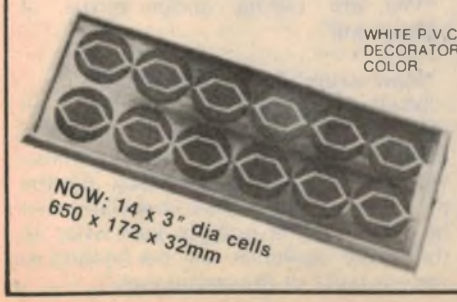

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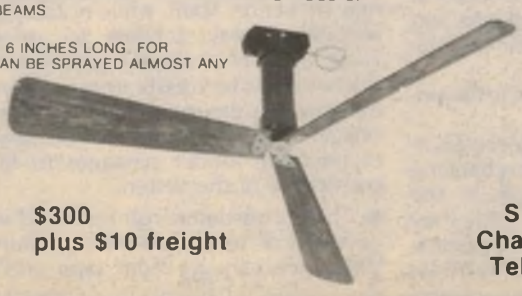

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FORUM

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HIFI DYNAMIC RANGE — Sacred cow, or is it a bull?

It is commonly assumed that, for a devotee of hifi sound, happiness is a recording which preserves the full dynamic range of an especially dynamic performance. In fact, such a recording might prove more of an embarrassment than a delight in a home situation.

Let's begin with a word picture of some memorable orchestral concert – an appropriate conductor and orchestra, an appropriate work, an appropriate venue, an appropriate audience. The lights have dimmed, applause has faded into an expectant hush, and the performance has begun.

For much of the time, in what follows, the music proceeds at a median level, neither notably loud or notably soft; but there are moments of high drama, in the musical sense: the lonely sound of a single instrument, muted chords on the piano, the tiny tinkling of a distant cymbal. The audience strains to hear, for the most part expecting those exact phrases. For some in the auditorium, the expectation may well have more substance than the actual notes!

MAGIC MOMENTS

But there are other times when the orchestra unleashes a veritable fury of sound. The conductor demands and the players give, with all the intensity of which they are capable. The adrenalin races and the entire audience shares in those magic moments of sonic – and visual – exhilaration.

There is no concern about how loud the sound may be – or how muted at other times. Outside, there are cars and trains; people going about their own affairs. That's another world.

Here in the auditorium, music is the only thing that matters.

Then, it's all over. The audience shuffles through the exits, exchanging remarks and pleasantries, still in the after-glow of an experience which they have just shared. If only that experience could be translated into the domestic living room per medium of a recording and a hifi system . . .

But, somehow, it can't be!

This is where the hifi technocrats and techno-salesmen are likely to buy into the situation, with a masterpiece of over-simplification.

It's basically a matter of dynamic range, they say. Once that limitation has been corrected with the aid of Dolby, dbx, digital or ditto, rapturous radiant recitals will be recreated in routine rectangular rooms!

Then follows certain conventional wisdom:

- In an orchestral performance, the ratio between the loudest sound and the most subdued sound, expressed in decibels, is about 100. (A suspiciously "nice round figure".)
- This is a much greater ratio than can be accommodated on recordings normally accessable to the public. Peak level signals may saturate the master tape, or overmodulate the record groove, or both. Low level signals may disappear into the background noise of the overall system: tape, disc and amplifier.
- The dynamic range for ordinary commercial discs and cassette recordings is about 60dB. Poorer quality recordings may be nearer 50dB, while notably good recordings may achieve 65 or even 70dB. But any of these figures are short of the requisite 100dB, imposing on the musicians or the recording engineers the obligation to boost the softer passages or limit the louder passages to fit the constraints of the system.
- These constraints rob recorded music of much of its drama and spontaneity. When we can get from tape and disc what actually happens in a concert hall, music in the home will really come alive!

I wonder?

The first major flaw in this rather simplistic line of thinking is that original performances are themselves seldom above criticism in respect to dynamic range. Certain aspects of many performances may need correction, not preservation!

EXPERT OPINION

In saying this, I am supported by the experience of our resident reviewer/critic, Julian Russell, who has attended more classical concerts, for more years, in more venues around the world than a whole lot of us put together. My question:

"In concert performances, do conductors and musicians always get things right in terms of dynamic range?"

"Certainly not. Some of them play too loudly and make the work sound coarse and brash as a result. I was only talking about this recently, over dinner, with . . . " (a conductor of international repute).

"Do they ever play too softly?"

"Again, yes. They can over-estimate the carrying power of softly played notes. For example, the celeste can be a problem instrument in some venues."

"We are talking about errors of judgement?"

"Yes!"

"How would they come about?"

"Well, conductors are involved with different works, different orchestras and different venues, with an enormous variation in building acoustics. All the time the conductor has to translate what he hears on the podium into what he thinks the audience will be hearing in various parts of the auditorium."

"I guess so."

"And think of the conductor who spends part of his time with opera. The sound projection from an orchestra in a pit is quite different from one on an elevated stage."

"It would have to be."

"And there's another point: if a conductor wants to listen to the sound from the auditorium, he can only do so during rehearsals, when the place is empty. He has to guess what it would be like with the seats occupied."

What emerges from all this is the dubious wisdom of basing system requirements on the most wayout readings obtained or deduced from live orchestral concerts.

Let's at least make sure that the performances we are talking about – and seeking to preserve – are musically valid in the first place: not misjudged or vulgar in the fortissimo passages; not below audibility, at the other extreme, for a significant proportion of the audience.

THE ENVIRONMENT

A further point was referred to earlier: the significance, in a concert situation, of the environment and the visual contact between the performer(s) and the audience. The sound which is natural to that situation may not be optimum when the environment, the audience and the visual clues are stripped away – even allowing for the listener's imagination.

Audio-only is a quite different stimulus, with different implications, and these may well include careful re-thinking of dynamic range.

Particularly would this be the case when, as normal, recordings are played in a home situation. Listening rooms have an ambient noise level of between 30dB SPL (very quiet) to 40dB or more SPL (typical).

Let's say that, having acquired a fabulous new recording with a fully exploited 100dB of dynamic range, we preset the volume control of the amplifier so that the softest passage is barely audible.

This done, we settle back, determined not to negate the eagerly awaited experience by twiddling knobs.

By definition, during the next 10 or 15 minutes, the sound level in the room is going to hit 130 or more dB SPL, which is nudging the pain area.

(I am assuming that the amplifier and loudspeakers are equal to the task – and that's quite an assumption in itself.)

That kind of sound may be fine for hermit members of the Dynamic Range Intact Preservation Society (DRIPS). But most of us are ordinary citizens with ordinary families and ordinary neighbours, who may not generate instant enthusiasm for the full range of the "1812 Overture" or the "Rite of Spring". These unfortunate, deprived folk may even get quite upset by anything more than about 110dB SPL in our listening lair!

To be practical, the most suitable recordings for home listening, even serious home listening, are those which are compatible with home listening conditions, irrespective of how they relate to concert situations, real or imagined.

In fact, I can't escape the conviction that, in terms of dynamic range in domestic sound reproduction, the hifi industry has already arrived. There may well be room for refinement and greater consistency but we are already experiencing as much dynamic range as we would want to cope with. More will simply be an embarrassment, both sonically and electrically.

Digital mastering can now cope with a dynamic range of 90dB as a matter of course. The normal procedure is to set up the microphones, adjust the levels during rehearsal and record the ultimate performance without touching the panel controls. This would suggest that the dynamic range of a fully rehearsed orchestral performance is comfortably below 90dB, as distinct from that "nice round figure" (including errors of judgment) of 100dB.

I note also that the promoters of the dbx system of noise reduction quote a figure of 90dB.

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FORUM — continued

(From "About Your Hearing" — G. A. Briggs.)

(Dont't be tempted to dismiss that 10dB as a quibble. Apart from anything else, it would diminish by a factor of 10 the demands made on the amplifier and loudspeakers.)

What of the best analog discs? It is now commonly accepted that the top grade analog discs — digital mastering, half-speed cutting European pressings, etc — are way ahead of that other "good round figure" of 60dB. One recent research program puts the figure at 88dB, assuming full groove geometry and a high trackability cartridge. dbx processing of the disc could extend this even further.

And, having reviewed many recent audiophile records I, for one, am prepared to cry: "enough, enough"!

As it is, I have to silence the ticking of the antique clock on the mantelshelf, and avoid Thursday evenings, when late shoppers are on the move outside. I also have to avoid those other occasions when members of the family want to study or sleep or use the telephone.

Either that, or I have to keep nudging the volume control thereby negating what the recording engineers have already achieved.

THAT MAN AGAIN!

Elsewhere in this issue, in the record review columns, Julian Russell registers his reaction to a couple of recent CBS digital releases and the same message comes through. As a long-time concert-goer, he has no sympathy whatever with the cult talk about ever more dynamic range. Whatever is on the CBS discs is adequate, to say the least. More than that would be a positive liability, according to Julian.

In saying all this, I am not criticising noise reduction or digital techniques or the PCM (pulse code modulated) video-style discs that are around the corner. If, by such methods, we can acquire the capacity to accommodate 100dB or more of dynamic range, that is all to the good.

It will give recording engineers the latitude they need to keep the music consistently above the noise floor of the system, and consistently below the overload level on transient peaks. NR systems and digital mastering have already made very useful contributions towards that objective.

But the ability to eliminate noise and accommodate the sudden transient is a quite different thing from stretching the pianissimos and the fortissimos all the way from the inaudible to the unbearable!

EFFECT OF AGE

Let me add one more thought that is particularly relevant to those who have left youth behind. The following figures are taken from the book "About Your Hearing" (G. A. Briggs) and are based on a test of 326 males and 319 females from a rural area in Scotland, conducted by the British Medical Research Council.

At the comparatively low frequency of 250Hz, average hearing loss was shown to be 3dB at 40 years, 5dB at 50 years, 7.5dB at 60, and 10dB at 70.

At 2kHz, the losses were respectively 5, 7, 10 and 15dB. At 6kHz, the figures were −8, −14, −20 and −33dB. The response at 8kHz was, of course, further down again. It was pointed out that hearing loss would have been significantly greater among people who had been exposed to industrial noise or medical trauma.

In terms of the musically significant threshold of hearing, this probably means that the average Australian adult has to think in terms of a loss of acuity ranging from about 5dB at age 40 to 7dB at 50, 10dB at 60 and 13dB at age 70.

What this adds up to is a diminishing ability, with increasing age, to cope with wide dynamic range, particularly in the home.

A younger person may set the minimum level at about 40dB SPL and, with a dynamic range of 80dB, end up with maximum SPL of 120dB.

An older person may have to advance the volume control to gain an extra 5, 10 or 15dB to hear the soft passages. That would push the loudest passages to 125, 130 or 135dB SPL — probably sufficient to distress the listener, the family, the neighbours — and the amplifier!

To expand a phrase used earlier:

In respect to dynamic range, enough is enough, even for the young but especially for the not-so-young!

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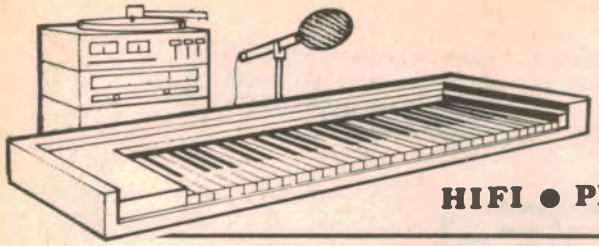

AUDIO ~ VIDEO ELECTRONICS

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VIDEO TAPE HEADS: Do they get dirty — and, if so, how do you clean them?

If you've grown weary of arguing about such subjects as regulations, copyright, ion generators or dynamic range (elsewhere in this issue) a brand new topic is now available — that to do with the cleaning of heads in home video recorders. Depending on who you talk to, commercial head cleaning gadgets range all the way from desirable to anathema!

by NEVILLE WILLIAMS

In audio recorders, as distinct from the video variety, regular cleaning of the heads has long been accepted as a necessary exercise, particularly if they are used with other than premium quality tapes. Gradual shedding of the coating – plus grime in some cases – can cause a build-up of "gunk" on or around the heads. This can prejudice intimate contact between the tape and the magnetic gap, reducing output, particularly at the highest frequencies.

Manufacturers of audio decks are quick to warn against a heavy-handed approach but they accept the idea of consumers cleaning the heads, guides and rollers, provided they use an approved method and an approved cleaning fluid.

In the case of audio cassette decks, special cleaning cassettes are also available which will do the job without the user having to get involved with the internal workings of the deck. Some such cleaners use a short length of gently abrasive tape; the Allsop unit, described last month, has a swabbing/polishing action.

It is natural to assume that a parallel need will arise with the home video decks which are now flooding on to the market; that users will have to get involved in regular cleaning of the heads and tape path, if picture and sound quality is to be preserved.

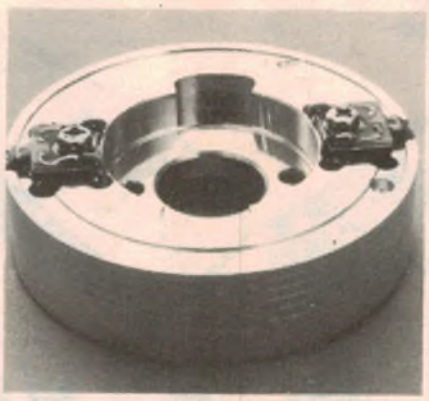
In fact, such an assumption is wide open to debate, as we found out when we began to ask questions within the industry.

Behind this statement is the fact that a home video recorder is a vastly more complicated and critical unit than the average domestic audio tape deck, whether open reel or cassette. Ill-advised tampering can easily do more harm than good.

Importantly, the actual video heads – two in most decks, four in others, are attached to a drum spinning at 1500rpm in a PAL system deck. The pole tips, virtually flush with the surface of the drum, have to record and recover frequencies of the order of 3MHz – a requirement that makes heavy demands on their design, installation and long-term operating condition.

In addition, there is a number of stationary heads: full-width erase; audio track erase (in some decks); audio record/replay; control track record/replay.

The rotating heads are the ones which deck manufacturers are most concerned about, in case they should be subjected to physical stress, or chipped, or scratched or exposed to unnatural abrasion. The tips are tiny by audio standards, capable of laying down and reading magnetic tracks of hairline width – typically between 30 and 50 microns in PAL format decks. They are glass-hard in order to resist wear, but they are also glass-brittle!



Removing the upper drum from the assembly pictured top-right shows the two heads, as above. The pole tips and windings are accommodated on the outermost 1mm and are barely visible. Most of what you see is provision for securing and connection.

The video motor/drum/head unit from a modern National Panasonic VHS home video deck. The tip of one head is indicated by the arrow.

A typical instruction brochure, issued by one manufacturer for professional video maintenance mechanics, shows how to gain access to the mechanism and how to clean the various heads and surfaces with a chamois-or deerskin-tipped wand, moistened with freon or ethyl alcohol. A flow-chart indicates the "do's" and "don'ts".

The brochure expressly warns against trying to clean the video heads while the drum is rotating. It also warns against touching the head tips or even the polished surface of the head drum with bare fingers – presumably to avoid contamination by body moisture or the greasy residue from a lunch-time sandwich! Silk gloves are advised.

How far deck users can stray from this kind of advice has been experienced in Sydney by at least two distributors, who were called upon to service decks (one VHS, one Beta) which had been

"cleaned" with steel wool!

In both cases, the heads had been fractured and the drums scored beyond redemption.

In conversation with distributors of both classes of machine, it was apparent that they do not approve of customers poking around in the "works", even with gadgets and fluids that someone, somewhere has approved for the purpose. "Metho" and ordinary cotton tipped wands are especially taboo; metho because of its uncertain chemical history and cotton because fragments can lodge in head crevices and harbour foreign deposits.

In fact, the distributors of video decks were virtually unanimous in claiming that the need for regular head cleaning is being over-emphasised in some quarters; that, for most home recordists, it is a non-problem.

In Britain, for example, an official joint statement was issued recently by companies marketing VHS type decks – Akai, Ferguson, Hitachi, JVC, Panasonic and Sharp. They said that the use of head cleaning procedures in the home was unnecessary with any VHS machine, "since the composition and action of the tape itself cleans the heads during use".

Further: "The video heads in VHS machines should be cleaned only by qualified service engineers, after they've established the need for this".

The validity of this advice depends, of course, on the frequency with which the need for head cleaning is likely to be "established". Once a year might be reasonable; once a month would be intolerable!

WHAT DISTRIBUTORS SAID

With this in mind, we put the question to a number of home video distributors in Sydney and what follows is a precis of what, in some cases, turned out to be quite lengthy conversations:

Distributor No. 1 (VHS): Strongly contested the need for, or use of, any head cleaning procedures in the home by non-qualified people. If head fouling does occur at short intervals, get the deck cleaned professionally – and then invest in some decent quality tape!

Distributor No. 2 (VHS): A few selected users in educational institutions have been instructed in head cleaning procedures using a chamois-tipped wand and freon liquid. Some other machines are covered by routine maintenance contracts. But most customers operate decks for long periods without need for attention. Service specifically for dirty heads is very rare.

Distributor No. 3 (VHS): Does not encourage the use of home head-cleaning gadgets. Not an urgent problem, anyway.

Distributor No. 4 (Beta): Policy is to

AGFA — a cassette tape for every purpose

Agfa-Gevaert is making a determined effort to ensure that dedicated cassette users never have to move outside the Agfa product range, no matter what their needs, or what the nature of the deck they are using. Agfa's efforts have been concentrated both on the products themselves and on product identification.

Agfa are obviously fully aware of the confusion which can exist in the minds of consumers about brands, magnetic coatings, recording bias, compensation, claims about low noise and "dynamic" energy, and so on. All this, along with the mechanical details and playing times, adds up to potential bewilderment.

Agfa-Gevaert major on the name AGFA, which they obviously want to associate with quality, but they exploit colour treatment and labelling to help position each tape in the product range.

Built into the title is a Roman numbering system which indicates the nature of the coating: I for iron oxide tapes; II for chromium dioxide; III for normal iron oxide plus chromium dioxide; IV for pure metal. Additional information on the box confirms the single or two-layer formulation, the optimum bias switch position and the appropriate compensation (70/120μs) if separately accessible. The range includes the following cassettes:

AGFA FERROCOLOUR: Basic "high dynamic" iron-oxide cassette for use in decks providing normal "Fe" bias and 120μs compensation. Playing times available are 66, 96 and 120 minutes or, as branded, 60+6, 90+6 and 120.

AGFA SUPERFERRO: Also an iron-oxide formulation requiring normal "Fe" bias and compensation but of premium quality with improved maximum output level. Playing times are again 66, 96 and 120 minutes.

AGFA CARAT FeCr: A high quality two-layer iron-oxide and chromium-dioxide tape for decks with an "FeCr" switch position or capable of being set for "Fe" bias and "Cr" compensation. Playing times, 66 and 96 minutes.

AGFA STEREOCHROM: A standard chromium-dioxide formulation, notable for its excellent high frequency response. Requires normal "Cr" bias and compensation (70μs). Playing times 66, 96 and 120 minutes.

AGFA SUPERCHROM: An unusual formulation which, despite the name, is actually a two-layer tape. The main finely divided chromium-dioxide coating is underlaid with iron-oxide. Unlike the more usual FeCr cassettes, Superchrom requires normal "Cr" bias and compensation. Agfa claim that the performance is outstanding. Playing times are 66 and 96 minutes.

encourage customers to adhere to a preventative maintenance plan, as for the family car. Have the deck checked and cleaned professionally after each 500 (approx) hours, with lubrication, tension adjustments, belts, etc, variously at 1000, 2000, 3000, 4000 hours. That should ensure continuing peak performance.

Distributor No. 5 (Beta): Supports the idea of preventative maintenance but owners can save money by dropping out the shorter-term clean and check calls, if no problem is evident. In any case, in a Beta machine, where the tape remains around the drum, a fast-forward fast-reverse cycle with any good quality tape will polish the heads, anyway!

Right: The new Allsop cleaner cassette for Beta format video decks. Price complete is $34.95, and $9.95 for replacement cartridge and fluid. Details from Communications Power Inc (Aust) Pty Ltd, PO Box 246, Double Bay, NSW 2028. Phone (02) 357 2022.

Left: VHS and Beta cleaning cassettes from TDK (Aust) Pty Ltd, at 4 Dowling St, Woolloomooloo, NSW 2011. Phone (02) 358 1877. Both are priced at $24.95. They must be used as per directions.

In short, those Australian distributors we talked to supported their British counterparts, to the extent that they do not see head cleaning as an urgent every-week or every-month need, assuming normal domestic usage, normal care and the use of proven major-brand cassettes.

THE REAL WORLD?

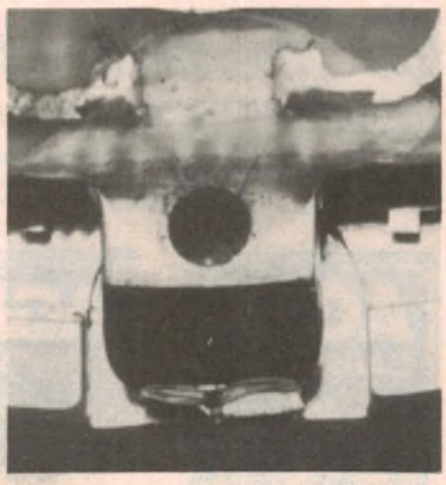
That last qualification may be significant in what is, otherwise, a quite unreceptive environment in which to promote home video head cleaning equipment. Deliberately or unwittingly, people do sometimes use other than top quality tape, and that may produce special problems.

This was emphasised by a warning in a recent issue of British "Television" magazine in regard to a "flood of cheap imports", triggered by an earlier shortage of normal quality name-branded video cassettes. The influx included not only obscure brands of "E" (European PAL/SECAM) tape but "T" (NTSC system) varieties, which are not optimum for European standards, anyway.

The report said: "The tape can be abrasive and can shed oxide which causes clogging and damage to the heads."

The extent of any such problem in Australia is not very clear, at present, but observations have been passed about four potential trouble areas:

- Obscure brand cassettes: They may be quite okay but, equally, they may be loaded with unsuitable or reject tape. The prospective purchaser has no way of knowing, short of actually trying them.
- Well-known brand cassettes but offered at a low price through an unusual channel: They could be a legitimate clearance but fake products are not uncommon on the Asian scene.
- Pre-recorded cassette features from obscure sources, purchased or borrowed for the evening: Poor quality tape may have been used.
- Cassettes of any description, but particularly the poorer ones, which have been exposed to excessive humidity and/or repeatedly "cooked" in locked cars: This may cause some breakdown of the coating, with resultant shedding.



This picture, by staff photographer Bob Donaldson, shows a video head magnified about 7.5 times. The pole tips and windings are at the extreme bottom of the picture and, in reality, measure about 3mm x 0.8mm. Note that one of the tiny pole tips – about the size of half a pin-head – has been broken off.

CLEANING METHODS?

If one assumes that video deck users can encounter head fouling in certain circumstances, the question follows as to what options are available to deal with the problem in the home.

One has already been mentioned – that of fast cycling Beta type decks, using a known good tape. According to a service executive in one major Beta distributor, it will quickly dislodge any slight built-up that may have occurred from previously playing a poor tape.

With VHS machines, the option would only be available with those models which have a fast cueing mode, allowing the tape to be cycled at high speed through the tape path. (For normal fast-forward and rewind in a VHS machine, the tape is withdrawn back into the cassette.)

A second option, also mentioned earlier, involves the use of a wand tipped with chamois or deerskin, and freon or ethyl alcohol liquid. This is the method most commonly used by qualified technicians but frowned upon by deck distributors, in respect to consumers. They simply do not want non-technical people poking around inside video decks except, in certain cases, after face-to-face instruction.

That leaves cleaning devices which plug into the decks like ordinary video cassettes, performing their cleaning function while the deck operates in the "Play" mode. In the design of such head cleaning cassettes, there are two main approaches.

What's new in cassette decks at Sansui?

For starters, you won't find any belts, cams or gears in the capstan drive system of the new D-550M cassette deck. They've all been eliminated in the name of speed precision and transport reliability.

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The three-head D-550M uses a combination Rec/Play head for no-compromise performance. Each head has its own amp (complete with a Dolby* noise reduction circuit) to enable you to monitor recordings as they are being made, Dolby-encoded if you wish.

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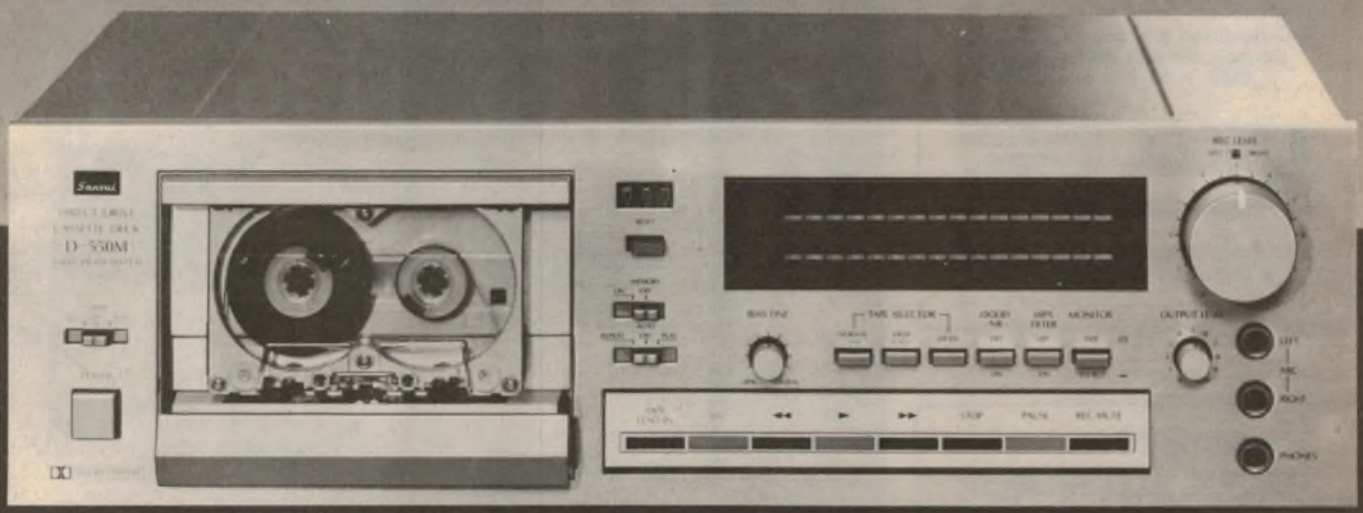
*Dolby is a trademark of Dolby Laboratories.



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Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $4.50,** OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield, 2014. **PRICE $5.20.**

The first is typified by a unit which, we understand, was the result of collaboration between TDK and a number of Japanese video deck manufacturers. Applying the principle used in audio cleaner/cassettes, it contains a short length of carefully selected abrasive tape in a normal cassette – VHS or Beta, as the case may be.

If there is evidence to suggest that the heads are fouled, the cleaner/cassette is inserted into the deck in the normal way, and the deck operated in the "Play" mode for about 30 seconds. Eject without rewinding, and use a known good recorded tape to see whether the picture and/or sound has improved. If not, try another 30-second cleaning cycle.

The instructions warn against more than four 3-second cycles on any one occasion on the basis that, by then, all the heads should be clean and any remaining problem is from some other cause.

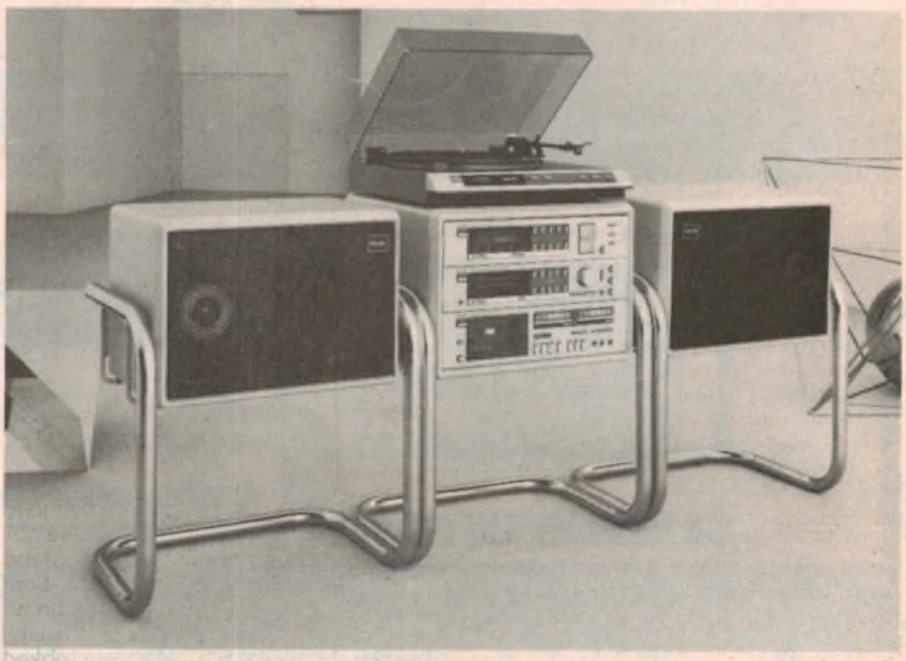
Ironically, deck manufacturers now appear to have backed away from abrasive cleaner/cassettes, even those which may appear in their own catalogues. However TDK, a very experienced and reputable company, have stocks available in Australia of both VHS and Beta cleaner/cassettes. Both can be used for 200 30-second cleaning operations before their effectiveness is seriously compromised.

TDK have curves which indicate that use of their cleaner should not significantly affect the life of the heads. It would appear, however, that objections to abrasive cleaners are based, not on normal use, but on the risks of their possible abuse. If, through negligence, or the continued use of poor tape, or simply excessive zeal, a video recordist subjects his deck to disproportionate abrasive "cleaning", head life may suffer.

In short, if the heads in a video deck do need to be cleaned, there's little doubt that the TDK cassettes (or similar) will do the job, but don't overdo it!

The alternative type of head cleaning cassette is as explained and illustrated last month. Produced by Allsop Inc, Washington, USA, it is also assembled in a normal VHS cassette but contains a length of chamois in place of the tape, and a couple of felt pads. In use, the chamois and felt pads are moistened with the freon/alcohol liquid provided, the cassette is inserted and the deck

TEAC Soundscape ACE series



As a departure from the now conventional rack presentation, TEAC have achieved a significant breakthrough in styling with their L-9S audio stands, as pictured, which can support both the components and the loudspeakers in a stylish fashion. The units are from the TEAC Soundscape ACE series, which offer options as follows: (from top) Turntable, the P-7 or P-9 direct-drive, fully automatic, the latter quartz locked; Tuner, T-9 digital synthesised AM/FM-stereo; Integrated amplifiers A-7 and A-9 delivering respectively 40+40W and 60+60W; Cassette deck V-9, metal compatible with unique colour-keyed level indicators; Loudspeakers S-7 and S-9, combining high performance, compactness and excellent sensitivity. For further details: TEAC Aust Pty Ltd, 115 Whiteman St, South Melbourne, Vic 3205. Phone (03) 699 6000.

switched to "Play" mode.

The deck will operate for only about five seconds before it switches off automatically. In that time, however, the pads will clean the capstan and pinch roller and the chamois will be drawn into the mechanism so that the spinning video drum will run against it.

Allsop have objected vigorously to their cleaner/cassettes being lumped in with those containing an abrasive tape. Allsop say that, in using chamois and freon, they are merely automating the procedure used by video technicians. The chamois strip is not abrasive and, in any case, the automatic shut-off ensures that the cleaning procedure cannot be unwittingly prolonged. It can only be deliberately repeated.

In recent months, Allsop has concentrated on building up evidence, based on both experience and research, to establish that their cleaner/cassette does not cause any detectable wear in video heads. Evidence to this effect is mounting – which is not surprising, considering the nature of the unit. Nor can there be any objection to the cleaning fluid which they provide.

What does come through is that the cleaning effect may be limited to accessable deposits on the surface of the head cyclinder, as distinct from any cavities around the head. Cleaning action on the various stationary heads will also be very limited.

Allsop do not contest this but say that their cleaner/cassette is not intended as a substitute for periodic cleaning and service in an approved workshop. What they simply say is that, by removing deposits, if and when they occur, the Allsop cleaner/cassette will ensure more consistent results and help space out formal technical service – this without danger to the mechanism.

That seems to make sense – provided there are no other problems.

Which brings us to the final point: When we went to press with the June issue, Allsop only had cleaner/cassettes available only for VHS format decks. Those for the Beta format were still somewhere back in the pipeline, delayed, we understand, by the need to reconcile tantalising differences in detail between different makes and models of Beta deck.

That has now been sorted out and Beta format cleaner/cassettes are now available in Australia at a recommended retail price of $34.95, with replacement cartridges for $9.95 – the same as for the VHS units.

In Brief . . .

PC STEREO PTY LTD, who distribute the Telarc label records in Australia, are delighted to announce that Telarc's Producer, Robert Woods, has won the Grammy Award in the USA, as the Best Classical Record Producer. The 6-record group which carried the day were the Telarc releases as follows: 10045, Boito, Verdi, reviewed in Electronics Australia Jan '81; 10046, Chausson, EA Nov '80; 10047, Tchaikovsky, EA May '80; 10048, Bizet, EA Oct '80; 10050, Arnaud-Vaughn Williams-Grainger, EA Apr '81; 10051, Saint Saens, EA Dec '80. PC Stereo are at PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.

JAMIESON ROWE, former Editor of "Electronics Australia", had the opportunity, while in the USA recently, to browse through a Macy's store and a Sears store. It gave him the opportunity to have a good look at a Philips/MCA LaserDisk record on a Pioneer brand player at $799. He also spent time watching an RCA (capacitive) disc on an RCA player at $499. Viewed critically, the picture from the laser system looked a little better but, in fact, both were quite impressive. In both cases, the discs were of full feature movies retailing at about $20.

DIGITAL MASTERING for normal analog discs has certainly come a long way from the era, a couple of years back, when it was largely exclusive to a few of the smaller companies involved in the production of audiophile discs. Evidence of this is in the May '81 issue of the time-honoured British "Gramophone" magazine. The Orchestral section of Classical Record Reviews covers 24 releases; half of them are from digital master tapes.

OPTICAL VIDEO DISC production will be enormously boosted by a new plant which is being commissioned in Japan by a consortium involving Pioneer Electronics and Universal Pioneer, the latter identified with "DiscoVision" and jointly owned by Pioneer, IBM and MCA. Pressing capacity of the new plant will be 5,000,000 discs per year, aimed at the Japanese, American and other system-compatible markets.

MR ACOUSTICS of Annerley, Qld, advise that they have taken over the product lines and associated warranties formerly handled by Depro Industries of North Sydney. The products include Audio Pro equipment, Opus 3-records, Proprius records, and the very popular Fresh Aire records. Postal address for MR Acoustics is PO Box 165 Annerley, Qld 4103. Their phone number is (07) 48 7598.

High performance AM, FM tuners

Shown above is the Audiosound T 752 FM-stereo tuner. Designed and manufactured in Australia, the T 752 features a tuning lock muting system which is claimed to be even more precise than the quartz lock system. Specially designed filters prevent the 19kHz and 38kHz subcarrier energy from penetrating the audio system. Price for the T 752 is $460.

The Audiosound T 751 AM/FM-stereo tuner offers FM facilities and lock tuning similar to the T 752. However, the AM section provides for a low noise antenna system, narrow band and wideband reception to 10kHz and a simulated stereo audio signal. Price is $594. Further information is available from Audiosound Electronic Services, 148 Pitt Rd. North Curl Curl, NSW 2099. Phone (02) 938 2068.

Nakamichi "Computing Cassette Deck"

Second only to the 1000ZXL in the extensive range of Nakamichi cassette tape recorders, the new 700ZXL should really be considered as an addition to the line. Whilst it carries the same designation (700) as a previous model, the ZXL is effectively a completely new unit, having very little in common with its predecessor, apart from its at-a-glance appearance and approximate physical dimensions.

First impressions are of great size and bulk. The 700ZXL measures 500mm wide × 262mm high with a depth of 250mm, and a mass of 14kg. It certainly does not belong to the personal portable class! On closer inspection it is seen to have an impeccable finish and offers a variety of features probably only exceeded by its illustrious brother, the 1000ZXL.

Probably the most interesting – and useful – feature is the one which automatically optimises the record channel characteristics to a particular cassette. Nakamichi call this automatic calibration facility ABLE (for azimuth, bias, level and equalisation). On command, ABLE starts tape motion, aligns record head azimuth, sets bias, adjusts (recording) level and equalisation; after which it winds back to the start – ready to commence recording. And all this in less than 15 seconds!

The other major innovation is a "random access music memory" (called RAMM) which works with subsonic code signals to provide fully automatic programming. It encodes information (onto the tape) detailing the sequential track number, selected record equalisation characteristic and chosen noise reduction system – if any – used during the process of recording.

Prior to replaying an encoded cassette the user may select the sequence in which he desires the tracks to be played and, on command, the 700ZXL will implement this sequence, as well as selecting the appropriate complementary replay equalisation characteristic and noise reduction system.

Removal of the top cover reveals that the interior space is well utilised; there being some 10 major circuit cards, together with an additional 10 (or more) minor cards. Layout, wiring and construction are excellent.

As can be seen from the photo, the front panel is relatively uncluttered, having the usual tape motion controls – soft pushbuttons actuating logic circuitry – together with the RAMM and Tape Memory pushbutton banks, tape counter reset, line input level controls and A-B Monitor ("Tape"/"Source") selector. However, another dozen less-used controls are located behind a spring-loaded cover plate situated on the right hand side of the front panel.

These controls provide for three microphone inputs, 400Hz test tone, subsonic and MPX filters, selection of tape type, record/replay equalisation, noise reduction, line output level, counter memory selector and capstan motor speed. At the top of the front panel is a matt black strip, approx 30mm high, which serves to display the status and dynamic functions of the machine.

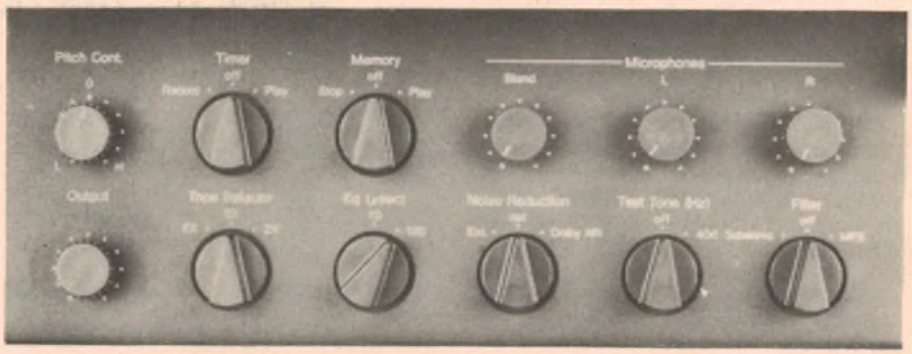
Using red LED-type readouts, we find at the left end of the strip information re bias, level and equalisation for the Auto Cal functions, thence tape type indicator, followed by equalisation and noise reduction. A thin illuminated area (beneath the above displays) shows RAMM together with digits 1 to 15 inclusive. At the centre of the strip is a large four-digit seven-segment tape counter, whilst the right hand side is occupied by twin bar-graph level displays.

These bar-graphs are easily the largest we have encountered, being some 180mm in length and each containing 30 separate 4mm segments. They are scaled from −40 to +10dB, covering a range of 50dB. As all segments are red in colour, a recordist has to closely watch the position of the illuminated segments. However, in common with many other bar-graph displays, those on the 700ZXL incorporate a "peak-hold" function which holds the last highest reading for approx five seconds.

In respect to accuracy, the bar-graphs on the 700ZXL exhibited somewhat peculiar characteristics in that they had errors of less than 1dB at levels of −10dB and below, yet stretched the top end of the range, with errors of 2dB and more in this critical area. The best that can be said about this characteristic is that, in this region, the indicated level was greater than that recorded on the tape.

The rear panel of this machine carries the usual array of line input/output sockets together with a further eight phono-type sockets for interfacing an accessory stereo noise reduction unit, such as the Nakamichi/AEG-Telefunken High-Comm II or the recently released Nakamichi Dolby C unit.

In keeping with the high standard of finish on this machine, all phono sockets are of the gold-plated variety. Three jacks are provided for separate microphones – left, right and "blend" which simultaneously records on left and right channels. Separate volume controls for these are located under the flip-up front panel, so that their signals may be mixed with those from the line input sources.



This is the control panel hidden by the flip-up door on the front panel of the 700ZXL.

Both tape motion and RAMM functions are brought out to sockets, permitting the connection of optional remote control units as desired.

The unit is not earthed, being equipped with only a two-core mains cable. It does not appear to be double-insulated. However, we have been advised by the local distributor that this 700ZXL is a pre-production sample; production versions will be double-insulated and will carry the international double-square symbol.

The 700ZXL carries on the Nakamichi traditions of closed-loop dual capstan drive and cassette pressure pad disablers (pressure pads are unnecessary in a closed-loop system) which obviates problems due to pad variation from cassette to cassette. Rather than use conventional solenoids for transport control, Nakamichi provide a motor-driven cam system to perform this function.

They claim that, in addition to providing a quieter, smoother operation, the motor-governed head insertion-retraction eliminates the needs for dampers and reduces shock which can affect the critical head alignments. Two other motors are included, one for capstans drives; the other for the reel hubs.

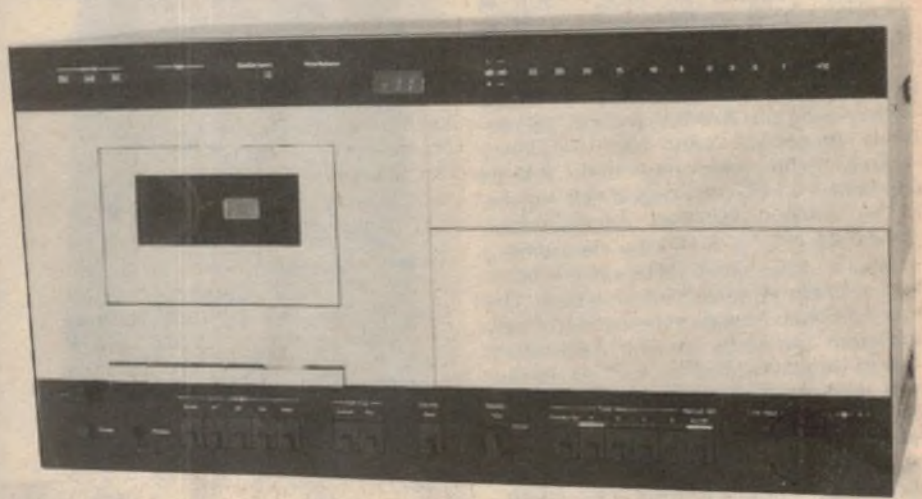
In common with several other Nakamichi models, the 700ZXL features three discrete heads – erase, record and replay – and has two complete sets of electronics (record and replay) for each channel. Double Dolby-B noise reduction circuits enable simultaneous replay monitoring whilst recording.

The 700ZXL also features "cueing" which enables the operator to listen – at a muted level – during either the fast forward or rewind modes. Pressing the Pause button during either of these modes reduces the winding speed to one-third of its original speed and also moves the replay head into close proximity with (but not touching) the tape. Whilst in this "cue" mode, winding speed can be further reduced (to approximately one-fifth) by pressing and holding the fast forward (or rewind) button. In this manner the tape can be shuttled back and forth to locate a desired point in a recording. Simultaneously pressing the fast forward and rewind buttons stops tape motion, but leaves the machine in the cueing mode.

A variable speed control (labelled "pitch") for the capstan motor permits variations of ±6% relative to the nominal, which is easily located by means of a detent in the centre. The control is only functional in the "play" mode, thus preventing recordings being inadvertently made at a non-standard speed. At the detent setting tape speed was approximately 0.1% slow. Peak wow and flutter was 0.1% DIN weighted – an excellent performance. Fast forward and rewind times set a standard for the rest of the industry, being only 47 seconds for a C60 cassette.

Line output level is adjustable and, at the 0dB metering point may be set to any level up to almost one volt. Replay of test tapes shows that 0dB deflection is obtained from a recorded level of 170nWb/m. Internal output impedance at the line output sockets varies between 2500 and 4000 ohms, depending on the setting of the line output level control.

Prior to making a recording the 700ZXL can be optimised for a particular cassette. Positions of the tape type selector and equalisation switches should be checked; then the deck is placed in the record-standby mode by depressing both the pause and record buttons. Implementation of ABLE is carried out by simultaneously pressing the Auto Cal Run and Play buttons. The machine now records and plays back to itself tones which it uses for adjusting record head azimuth, bias, tape equalisation and mid-frequency record level. During this procedure indicator lights flash in sequence to show which part of the operation is taking place. As each operation is completed, this light remains steadily illuminated, and the computer moves onto the next operation. Finally all indicators remain steadily lit and the tape is stopped; then it rewinds to the start point, indicating the job has been completed and that recording can commence. As previously mentioned all this takes only about 15 seconds.



Having optimised the 700ZXL for a particular cassette type, by merely pressing two buttons it is possible to enter this information into one of four "tape memories" which are available for this purpose. In this way data for four different kinds of tapes and information on replay equalisation and noise reduction can be assigned and stored. This information may be called up, at any time, and is displayed on the left hand side of the strip at the top of the front panel. Memory retention is not dependent on mains power, as two dry cells provide backup power when the machine is "off".

Nakamichi specifications, quote an overall (record and replay) frequency response within ±1.5dB between 20Hz and 20kHz, and within ±3dB between 18Hz and 24Hz using any of their cassette formulations. The 700ZXL easily met this specification being within ±1dB between 15Hz and 22kHz and ±2dB to 25kHz. This performance was also achieved with samples of the three cassette formulations – Types I, II or IV – chosen at random from other cassette brands. For this reason there was no point in publishing our usual frequency response curves – as they would essentially be just straight lines!

With metal tapes (type IV) 1kHz total harmonic distortion measured 0.9% at 0dB, 2¼% at +6dB and 5½% at +10dB. These are easily the best figures we have ever recorded for metal tape, indicating that neither the record amplifier nor record head are being overloaded at the high levels required.

Using type II (chrome type) tapes, distortion was 1% at 0dB, 3½% at +6dB and 9% at +10dB. And with type I tapes (ferric oxide) the distortion was 1.2% at 0dB, 6% at +6dB and 13% at +10dB.

These figures indicate that, to achieve best results from this deck, it is necessary to use the more expensive types II or IV cassettes, and preferably the latter. Yet for only a few hundred dollars, many cassette decks yield 1kHz distortion figures (at the +6 and +10dB levels) – with ferric oxide type I tapes – less than half those produced by the 700ZXL. Their high frequency response may not extend much above 15kHz (vide the 700ZXL's 25kHz), but Nakamichi might do better to re-think the bias level and deliberately trade off some of this supersonic response for a reduction in mid-range distortion.

As matters stand, the deck owner cannot opt for such a compromise, because the recording parameters are entirely under the control of the in-built ABLE computer.

Turning to signal-to-noise ratio the unweighted figures below 0dB replay level (170nWb/m) were 47dB with the 120μS replay characteristic, and 51dB with 70μS. Selecting the internal Dolby-B noise reduction facility improved these figures to 56 and 60dB respectively.

Interchannel separation measured bet-

ween 40 and 43dB for frequencies between 50Hz and 3kHz, decreasing to 34dB at 10kHz and 27dB at 20kHz. With Dolby selected the separation figures improved by at least 6dB at 1kHz and above.

Crosstalk between forward and reverse tracks (tks 2 and 3) was at least 53dB at frequencies above 150Hz, but decreased to 45dB at 50Hz, 40dB at 30Hz and 18dB at 20Hz.

A switch-selectable MPX filter is incorporated in the unit, and provides a notch of greater than 30dB at the 19kHz FM pilot tone frequency, with only minimal change to the response at 15kHz and below. There is also a selectable "subsonic" filter which produces an extremely steep rate of attenuation below 30Hz, being very useful for removing rumble generated in turntable systems. Response is 0dB at 30Hz, −3dB at 27.5Hz, −32dB at 20Hz and −54dB at 10Hz.

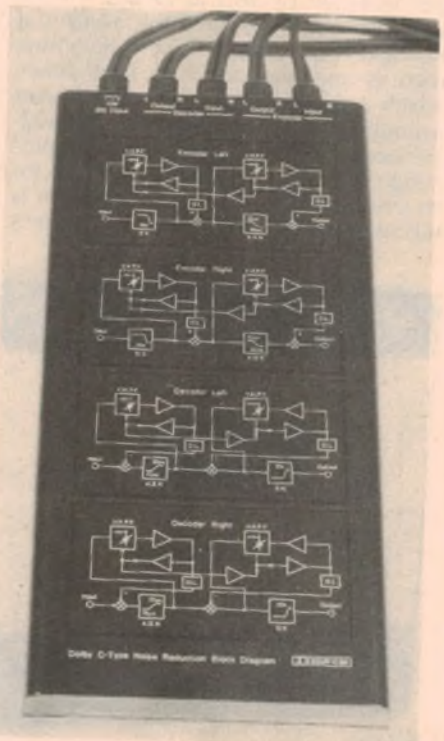
The Owner's Manual recommends that this subsonic filter be always in circuit when using the RAMM function, to prevent unwanted very low frequency signals from interfering with RAMM operation which uses coded 5Hz signals.

This RAMM (Random Access Music Memory) system works by recording a subsonic code signal (5Hz) on the blank space between selections on a tape. The coded signals may then be used to freely program the order in which selections are to be played and, in addition, to permit repeat playings of particular items. RAMM signals can be recorded either manually or automatically. Manual operation entails pressing the RAMM button each time it is desired to record a RAMM signal. In this mode it is possible (and permissable) to record RAMM signals during the middle of an item, as well as in the breaks between items.

By selecting the automatic RAMM record function, a code signal is recorded automatically on the tape whenever there is a blank space (silence in the source signal) of more than two seconds. This is especially useful when copying a disc to cassette. It is also possible to change from automatic to manual coding (and vice versa) at will. This enables a RAMM signal to be placed in the middle of an item, yet retain the automatic function between items.

It is most fascinating to watch the machine follow a RAMM replay program, as the transport alternatively runs backwards and forwards with the tape apparently moving in any one of the three available speeds according to the distance between selected items. It usually appears to set-off at a medium speed, identify its position, decide that the next selection is, perhaps, a long distance away, engage high speed; thence medium speed as the desired item is approached, and finally low speed in homing onto the desired selection. Then possibly reverse, if it has overshot the coded signal. All very intriguing!

One minor point. It does not appear to be possible to use this worthwhile facility with pre-recorded cassettes. So if you possess a library of pre-recorded cassettes you will have to forego this RAMM facility when using them. As the lesser 680 model in the Nakamichi range does



Above is the Nakamichi Dolby-C Adaptor.

feature a system – albeit far less sophisticated – which recognises the blank spaces between recorded items for replay pre-selection purpose, it seems strange that the 700ZXL cannot perform this function.

The 700ZXL has provision for interfacing an external noise reduction processor into its record and replay circuits. This facility may be implemented by setting its noise reduction selector to EXT. Sockets on the rear panel allow for connection to the device, and include a power outlet for energising Nakamichi's own range of accessory units.

Two accessory noise reduction units are offered; the first being the High Com II system which we reported on in our April, 1980 issue. The other is a new Dolby C-type processor – model No. NR-100, priced at $250 – which provides two encode and two decode channels for direct interfacing with the 700ZXL (or the 1000ZXL). As related in previous issues of this magazine, Dolby C noise reduction is effective over a wider band of frequencies, and offers a greater dynamic range than the well-known Dolby-B system.

Similar to Dolby-B, Dolby-C is a level dependent, sliding band compander. High level signals are passed through the encoder without compression and, subsequently, through the decoder without expansion. At lower signal levels – where noise is not masked by music – mid and high frequencies are compressed during encoding, expanded in a complementary fashion upon playback. The frequency at which compression begins, and the amount of compression depend upon signal level; with the amount of compression increasing as signal level diminishes.

In the Dolby-B system maximum compression occurs with signal levels 40dB or more below Dolby reference level (200nWb/m) and is approximately 10dB in the high frequency region. In the C-type system, compression continues to increase as signal level diminishes until it reaches a maximum of 20dB at 60dB below Dolby reference level. To maintain a subjectively uniform degree of noise reduction, Dolby-C starts to have effect about two octaves lower in frequency than Dolby-B.

Dimensions of the Nakamichi Dolby-C NR-100 are 120 × 240 × 41mm (W × D × H), and it has a mass of 0.88kg. Design and workmanship conform to Nakamichi's usual high standard. Because of lack of time we were unable to subject the NR-100 to an in-depth evaluation; however it appeared to produce the expected 10dB improvement in s/n ratio over Dolby-B; and on the limited musical material we tried, did not appear to degrade the sound quality of the selections.

How are we to conclude? Simple. The Nakamichi 700ZXL is a superb machine. If size and price are of little consequence, then this is the machine for you! It incorporates just about every feature you could wish for in a cassette recorder. Notwithstanding our criticism of the accuracy of its meter calibration and its distortion with ferric oxide cassettes, it is capable of making superb recordings on chrome or metal type cassettes. So, like a Rolls Royce, if you can afford to purchase it, you should be able to feed it the premium cassettes it deserves!

Recommended retail price of the 700ZXL is $2500 including tax; with an additional $250 being required for the NR-100 Dolby C Processor. Gold-plated RCA to RCA audio cables are supplied with both units. An "accessory box" containing a cleaning kit and three C60 cassettes of Nakamichi EXII, SX and ZX tapes, is also included with the 700ZXL. Further information can be obtained from high fidelity retailers, or the distributors – Convoy International Pty Ltd, 4 Dowling St, Woolloomooloo, NSW 2011. (P. de N.)

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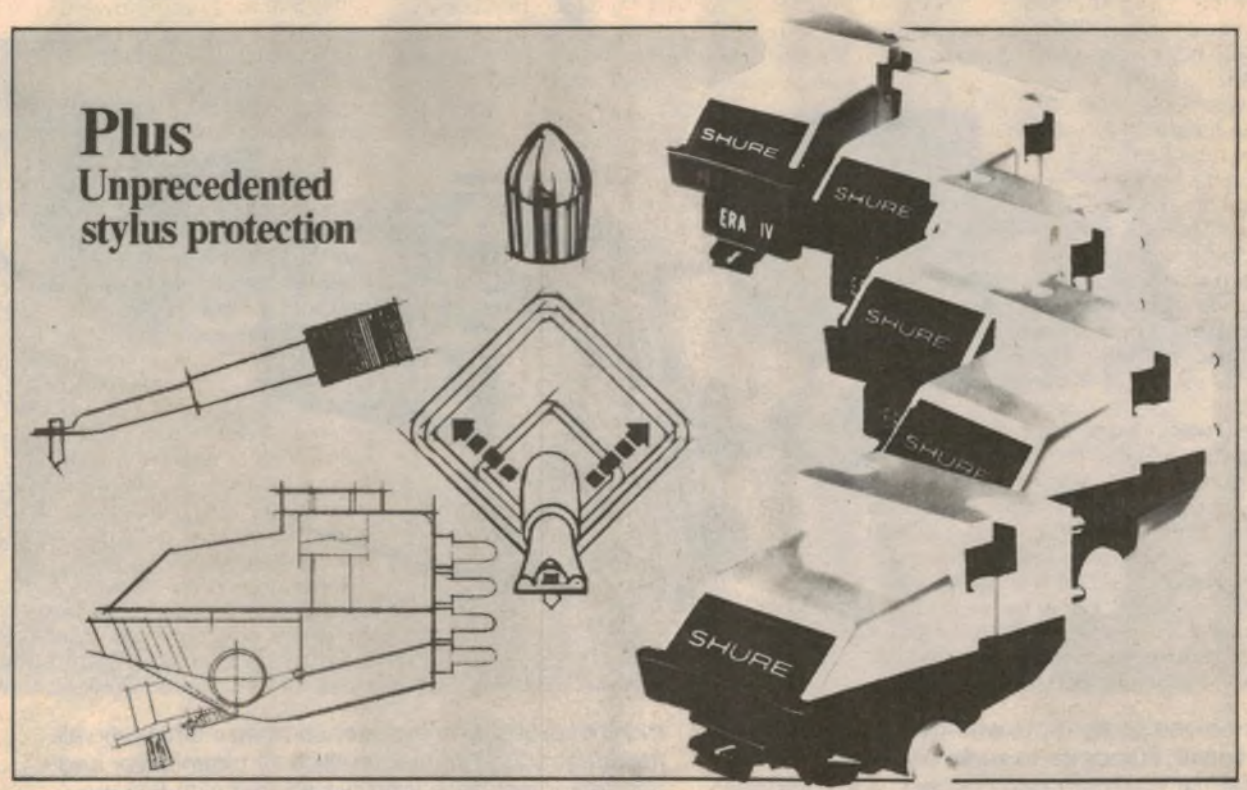

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The 980LZS features the famous Stereohedron™ stylus and a lightweight samarium cobalt super magnet. The output can be connected either into the moving coil input of a modern receiver's preamps or can be used with a prepreamp, whose output is fed into the conventional phono input.

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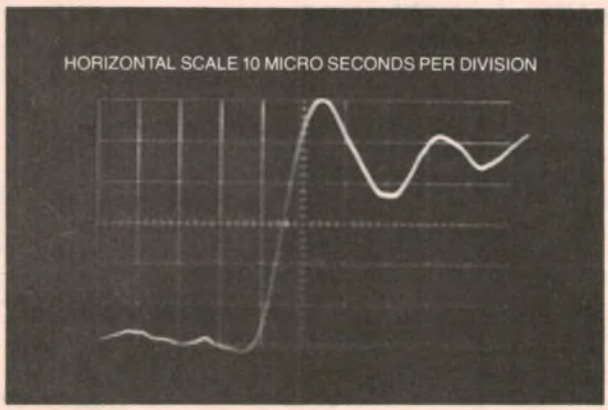

Actual unretouched oscilloscope photograph showing rise time of 980LZS using CBS STR112 record.

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50 & 25 YEARS AGO

Wireless Weekly 5p

July, 1931

"Two years of **Russia's Five-Year Plan** for expansion of its radio system ended on October 1, 1930, with the Soviet radio set trust considerably behind its orders for receiving sets, according to the Communists' Almanac for 1931. There were 1,267,000 radios in use in Russia on that date, instead of the 2,500,000 planned. Only about 65% of the 150,000 sets which were to be added between October 1 and January 1, 1931, were delivered.

"Although falling behind in orders, Russia is importing very little radio equipment — at least from the United States. Formerly one of the United States' customers for radio supplies, it cut imports very substantially under its plan to have its own radio set trust supply the sets, which are being placed mostly at points where people congregate, rather than in private homes."

☆ ☆ ☆

"The operation of an **automatic wireless telephone exchange** conecting a city with its various country towns, or city with city, is not only possible, but is likely to be an accomplished fact in the near future. At the present time a series of experiments are being carried out by the Marchese Marconi, world-famous inventor in automatic radio-telephony.

"The impulses will be transmitted across the sea by shortwave wireless in a fashion similar to that in which the Marchese Marconi, in collaboration with Amalgamated Wireless, switched on the lights of the Sydney Radio Exhibition in March of last year, from his yacht at Genoa. Once the connection has been established, conversation will be carried on by ordinary wireless telephone, and will be secret, as the system is based on many super-imposed wireless waves, which cannot be intercepted.

"It is interesting to recall Marconi's success in causing a switch to be closed at the Sydney Town Hall, which released approximately 100 horse power of electrical energy, and electrically illuminated the Town Hall with 2800 electric lights."

☆ ☆ ☆

For several years now **the development of television,** which so tickled the public's fancy when it was first mooted, has sadly languished. The experimenters who brought the new science to a successful issue did so mainly by mechanical ingenuity rather than by the discovery of an entirely new method of handling light impulses that could be considered a parallel of the vacuum tube, which set the radio industry off on its astonishing course. As a result of this not one of these inventions (they have all been described in "Wireless Weekly" at various times) lent itself to simple and cheap production in such a way as to be practicable for public use. Reproduction of televised images six feet square with sound synchronisation via radio has been accomplished, but only at a prohibitive cost. And when this cost has been cut down there has been an accompanying reduction of the size of the image until in some televisions offered to US listeners the image is nothing more than a fuzzy silhouette about the size of a cigarette card.

"Nevertheless, there has persisted a keen interest in television, which has heightened considerably during recent months as a result of the development of a new cathode-ray tube, which it is whispered may set television promoters on the road to popular success in the same way as the vacuum-tube freed the radio promoters."

☆ ☆ ☆

"A French musical authority, M. Paul Dermee, says it is absurd to encourage the composition of music especially intended for broadcasting. He says that for composers to concentrate on the middle register, leaving out low notes and high notes, which do not broadcast so well, would be as harmful as to have given the gramophone a diet of music entirely nasal in its early days. He believes that the engineers must study the composers, and not the composers the engineers."

RADIO TELEVISION AND HOBBIES 1/6

July, 1956

"Automation is hot subject: A new device is used today for the setting up of type in printing factories by means of the Monotype machine. This machine was invented many years ago and is as much a part of "automation" as any other modern device.

"The machine has a keyboard like a typewriter and linotype machine. As the operator presses the keys for typing, a paper roll is punched with the holes in a position which corresponds with the letters of the alphabet or numbers, including all punctuation marks, spacing, margins and so on.

"Thus the operator will type out a complete page of a book which is transferred to the paper roll in the form of punch marks together with the complete setting out of the spacing, etc.

"When this paper roll is placed in another machine, it revolves like a player piano roll, whereupon air is sucked through the holes and releases the moulds for the particular letters required.

"Molten type metal falls on to each mould in turn which then fall into a frame in exact replica of the printed page. The type is moulded one letter at a time hence the word "Mono"-type.

"The American Patents Office intends to install machines for searching the files regarding patents. When anyone lodges a patent with a patents office human examiners commence an exhaustive search to find out whether any similar patent has been issued. This usually takes months or years. Automatic machines will reduce this time to negligible proportions.

"In the Metropolitan Life Insurance Co of New York an electronic computer has replaced 135 operators and 100 punch card machines.

"In the meantime man can look forward to the day when he can lay in bed of a morning, happy in the thought that everything he requires will be attended to by an automatic device on which his instructions are "played" by a perforated roll of paper."

☆ ☆ ☆

"Britain revels atom secrets: It is the opinion of many Harwell men that thorium is likely to be used more in the future, as it is three times as plentiful as uranium and — an important point — there is plenty in the Commonwealth. Another fissile isotope of uranium, U233, can be "bred" from thorium.

"In many of Harwell's buildings work has to be done by remote control from behind lead shielding, in others through what are called "glove boxes", glass cases into which the hands are inserted into rubber gloves to avoid contamination. Some of these glove boxes contain lathes, welding equipment, grinding machines.

"There is no harm in handling rods of natural uranium or plutonium. Both are greyish metals decidedly heavier than lead. But there are many difficulties with the nuclear metals. Plutonium for instance increases in size by as much as 8% when it gets hot. Uranium has been known to double in size.

"Sir John Cockcroft told us that the long term program at Harwell goes even beyond the fast reactor. Work is going on in the field of controlled thermonuclear reactions, a project of great scientific interest but one that, he said, is far away from practical application.

"The Russians in their published experiments have produced a temperature of the order of a million degrees centigrade but they do not claim to have reached a controlled thermonuclear reaction.

"The major advantage over conventional atomic energy is not so much the greater release of heat and power but in the limitless supply of fuel. There is plenty of hydrogen about."

A preamplifier for moving-coil cartridges

For those who prefer the sound of moving-coil cartridges, we present this fine preamplifier using ultra well-matched monolithic transistor pairs to achieve very low noise. The circuit can be battery operated or mains-powered with a plugpack.

by RON DE JONG

By far the most common cartridge currently in use is the moving magnet (or MM) cartridge. In this design, a tiny magnet mounted on the remote end of the cantilever provides a magnetic field cut by two fixed coils mounted close by.

When the magnet is set in motion, as occurs when the stylus tracks the record groove, the magnetic field moves and small electrical signals are generated by the two coils. These signals are subsequently fed to a phono preamplifier and to the tone control and power amplifier stages.

Over the last few years, however, there has been renewed interest in another type of cartridge – the moving coil (or MC) cartridge. Some dedicated hifi enthusiasts claim that the MC cartridge offers advantages in terms of transient response, frequency response, and phase response at high frequencies. Whether or not these claims are valid is a matter for some argument – suffice to say that we do not intend to enter the debate here.

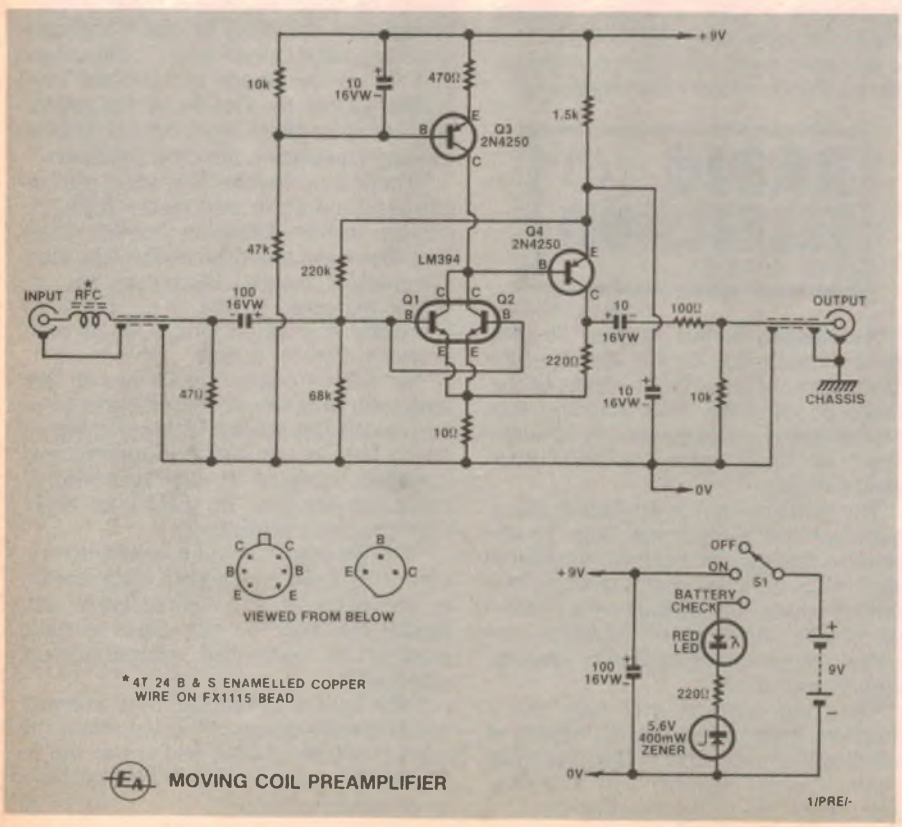
So how does a moving coil cartridge differ from a moving magnet type? The answer is that the positions of the coils and magnets are reversed, although the principle of operation remains essentially the same.

In the moving coil cartridge, the magnet is held stationary while two miniature coils are mounted on the cantilever assembly and move as the stylus tracks the groove (hence the name "moving coil"). Since the coils are attached to the cantilever, they must be kept extremely small to keep the tip mass to a minimum. As a result, the output level of an MC cartridge is extremely low, typically around 200μV at a recording velocity of 5cm/s.

This is around 27dB below the output level of an MM cartridge, which is typically around 5mV (or more) at 5cm/sec.

Because the output of an MC cartridge is so low, considerable voltage gain is required before the signal is fed into the phono inputs of a conventional hifi amplifier. One solution is to use a transformer but these are quite expensive and difficult to manufacture. The alternative solution is to use an additional preamplifier stage, and the design presented here has performance equal to or better than most commercial units for a fraction of the cost.

Before taking a look at the circuit, however, it may be as well to point out that the requirement for a separate preamplifier is one reason why MC cartridges have not gained widespread popularity in the past. Commercial units tend to be expensive and this, coupled with the high cost of the cartridge itself ($100 or more), has been sufficient to deter most hifi enthusiasts. This project will help overcome that problem, at least as far as the cost of the preamplifier is concerned!



DESIGN CONSIDERATIONS

Perhaps the most important specification of an MC preamplifier is the signal-

SPECIFICATIONS

INPUT IMPEDANCE: 47Ω
FREQUENCY RESPONSE: 20Hz to 100kHz ± 0.25dB
CHANNEL SEPARATION: better than 80dB at 10kHz
GAIN: 27dB
NOISE: 64dB with respect to input level of 150μV unweighted over a 20Hz to 20kHz bandwidth
DISTORTION: .008% for 300mV output; unmeasurable at normal output levels.
MAXIMUM INPUT VOLTAGE: 20mV

to-noise ratio. Let's first take a look at the various sources of noise and find out how these may be minimised in a low noise preamplifier design.

There are four main sources of noise in a transistor amplifier: shot noise, emitter base voltage noise, 1/f noise and thermal noise. These individual noise sources are illustrated in Fig. 1 which shows a simplified model of a noisy transistor amplifier. Note that we only show noise generators at the input of the amplifier and not noise generated in later stages. In most cases this is quite valid since the amplifier is most sensitive at the inputs and following stages will operate at higher signal levels.

Looking at each noise source individually, "shot noise" or quantum noise occurs because of the discrete nature of electric current; ie the individual electrons comprising the current flow. The mechanism involved is analogous to rainfall in that individual raindrops striking a tin roof create noise. From this you can see that shot noise actually increases with collector current. Another feature of shot noise is that it is "white" ie, the noise amplitude is constant with frequency.

Referred to the input of the transistor this shot noise is called base current noise and is modelled by a current generator at the input (see Fig. 1). The formula for base current noise is given by equation (1) in Fig. 1.

Emitter-base voltage noise is modelled by a voltage source in series with the base and is given by equation (2). This is also a white noise source but, unlike base current noise, actually decreases with increasing collector current.

1/f or "flicker" noise is a significant source of noise at low frequencies because, as its name suggests, it has 1/f spectral characteristic and so noise voltage increases as the inverse of the frequency. There are no exact formulas for this and it is simply given by equation (3) where K and k are constants which depend on the actual device used.

The best known source of noise is probably the thermal or "Johnson" noise generated in a resistor. This also has a white noise distribution and is given by equation (4). We can minimise this source of noise by minimising the input resistance, and this has the added benefit of reducing input noise voltage due to base noise current.

Referring to Fig. 1, we can see that this input resistance consists of the source resistance and the "base spreading" resistance of the input transistor. The source resistance is the resistance of the MC cartridge and is about 3Ω, while the base spreading resistance is an inherent feature of the transistor.

Clearly, we can significantly reduce thermal noise by choosing a transistor with a very low Rbb – or base spreading resistance. Most audio transistors have an Rbb of around 100Ω while for some UHF transistors it can be as low 4Ω. In fact, some designs for MC preamps do use UHF transistors. We can also achieve low Rbb, however, by simply connecting a large number of transistors in parallel, thus dividing Rbb by the number of transistors used.

The approach we eventually took was to use an LM394 super-matched transistor pair. Each of these transistors actually consists of a large number of individual transistors connected in parallel, giving each device an Rbb of 40 or 20 when the two are connected together. These transistors also have very high Hfe of 500 and due to the large number of transistors, statistical variations are considerably reduced and 1/f noise is very low.

What has emerged so far is that we can minimise noise by reducing the input resistance, but so far we have not considered how to minimise the effect of base current noise and emitter-base voltage noise. Since one increases with collector current while the other decreases, there is an optimum collector current at which the overall noise is at a minimum. To work this out we have to sum all the noise sources into an "equivalent input noise voltage".

Since the various sources are statistically unrelated, we do not simply add the voltages together but take the square root of the sum of the squares as shown in equation (5). Differentiating this equation with respect to collector current reveals that the minimum noise occurs according to equation (6).

THE CIRCUIT

Let's now take a look at the actual circuit we have used. The basic configuration is one we have taken from the National Semiconductor Linear Applications Handbook and uses just four transistors. Briefly, Q1 and Q2 are connected in parellel as a common emitter amplifier with Q3 as a constant current load. This drives Q4, another common emitter amplifier, which in turn drives the output and the feedback network to Q1 and Q2.

Looking at the circuit in more detail now, we have included a small RF choke at each input. This consists of four turns of 28SWG wire on an FX1115 bead and, in conjunction with the 47Ω resistor following, prevents RF interference from being rectified by the input stage and

The outputs from the Moving Coil Preamplifier are fed into the "phono" inputs of a conventional hifi amplifier. Unit has built-in battery check function.

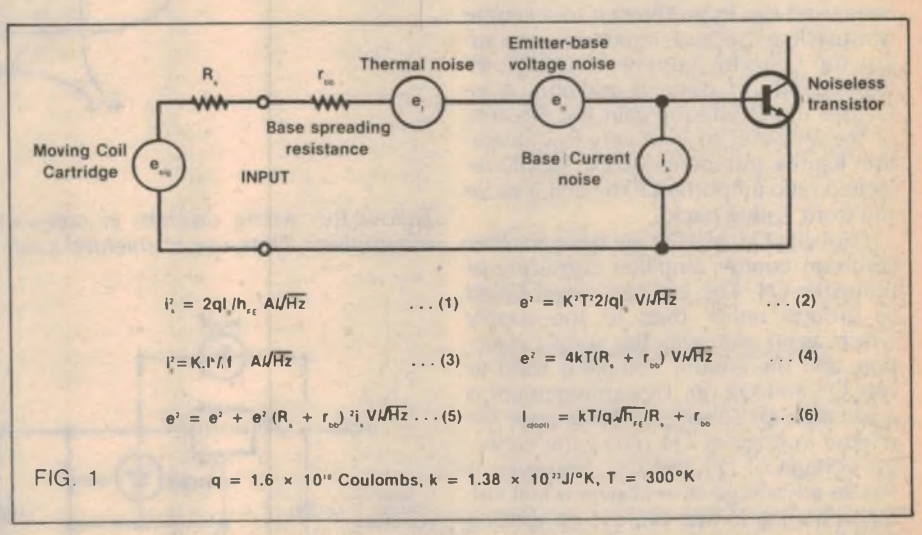


FIG. 1

passed to the amplifier Q5. A 100μF electrolytic capacitor couples the input signal to transistors Q1 and Q2.

Because of feedback to the emitters of Q1 and Q2, the input impedance of the stage is quite high at around 35kΩ. The recommended load for most moving coil cartridges is merely stated as being greater than 10Ω but if it is too high the leakage inductance of the cartridge will create unwanted bass boost. It is for this reason that we have included the 47Ω resistor on the input.

Incidentally, this is the standard input impedance of most MC preamplifiers.

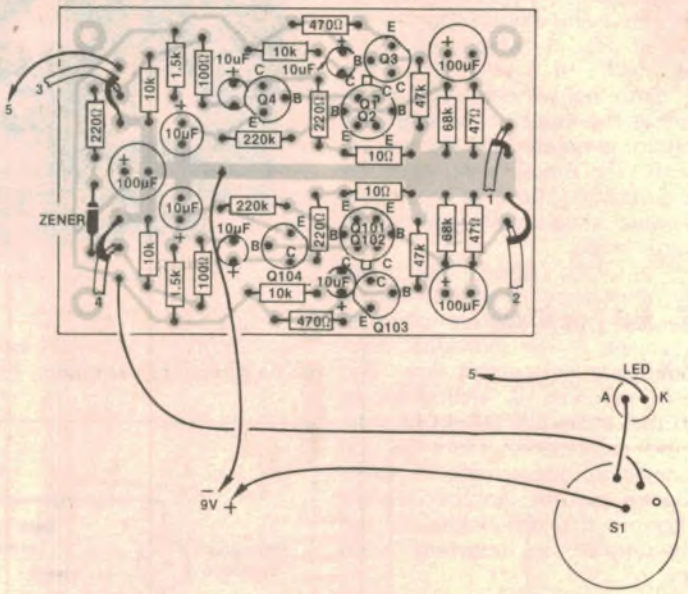
The collector load of Q1/Q2 is transistor Q3, used here as a constant current source delivering about 3mA. We have used this in preference to a simple resistive load because it permits us to adjust the collector current of Q1/Q2 independently of gain. In addition, it increases the open loop gain and linearity of the amplifier to give very low distortion figures and increases the supply rejection ratio (important if the unit is to be run from a plug pack).

Following Q1 and Q2 we have another common emitter amplifier consisting of transistor Q4. The emitter is decoupled to ground rather than to the supply which again improves the supply rejection, and the emitter voltage is used to bias Q1 and Q2 on. This arrangement is a variation on collector biasing since the emitter voltage of Q4 tracks the collector voltage of Q1 and Q2. However, it has an advantage over conventional collector biasing in that there is no loading effect.

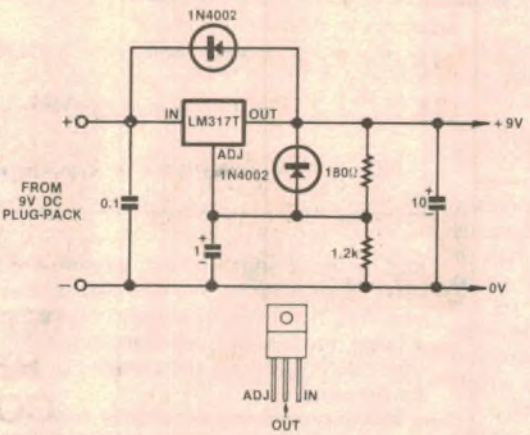
Collector load of Q4 is a 220Ω resistor which forms part of a voltage divider feedback circuit with the 10Ω emitter resistor of Q1/Q2. The voltage divider ratio sets the closed loop gain at 23 – or about 27dB – which is the gain required to bring moving coil cartridge output levels up to normal phono input levels.

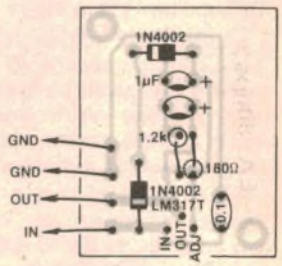
Output from the MC preamplifier is AC –coupled via a 10μF tantalum capacitor and a 100Ω resistor with a 10kΩ pulldown resistor after the capacitor to remove any DC voltage on the output. The purpose of the 100Ω resistor is to isolate the feedback loop from any loading effects of the following amplifier or shielded cable. If this is not done, any capacitive loading will introduce an additional "pole" or phase lag which could make the MC preamplifier unstable.

At this stage we can work out what the equivalent input noise voltage is and (hopefully) see if it matches the measured result. Using the formulae already given, the individual noise contributions are as follows: Emitter-base voltage noise = 0.327nV/(Hz)$^{\frac{1}{2}}$; Base current noise xR = .026nV/(Hz)$^{\frac{1}{2}}$; Thermal noise (including cartridge = 0.617nV/(Hz)$^{\frac{1}{2}}$.



Follow this wiring diagram in conjunction with the circuit when wiring up the preamplifier. Note use of shielded cable between the PCB and RCA sockets.





Optional voltage regulator circuit and PCB component overlay for plug pack operation.

Adding all of these vectorially gives 0.7nV/(Hz)$^{\frac{1}{2}}$ which taken over a 20kHz bandwidth gives a total input noise of 98nV. This gives a S/N ratio of 64dB with respect to a 150μV input signal, which is exactly the measured result.

One point which also emerges from this is that the base noise current is well below the other noise sources. Hence we could have increased the collector current of Q1/Q2 and thus reduced the emitter base voltage noise considerably. If we use the formula for optimum collector current for lowest noise we find that this current is around 20mA which is much greater than the 3mA we chose. We did this for two reasons however: lower distortion and lower power consumption.

Power for the unit can be obtained either from six 1.5V "D" size batteries or from a 9V DC plug pack and a small regulator circuit inside the unit. The regulator printed circuit board is one we have used before and is intended as a general purpose regulated supply. In practice we found that this arrangement was just as quiet as the battery operated version so long as the plug pack transformer is kept some distance from the unit.

We have also provided a battery check function consisting of a front panel LED, 220Ω resistor and 5.6V zener diode. When the front panel switch is set to "battery check" power is applied to this circuit. If the battery voltage exceeds the 5.6V drop across the zener and the 1.6V drop across the LED – ie 7.2V – then the LED will turn on. If the LED glows very

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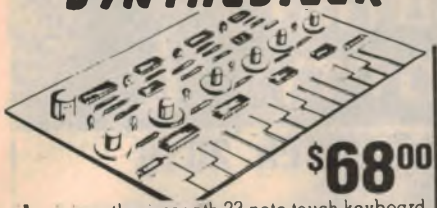

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Cat. K-3392 SEE EA JULY

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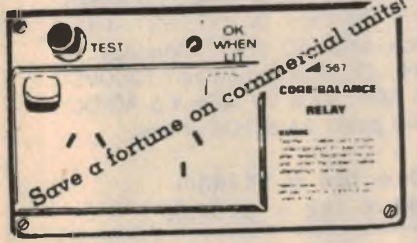

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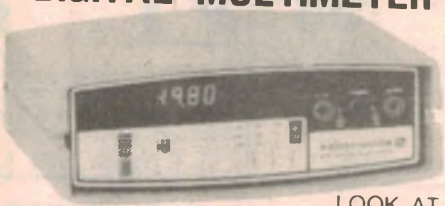
PRICE: Kit $176.00 + tax = $202.40
Assembled: $196.00 + tax = $225.40

DIGITAL MULTIMETER 2010



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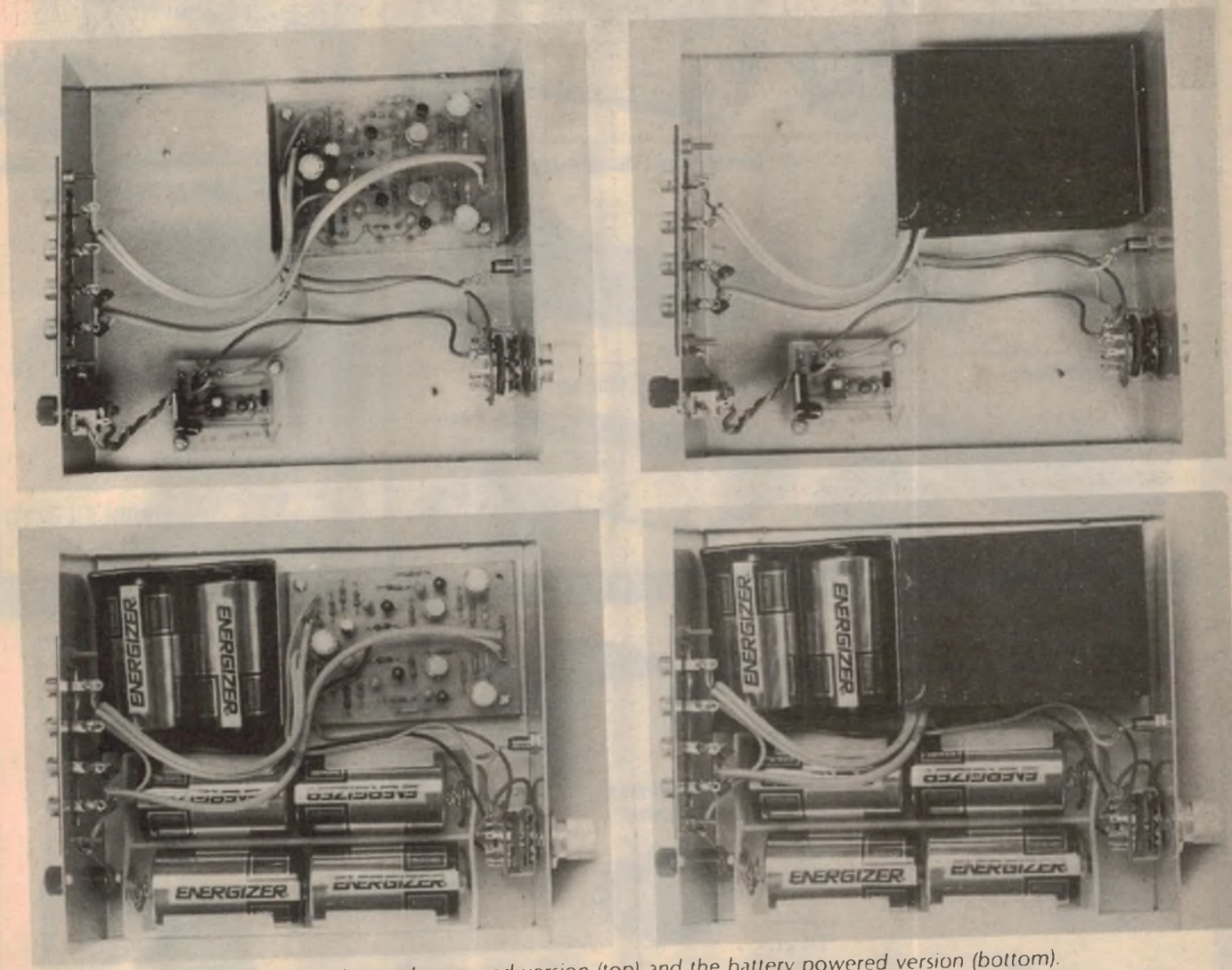

These internal views show the plug pack powered version (top) and the battery powered version (bottom).

feebly or not at all, a new battery is required.

CONSTRUCTION

Construction of the unit is straightforward. Most of the components are mounted on a single printed circuit board (PCB) coded 81mc7 and measuring 62 x 89mm. The optional regulator board is required for plug pack operation only. It measures 46 x 36mm and is coded 80gps3.

Mount the components on the main PCB according to the component overlay diagram included with this article. In particular note the orientation of the zener diode, transistors and electrolytic capacitors. We recommend that PC stakes be used for the various connections to the board, as these simplify connection and give a neat appearance.

We built our unit into a standard metal case measuring 184 x 70 x 160mm (D x H x W). This unit comes with a U-shaped steel cover and an aluminium base and, because the case is not all steel, trouble with hum fields from nearby power transformers may be experienced in some instances. Our solution was to mount the preamp board inside a separate small galvanised (more commonly referred to as galvanised iron) steel box. This gives excellent results and, because it is inside the main case, does not detract from the appearance of the unit.

You will have to fabricate the steel box yourself. It consists of two U-shaped pieces (which may be galvanised iron, Zincalume, Marviplate, etc) which form the base and the lid. Dimensions of the box should be 64 x 92 mm (ie, just large enough to accommodate the PCB), while the height should be around 40mm. The PCB is mounted inside the box using four 10mm tapped brass spacers, which also serve to hold the base of the box inside the main case.

Before mounting the PCB, however, make a cutout on the back panel for the 4-way RCA connector and drill holes for the back panel earthing terminal and the front panel switch and LED bezel. Drilling centres can be obtained from the front panel artwork shown actual size in this article. This artwork can also be used to produce a Scotchcal front panel or you can obtain a finished panel from the usual sources shown on the last page of this magazine.

The back panel earth terminal must be connected to an earthed lug and thence

We estimate that the current cost of components for this project is about

$30

including sales tax.

KITS KITS KITS KITS KITS KITS KITS KITS

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$44.90

Bidirectional Interface (Short Form Kit)

$60.00

Analogue and Digital Storage CRO Kit

$169.00

Oscilloscope Switch

$58.50

Infrared Light Beam Relay

$39.00

THIS MONTH'S KIT

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POOLS/LOTTO SELECTOR

Simple Fuzz Box

$19.00

Digital Storage CRO Kit

$78.00

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TV PATTERN GENERATOR
Kit of parts as featured in EA June 1980. Dot, Greyscale, Crosshatch, Raster, Check.
COMPLETE KIT (incl Scotchcal front panel) $48.49
KIT WITHOUT BOX $36.90

EPROM PROGRAMMER KIT
Kit of parts as featured in EA July 1980. Programs 2708, 2716 & 2532. Use with TRS 80, Sorcerer & Compucolour. Kit does not include connector from the programmer to computer.
COMPLETE KIT (inc Scotchcal Front panel) $72.49
KIT WITHOUT CASE $59.99

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Kit of parts as featured in EA MARCH 1980. Four Digits. Extremely popular.
COMPLETE KIT (inc Scotchcal Front Panel) $52.49
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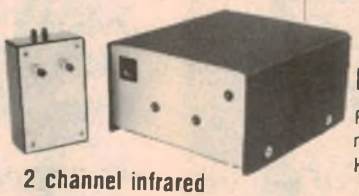
1. 240V to 6/7.5/9V $9.50
2. 240V to 9V $5.95



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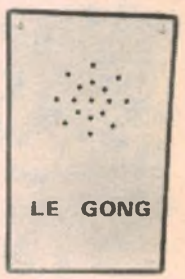

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KITS

ETI SERIES 4000 60W STEREO AMP KIT
Complete Kit Rack Mounting Case $199.00
Woodgrain Sided Case $189.00

PARTS AVAILABLE SEPARATELY

Front Panel	$10.90
Rack Mounting Case	$55.00
Wooden Sided Case	$49.00
ETI 471 PREAMP KIT of parts	$45.00
ETI 472 PS KIT of parts (without transformer)	$47.00
ETI 470 60W Kit pf parts (without heatsink)	$24.00
ETI 480 50W KIT of parts	$26.50
ETI 480 100W KIT of parts	$23.00
ETI 084 Car Alarm KIT	$17.50
EA TV CRO ADAPTER KIT	$22.50
EA 300W POWER AMP MODULE	$11.50
ETI 466 300W PA MODULE	$29.00
EA DIGITAL CAPACITANCE METER KIT (EA March 1980)	$63.50
AUTOCHIME KIT	$63.50
	$52.99
	$29.75

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ETI 576 ELECTROMYOGRAM KIT	$89.00

Please note we attempt to have all kits available to our customers. Provided of course we have the required information from the mags in time. Where a component is unavailable we may use a substitute or credit this cost so as to prevent delay.

EA Power Saver
August EA, an interesting approach to power savings. Kit of parts **$32.50**

ETI147 OCT 80 ELECTRONIC LOAD Kit parts	$75.00
ETI327 TURN HAZARD UNIT Kit parts	$22.00
EA DIGITAL ENGINE ANALYSER Oct 80 80TM8a/10 kit parts inc front panel	$44.95
EA CAR BATT VOLTAGE MON Oct EA kit parts	$6.50
EA BIPOLAR TRAIN CONTROLLER Nov 80 kit parts	$26.00
EA DIGITAL STORAGE CRO Adapter Nov 80 kit parts	$78.00
EA LIGHT BEAM RELAY NOV 80 Kit of parts	$13.00
EA RS232 PRINTER INTERFACE Nov 80 kit parts	$15.00

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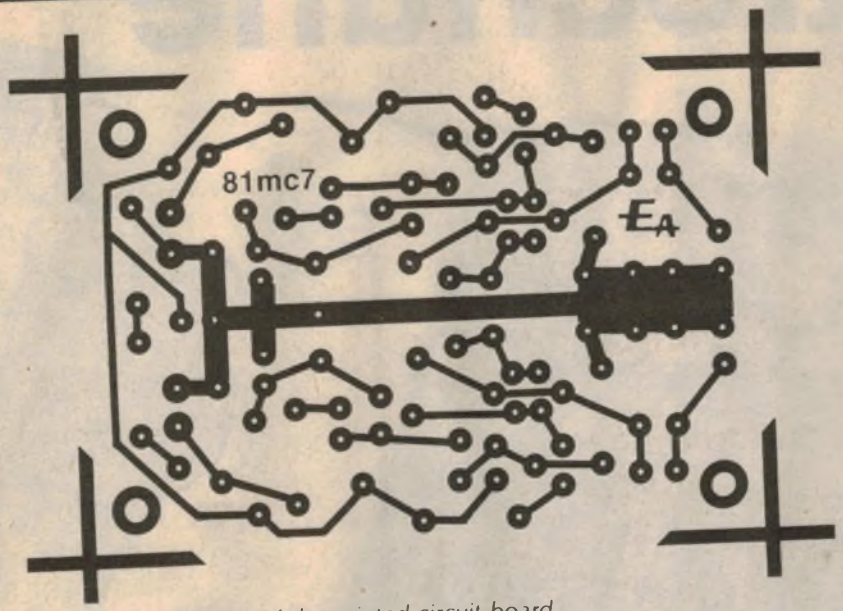
KITS



Actual size reproduction of the printed circuit board.

to the earth terminal on one of the output sockets. The RF chokes at the inputs are made by passing four turns of 28 SWG enamelled copper wire through a small ferrite bead, type FX1115 from Philips. One end of each choke is soldered to an RCA input terminal and the other end to the inner conductor at the shielded cable. The outputs from the preamp are also connected via shielded cable.

If you are using batteries to power your unit then you will require one 4 x "D" cell battery holder and one 2 x "D" cell battery holder. These are wired up in series to give the requisite 9V. Alternatively, a plug pack power supply and the regulator board can be used.

Finally, check all wiring carefully and then switch to the "battery check" position. The front panel LED should come on to indicate that battery voltage is present. Now switch to the "on" position and check the preamplifier for correct operation simply by connecting it to an MC cartridge and amplifier and "trying it out".

If an MC cartridge is not immediately available, touch the input terminals with your finger. You should hear a loud hum from the loudspeakers. Happy listening!

Back panel view of the unit. The two output sockets are at left while the input sockets are at right.

PARTS LIST

1 metal case, 184 x 70 x 160mm (D x H x W)
1 printed circuit board, code 81mc7, 62 x 89mm
1 single pole 3-position rotary switch
1 small red LED
1 4-way RCA panel socket
1 terminal post
6 1.5V "D" cell
1 4 "D" cell holder
1 2 "D" cell holder
4 10mm tapped brass standoffs
2 FX1115 ferrite beads
½ metre of 28SWG enamelled copper wire
½ metre of twin shield cable

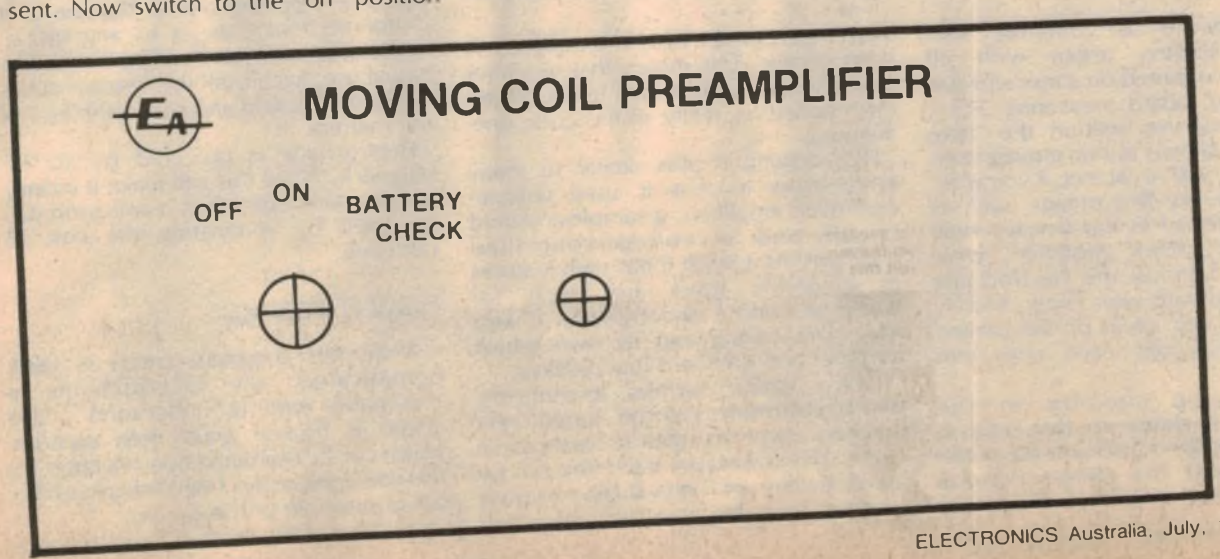
SEMICONDUCTORS
2 LM394 super match transistor pair
4 2N4250 PNP transistors
1 5.6V 400mW zener diode

CAPACITORS
3 100µF 16VW PC electrolytics
6 10µF 16VW PC electrolytics

RESISTORS (all ½W, 5%)
2 x 220kΩ, 2 x 68kΩ, 2 x 47kΩ, 4 x 10k Ω, 2 x 1.5kΩ, 2 x 470Ω, 3 x 220Ω, 2 x 100Ω, 2 x 47Ω, 2 x 10Ω

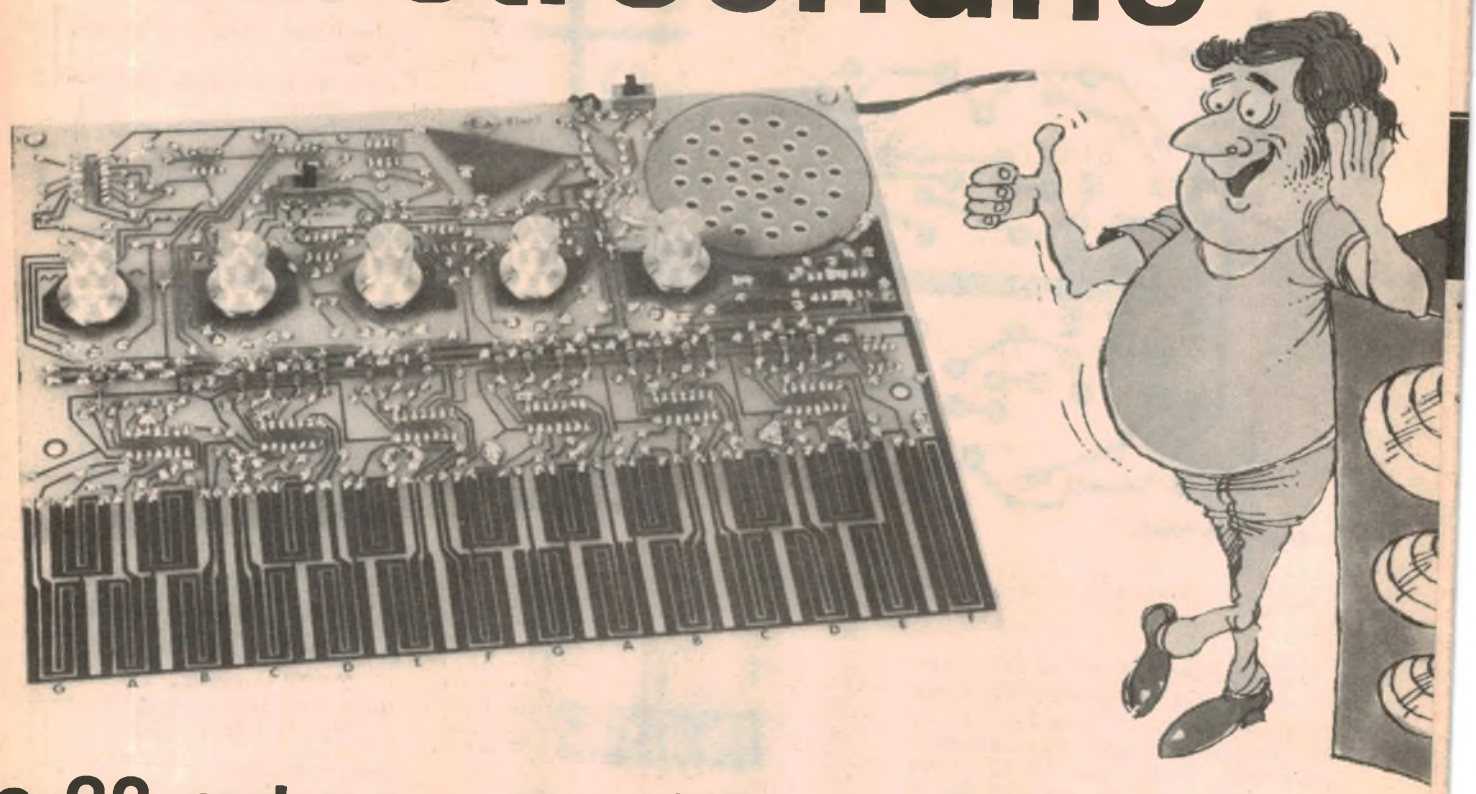
MISCELLANEOUS
Machine screws and nuts, hook-up wire, PC stakes etc.

ADD FOR PLUG-PACK OPERATION
1 9V DC plug-pack supply
1 printed circuit board, code 80gps3, 46 × 36mm
1 LM317T three-terminal regulator
1 3.5mm jack socket
2 1N4002 diodes
1 0.1µF metallised polyester capacitor
1 1µF 16VW tantalum capacitor
1 10µF 16VW tantalum capacitor
1 1.2kΩ resistor
1 180Ω resistor



Finished Scotchcal front panels will be available from the usual parts suppliers.

"Electrochune"



a 23-note organ with special effects

Why the name "Electrochune"? Because it's meant to be a fun name for a fun project. We think that readers will really enjoy it, both in the building and in making music. Electrochune is easy to put together, with no expensive hardware, and is capable of a surprising variety of harmonious sounds. Electrochune has a range of almost two octaves, together with sharps and flats, and has six controls for varying its sound output.

by JOHN CLARKE

Electrochune is a complete self-contained keyless organ with all components mounted on a medium-size printed circuit board measuring 249 x 201mm. It can be built in the "bare bones" form shown in our photographs or dressed up with a cabinet, if you wish.

While earlier keyless organs, such as the one published in the January 1969 issue of "Electronics Australia", were played with a stylus, the Electrochune can be played with your finger. Merely touching the "key" areas on the printed circuit board brings each note into action.

Much of the circuitry in the Electrochune is similar to that used in modern synthesizers and so it has some features similar to these popular instruments. For example, like most synthesizers, Electrochune is monophonic. This means that it cannot play chords and is meant to be played one-handed or, really, in this case, one-fingered.

Electrochune is also similar to many synthesizers in that it uses voltage-controlled amplifiers, a sample-and-hold circuit and a voltage-controlled oscillator. As a result it has such features as adjustable attack and decay for envelope control and tremolo. It also has voice mixing and its own inbuilt amplifier and on-board loudspeaker.

Unlike earlier keyless instruments, the Electrochune can be tuned very precisely over its almost two-octave range. This is because each key can be tuned exactly and individually, without affecting any other key. This means that if you want to use the Electrochune seriously, in spite of our remarks at the beginning of this article, you can do so and set up each key so that it is exactly on pitch.

It is also possible to tune the Electrochune to match other instruments. The mind boggles at the possible ramifications of this – you could even have "Electrochune in Concert".

Even though the Electrochune can be tuned very precisely, as noted above, it is not necessary to go to any special bother if you are just building the unit for casual use. Just install the resistor values we have specified and that is the end of the matter.

Electrochune is powered by an AC plugpack. While this will make it initially a little more expensive, it will soon pay for itself by eliminating the cost of batteries.

HOW IT WORKS

While the complete circuit is fairly complicated, the Electrochune is reasonably easy to understand if the circuit is broken down into sections which can be examined one at a time. To this end, look at Fig. 1 which explains the broad principle of the circuit.

Fig. 1 shows the heart of the circuit as a

voltage controlled oscillator (VCO). As the name implies, this has a frequency output which is proportional to a voltage applied to its input. The input voltage for each note is fed to the VCO from its individual voltage divider via an individual switch. Since there are 23 notes, there are 23 separate voltage dividers and 23 switches, each of which is actually a switch element in a CMOS quad bilateral switch package.

Following the VCO are the envelope-shaping and tremelo circuits and the audio amplifier and loudspeaker. Now if it were not for the fact that we wish to provide envelope shaping, the simple principle embodied in Fig. 1 would be adequate and the complete circuit diagram would be quite a lot simpler than it is.

By "envelope shaping" we mean giving

FREQUENCY OF NOTES USED (Hz)

G	196.0	G	392.0
G'	207.7	G'	415.3
A	220.0	A	440.0
A'	233.1	A'	466.2
B	246.9	B	493.9
C	261.6	C	523.3
C'	277.2	C'	554.4
D	293.7	D	587.3
D'	311.1	D'	622.3
E	329.6	E	659.3
F	349.2	F	698.5
F'	370.0		

a precise and defined value to the attack and decay of each note. This means that for a given setting of the controls for attack and decay, each note will sound roughly the same in initial intensity, in duration and in the way it fades into silence. Thus, the envelope of each note will be same regardless of whether the player hits the notes in staccato or slower fashion.

This is quite a refinement compared to previous keyless organs which provided very little facility for expression.

Okay. Now remember that the VCO requires a defined input voltage to produce a given frequency and that it is only while the particular keyswitches are closed that they connect the particular note voltage divider to the VCO. So what happens when the player takes his great greasy finger off the particular key and expects the note to fade away? It doesn't. Because when the input voltage is removed from the VCO its frequency immediately rises to a very high value which is its free-running frequency. Since this would lead to a very unmusical and totally unsatisfactory instrument, we need to provide some means for the circuit to "remember" the VCO input voltage after the key is pressed. This is done with a sample-and-hold circuit and this is incorporated into the scheme of things as shown in Fig. 2.

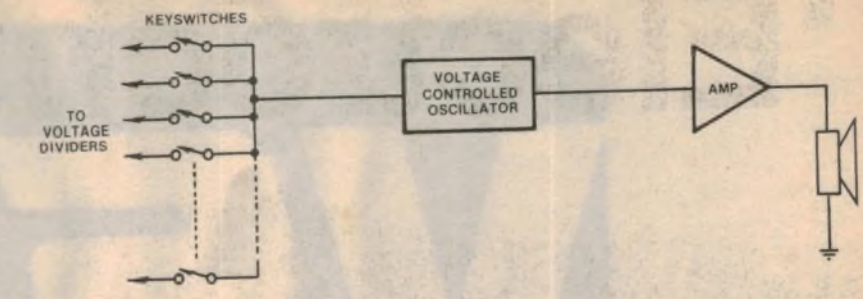


Fig. 1

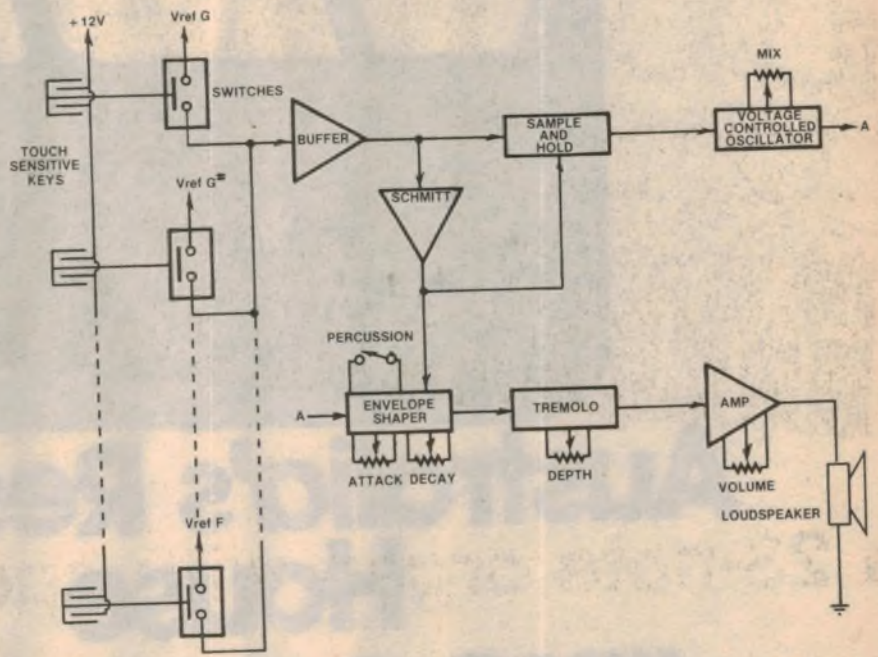


Fig. 2

This block diagram shows an array of switches for the various notes, each with its own voltage divider. When a key is touched, the appropriate CMOS switch is closed, feeding the note voltage through to a FET-input op amp which operates as a buffer stage. The output from this buffer is fed to a conventional op amp functioning as a Schmitt trigger and to a sample and hold circuit. The Schmitt trigger controls the sample-and-hold circuit as well as the envelope-shaping circuitry (for attack and decay) following the VCO. After the envelope shaper a similar circuit provides further signal processing in the form of Tremolo (amplitude modulation). Finally, the signal is amplified and fed to a loudspeaker.

Fig. 3 shows the different functions possible with the envelope shaping and Tremolo circuits.

Now with Fig. 1 and Fig. 2 in mind, we can consider the complete circuit diagram. The heart of the circuit, the VCO, is IC4, which is an Exar 2206 function generator IC. This is connected to provide simultaneous sine and square wave outputs which are mixed across a 5kΩ potentiometer. This provides the necessary range of sine and square waveforms.

Looking back to the key inputs, ICs 11, 12, 13, 14, 15 and 16 are quad CMOS bilateral switches which provide the input from the note voltage dividers. The CMOS switches are switched by skin resistance of the finger placed across the appropriate key pattern.

The selected note voltage is fed to a FET-input operational amplifier, IC10, operating as a buffer stage. The input of IC10 is normally held high by a 10MΩ resistor, when all CMOS switches are closed. This resistor has a negligible loading effect on the note voltage.

The output of IC10 is fed to IC8, the Schmitt trigger and also to the sample-and-hold circuitry. This consists of a single CMOS switch (IC14d) and IC3, another FET-input operational amplifier connected as a voltage-follower which monitors the voltage across a .047μF capacitor.

SAMPLE-AND-HOLD

As soon as a selected voltage appears at the output of buffer IC10, it drives the

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Carbon Film Resistors
¼ watt 5% tol.

Metal Film Resistors
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40¢	50¢	$2	$2.50
100 in 1000 lots*	100 in 100 lots*	100 in lots of 1000*	100 in lots of 100*

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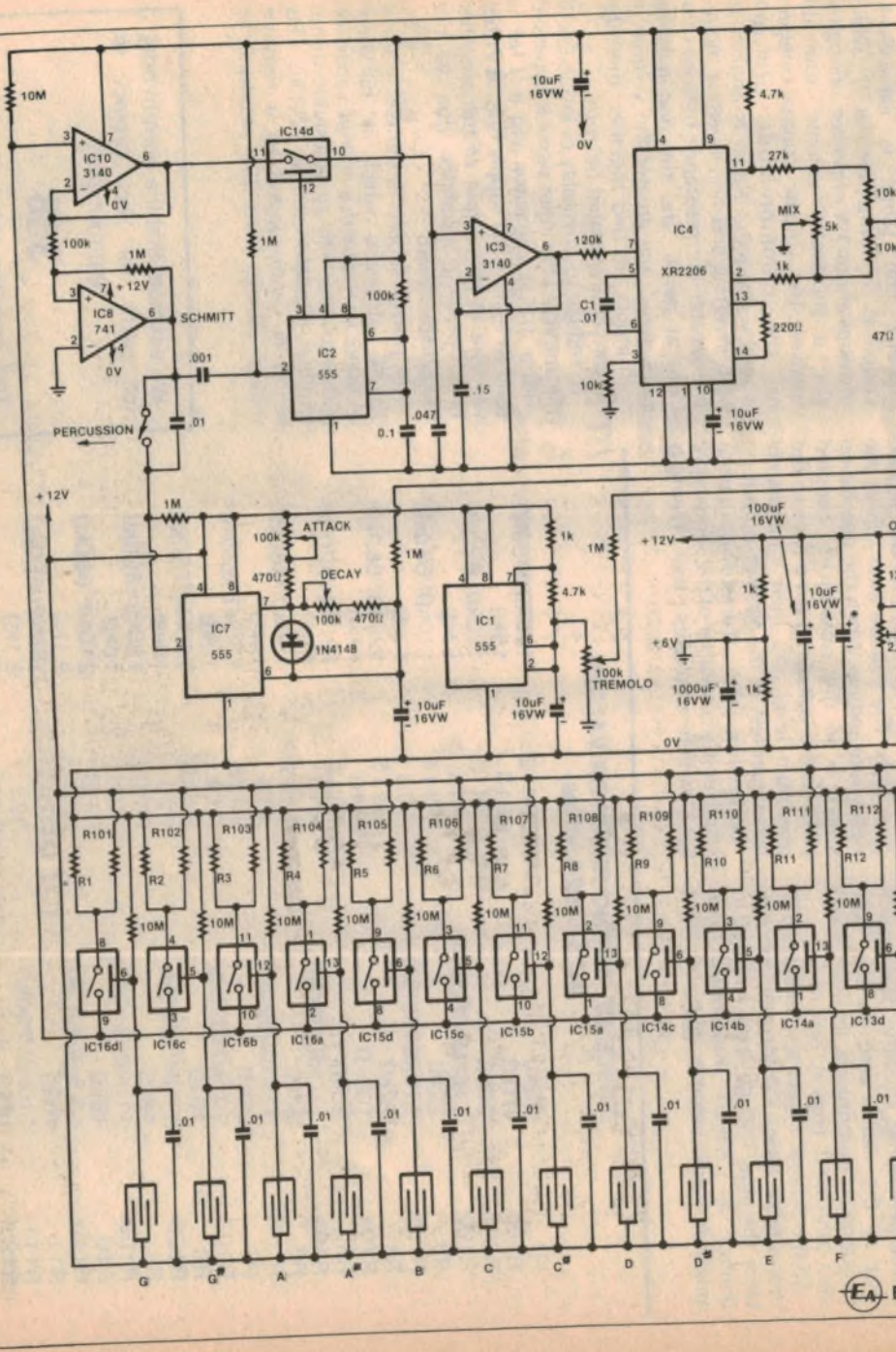
10M
IC10
3140
0V
IC14d
1M
100k
1M
+12V
IC8
741
SCHMITT
.001
PERCUSSION
.01
0V
IC2
555
100k
.047
0.1
IC3
3140
.15
10uF
16VW
0V
120k
IC4
XR2206
C1
.01
10k
4.7k
27k
MIX
5k
1k
220Ω
10uF
16VW
+12V
1M
ATTACK
100k
470Ω
DECAY
100k
470Ω
IC7
555
1N414B
IC1
555
1M
1k
4.7k
100k
TREMOLO
10uF
16VW
10uF
16VW
100uF
16VW
+12V
1k
10uF
16VW
+6V
1000uF
16VW
1k
0V
R101
R102
R103
R104
R105
R106
R107
R108
R109
R110
R111
R112
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
10M
IC16d
IC16c
IC16b
IC16a
IC15d
IC15c
IC15b
IC15a
IC14c
IC14b
IC14a
IC13d
.01
G
G#
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C
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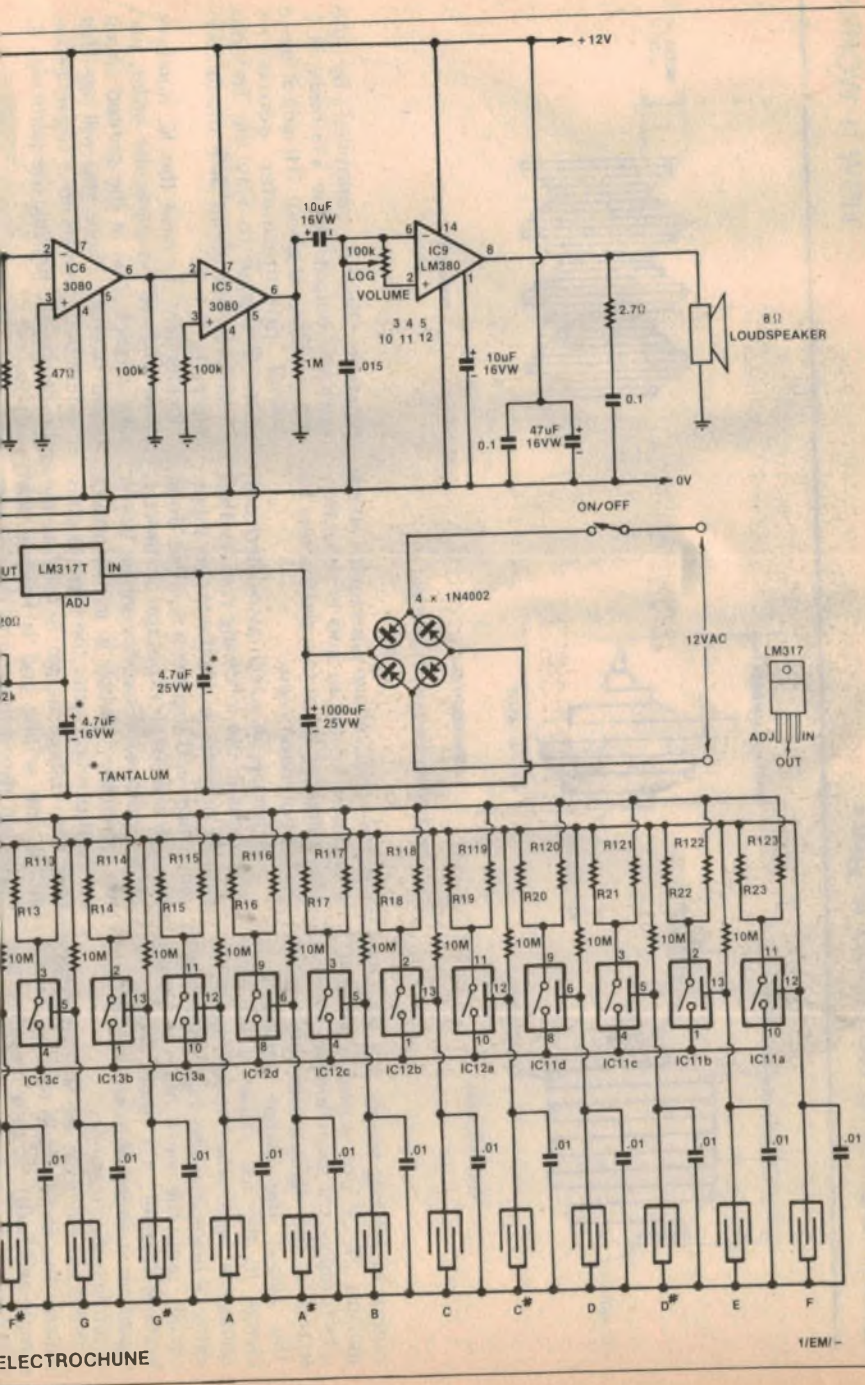
D
D#
E
F


+12V
10uF 16VW
100k LOG VOLUME
IC9 LM380
IC6 3080
IC5 3080
3 4 5
10 11 12
1M
.015
10uF 16VW
2.7Ω
8Ω LOUDSPEAKER
0.1
47uF 16VW
0V
ON/OFF
LM317T
IN
ADJ
4 x 1N4002
12VAC
LM317
4.7uF 25VW
4.7uF 16VW
1000uF 25VW
TANTALUM
R113
R114
R115
R116
R117
R118
R119
R120
R121
R122
R123
10M
IC13c
IC13b
IC13a
IC12d
IC12c
IC12b
IC12a
IC11d
IC11c
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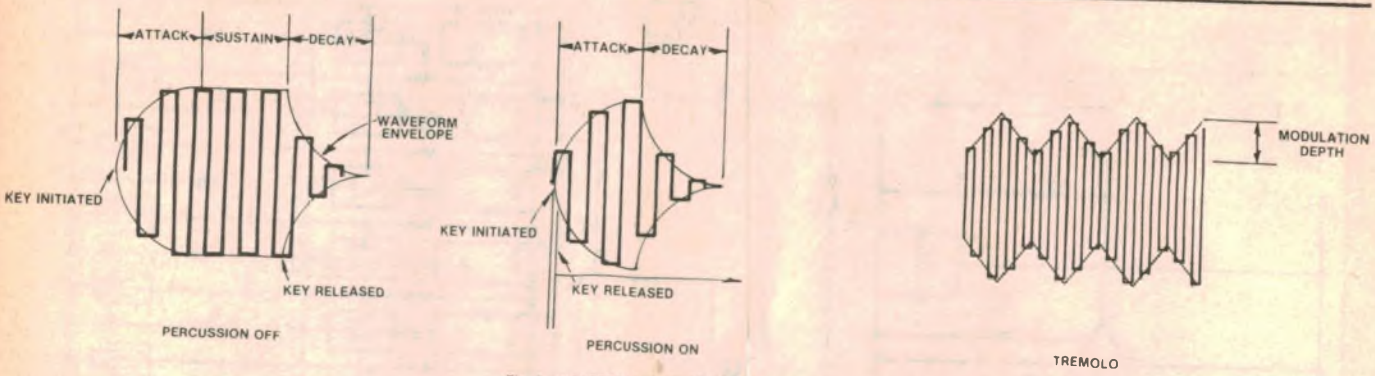

Fig. 3 WAVEFORM ENVELOPE CONTROL

output of Schmitt trigger IC8 low. This initiates the 555 monostable timer IC2 which delivers a short turn-on pulse to IC14d in the sample-and-hold circuit. This allows the .047μF capacitor to charge to the full value of the note voltage, a value which it will "hold", by virtue of being in a very high impedance circuit, until the next note is struck. Voltage-follower IC3 then feeds the capacitor voltage value to the VCO to determine the frequency.

At the same time as the Schmitt trigger initiates the monostable to operate the sample-and-hold, it also initiates the envelope-shaping circuitry. This means that at the same time as the note frequency is determined, its envelope is also controlled. Logical, isn't it?

So the Schmitt trigger also initiates 555 monostable timer IC7 for a set period. Here, the ramp voltage at pin 6 is used to control a CA3080 transconductance amplifier (read: variable gain amplifier) IC6. The ramp voltage goes up for attack and down for decay and is separately controlled for these two parameters by 100kΩ potentiometers.

The percussion switch associated with IC7 works in the following way. A 1MΩ resistor normally holds the trigger input, pin 2, high and triggering is either done through the .01μF capacitor or directly, via the percussion switch contact. When the percussion switch is in the direct coupled position, after the Schmitt goes low, the voltage at pin 6 rises at the attack rate setting and is held at the maximum rise voltage until the Schmitt goes high. The voltage then falls at the decay rate setting. When the percussion switch is in the capacitively coupled position the voltage at pin 6 rises to the maximum level and then immediately falls regardless of the Schmitt output.

Following the transconductance amplifier IC6 is another of the same type, IC5, which provides the Tremolo function. This is controlled by the sawtooth output of the 555 timer, IC1. IC1 oscillates at about 7Hz and it has a 100kΩ potentiometer across its sawtooth output to vary the Tremolo effect between about 30% modulation and zero.

Incidentally, in case the IC numbers seem to have no particular order, just take a quick look at the printed circuit board overlay. There you will see that the numbering refers to a sequence on the PC board, making the particular IC easy to find.

Finally, the signal is capacitively-coupled to amplifier, IC9, which provides about 1W of power, enough to give a substantial volume from the speaker. The volume control operates on the common-mode principle whereby the input signal is applied to both inverting and non-inverting inputs. The greater the resistance between the input at pin 6, and the non-inverting input, pin 2, the greater the volume. If both inputs are tied together, then the output volume would be zero.

To reduce to possibility of instability of the amplifier, the input signal is bypassed with a .015μF capacitor and a 0.1μF is used to bypass the supply rails. A Zobel network at the output of the amplifier helps prevent instability due to the loudspeaker load.

The power supply is derived from a 12VAC plugpack which is full-wave rectified, filtered with a 1000μF capacitor and regulated with an adjustable three-terminal regulator set to 12VDC. This supply is centre-tapped by a resistive voltage divider (two 1kΩ resistors) to

TABLE OF TUNING RESISTOR VALUES
(all 5% E24 series)

R1	22kΩ	R112	120kΩ//680kΩ
R101	91kΩ	R13	15kΩ
R2	22kΩ	R113	120kΩ//680kΩ
R102	110kΩ//680kΩ	R14	13kΩ
R3	22kΩ	R114	110kΩ//680kΩ
R103	110kΩ//750kΩ	R15	13kΩ
R4	22kΩ	R115	120kΩ//680kΩ
R104	100kΩ	R16	12kΩ
R5	20kΩ	R116	120kΩ//820kΩ
R105	110kΩ//680kΩ	R17	11kΩ
R6	20kΩ	R117	130kΩ//560kΩ
R106	110kΩ//820kΩ	R18	10kΩ
R7	20kΩ	R118	130kΩ//620kΩ
R107	120kΩ//620kΩ	R19	10kΩ
R8	18kΩ	R119	150kΩ//750kΩ
R108	110kΩ//620kΩ	R20	10kΩ
R9	18kΩ	R120	180kΩ//820kΩ
R109	110kΩ//910kΩ	R21	10kΩ
R10	18kΩ	R121	240kΩ//680kΩ
R110	120kΩ//750kΩ	R22	9.1kΩ
R11	16kΩ	R122	360kΩ//560kΩ
R111	110kΩ//750kΩ	R23	9.1kΩ
R12	16kΩ	R123	330kΩ

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

$68

This includes sales tax and the AC plug pack.

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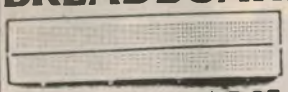
PRICE CRASH on BREADBOARD



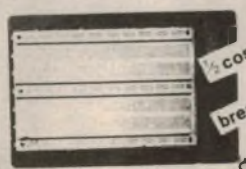
WB-TN 640 Holes $8.95

WB-DN 100 Holes $2.50

imported

WB-2N 200 + 640 Holes $13.50

WB-2N-1 100 + 640 Holes $12.00



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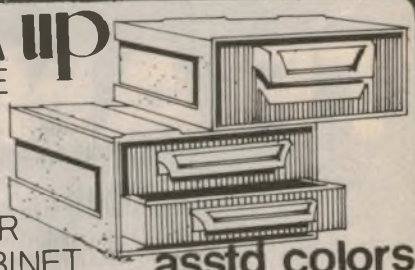

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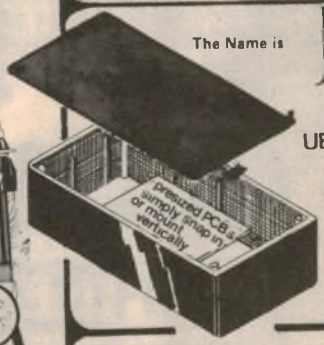

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2	3·75	3·00	2·75
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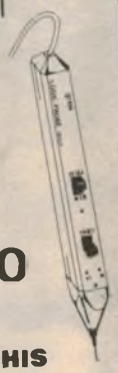

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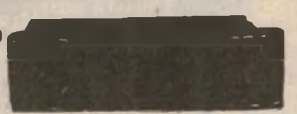

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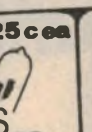

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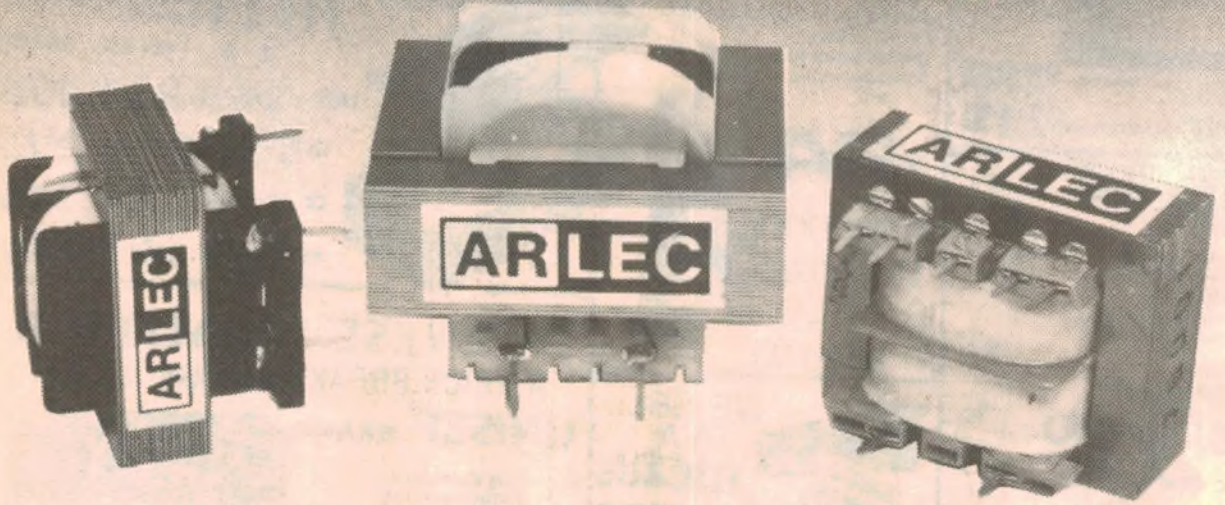

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All dimension in mm.

Size	1VA	2/3VA	5/7VA	10/12VA
Width	30	35	41†	48
Depth	25	30	33†	40
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†May also be supplied as 43×36

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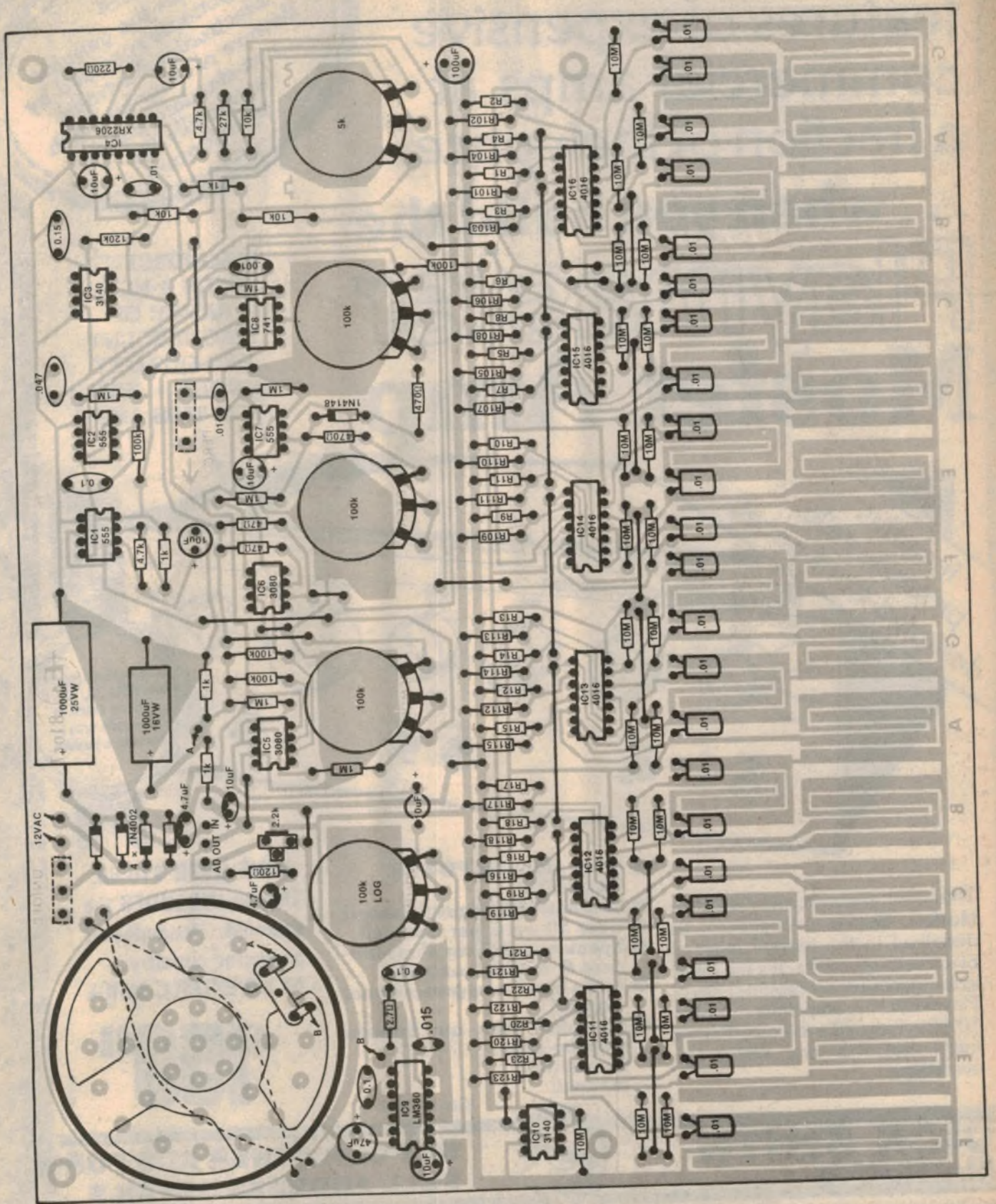

Building the "Electrochune" is easy – just follow this wiring diagram. Note that the ON/OFF and PERCUSSION switches are mounted on the copper side of the board. IC sockets are optional.

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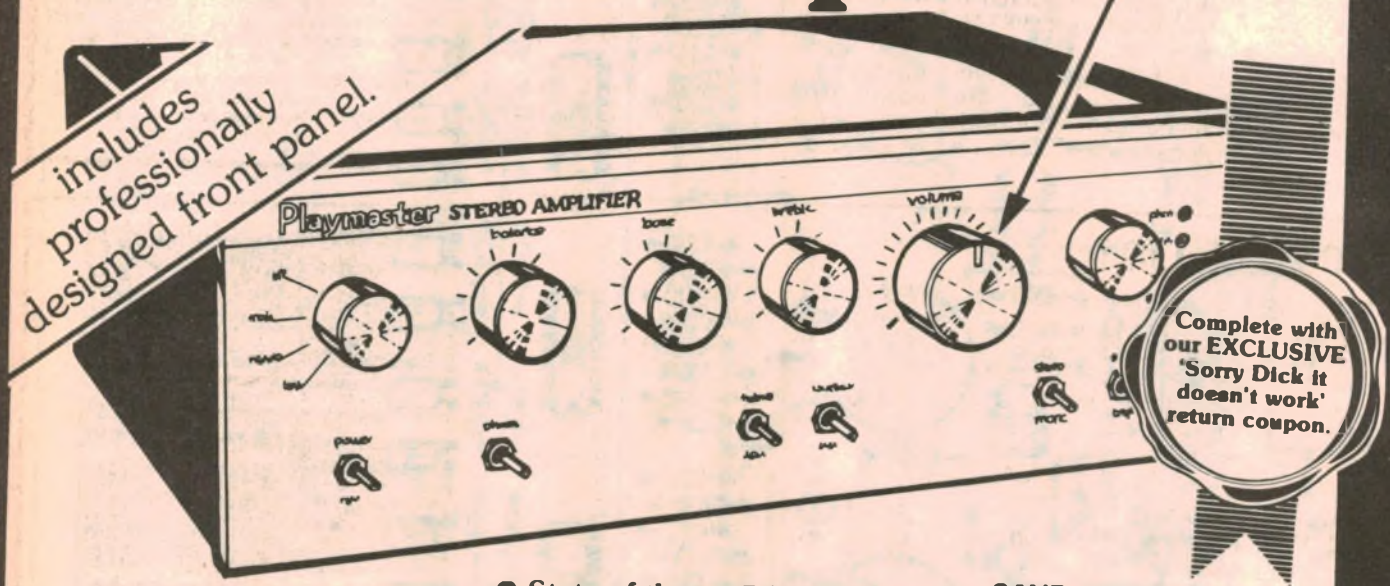

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This is it: the new Playmaster Power Mosfet Stereo Amplifier, as described in the current issue of Electronics Australia. It's the latest in the incredibly successful series of Playmaster amplifiers (over 10,000 Twin 25's & Forty/Forty's built!) but this one really has everything:

- **State-of-the-art POWER MOSFETS!**
- **Low-noise FET input preamps!**
- **Over 50 watts per channel!**
- **Speaker switching plus loudness & muting controls!**
- **And a brand new professional styling!**
- **Complete with our famous step-by-step instruction manual!**

SAVE OVER $10.00: This kit INCLUDES the optional loudspeaker protector circuitry: AT NO EXTRA CHARGE

$159.00

Cat. K-3610

DICK SMITH Electronics

SEE OUR OTHER ADS FOR FULL ADDRESS DETAILS

provide decoupled reference voltage for the various op amps. Decoupling is provided by a 1000μF capacitor which also carries the loudspeaker return current.

CONSTRUCTION

As mentioned previously, all the components are accommodated on a large PC board measuring 249 x 210mm and coded 81or7. While our prototype had a gold flash over it for corrosion protection, we understand that production PC boards will be tin-plated. This will provide the same corrosion protection and also make it easy to solder.

Start assembly by making sure the holes are drilled to suit the potentiometers and slider switches used. Solder in all the links (use tinned copper wire) keeping them straight and tight between the mounting holes.

Next all the resistors can be soldered in place. Note that R1/R101 to R23/R123, whose values are depicted in the accompanying table have some parallel resistor combinations. These are mounted on both sides of the PC board. The resistors on the copper side are soldered directly over the opposing resistor and on the same mounting holes.

Now the ICs can be soldered in place making sure the orientation is correct. Note that not all the ICs are oriented in the same direction. The CMOS ICs should be soldered in place last, making sure that the supply pins (pins 7 and 14) are soldered first using an earthed soldering iron.

The capacitors can then be connected in place. We soldered the 23 .01μF capacitors for the keyboard 3-4mm above the PC board such that they could be bent over flush with the PC board. This prevents them from being broken off and gives a neater appearance.

The potentiometers are bolted to the PC board in their respective holes, and the terminals of these soldered directly to the PC board. The solder lug eyelet of each terminal will need to be cut off and the whole terminal bent through 180° in order for this to be achieved.

The loudspeaker is mounted face down on the fibreglass side of the PC board. Two lengths of stiff tinned copper wire are then soldered across the back of the loudspeaker from one side to the

PARTS LIST

1 printed circuit board, code 81or7, 248 x 200mm
3 100kΩ linear potentiometers
1 100kΩ logarithmic potentiometer
1 5kΩ linear potentiometer
2 SPDT slider switches
1 65mm loudspeaker
1 AC plug pack 12VAC 500mA

SEMICONDUCTORS
1 XR-2206 monolithic function generator
2 CA3140 BiMOS operational amplifiers
1 741 operational amplifier
2 CA3080 operational amplifier
1 LM380 audio power amplifier (14 pin DIL)
3 555 timers
6 4016, 4066 quad bilateral switches
1 LM317 three terminal regulator
1 1N4148 small signal switching diode
4 1N4002 1A rectifier diodes

CAPACITORS
1 1000μF 25VW axial lead electrolytic
1 1000μF 16VW axial lead electrolytic
1 100μF 16VW PC electrolytic
1 47μF 16VW PC electrolytic
6 10μF 16VW electrolytic
1 10μF 16VW tantalum
1 4.7μF 25VW tantalum
1 4.7μF 16VW tantalum
1 0.15μF metallised polyester
3 0.1μF metallised polyester
1 .047μF metallised polyester
1 .015μF metallised polyester
25 .01μF metallised polyester
1 .001μF metallised polyester

RESISTORS (5% tolerance, ¼W) 24 x 10MΩ, 6 x 1MΩ, 1 x 120kΩ, 4 x 100kΩ, 1 x 27kΩ, 3 x 10kΩ, 2 x 4.7kΩ, 4 x 1kΩ, 2 x 470Ω, 1 x 220Ω, 1 x 120Ω, 2 x 47Ω, 1 x 2.7Ω, 1 x 2.2kΩ miniature vertical trimpot.

RESISTORS (5% tolerance, E24 series) 1 x 910kΩ, 3 x 820kΩ, 4 x 750kΩ, 7 x 680kΩ, 3 x 620kΩ, 2 x 560kΩ, 1 x 360kΩ, 1 x 330kΩ, 1 x 240kΩ, 1 x 180kΩ, 1 x 150kΩ, 2 x 130kΩ, 6 x 120kΩ, 7 x 110kΩ, 1 x 100kΩ, 1 x 91kΩ, 4 x 22kΩ, 3 x 20kΩ, 3 x 18kΩ, 2 x 16kΩ, 1 x 15kΩ, 2 x 13kΩ, 1 x 12kΩ, 1 x 11kΩ, 4 x 10kΩ, 2 x 9.1kΩ.

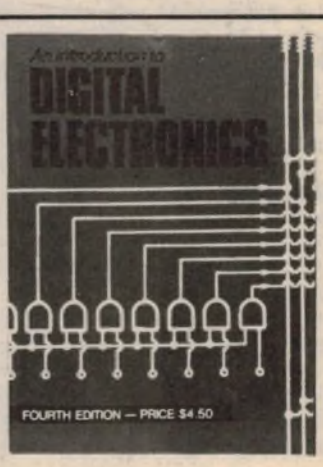
MISCELLANEOUS
Tinned copper wire, solder, hook-up wire etc.

NOTE: Components specified are those used in the prototype. In general components of higher voltage and/or wattage ratings can be used providing they are physically compatible.

FUNDAMENTALS OF SOLID STATE

Fundamentals of Solid State has been reprinted, revised and updated showing how popular it has been. It provides a wealth of information on semiconductor theory and operation, delving much deeper than very elementary works but without the maths and abstract theory which make many of the more specialised texts very heavy going. It begins with atomic theory, diode types, uni-junction, field effect and bipolar transistors, thryistor devices, device fabrication and microcircuits. A glossary of terms and an index complete the book.

Available from "Electronics Australia", 57 Regent St, Sydney. **Price $3.50.** Also by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. **Price $4.20.**



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other and hold it tightly to the PC board.

Finally the wires can be brought to the loudspeaker and the slide switches soldered to the PC board. Note that the switches are soldered on the copper side of the board, and not the fibreglass side as would normally be the case.

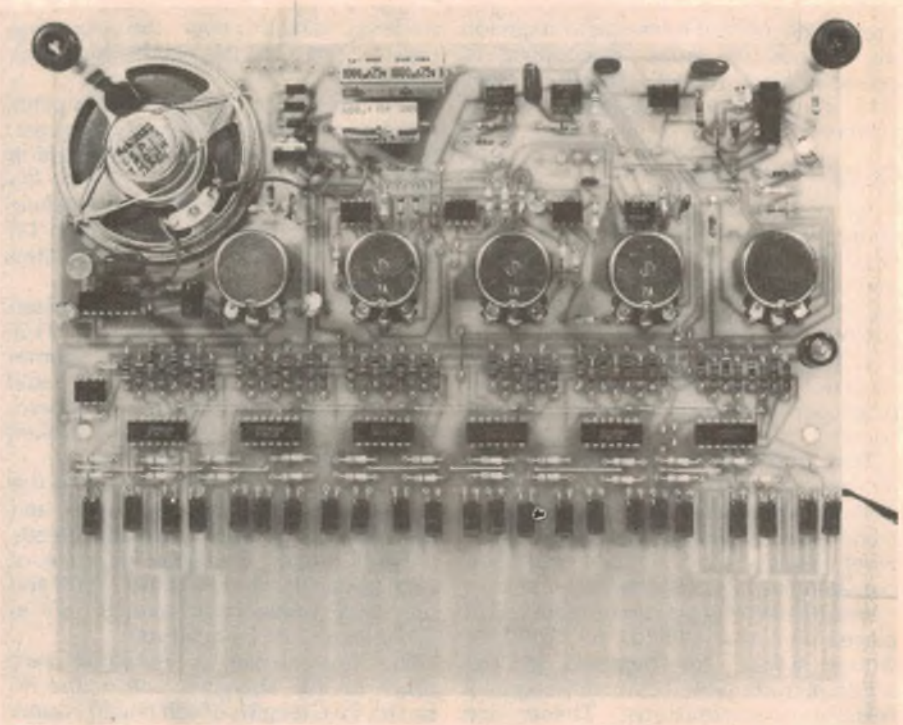
As far as tuning is concerned, we have attempted to make this as simple as possible. By using the values specified, the organ should be in reasonable tune. However, the overall tune would depend upon the voltage provided by the regulator being set close to 12 volts and the capacitor used for the oscillator on IC2.

For critical tune applications, the organ can be adjusted with the aid of a frequency meter or organ tuning standard. The frequencies for each note are given in the accompanying table for frequency meter use, but for the tuning reference methos, beats can be listened for or Lissajous figures set up on an oscilloscope. Various parallel resistors can be placed across the reference resistors, R1/R101 to R23/R123, until the instrument is in tune.

Note that the order of tuning resistors does not exactly follow the keyboard note order, but the relevant resistors for each note are labelled on the PC board overlay diagram for easy identification.

If you wish to make the Electrochune tunable to match other instruments, it will be necessary to have a variable capacitor in parallel with C1, which is connected between pins 5 and 6 of IC4, the VCO. The largest suitable variable capacitor we know is the solid dielectric type used in most portable AM radios. These normally have a range of several hundred picofarads, giving a useful tuning range.

Note that if you wish to make use of this option, you will have to make sure that, when the variable capacitor is in circuit, the Electrochune can be brought to standard tune, ie A at 440Hz. The same remark applies if you wish to tune the whole instrument precisely, as described above: first make sure that you have a precise 12 volts from the regulator and then set A440 by suitable adjustment (ie, padding with small parallel capacitors if necessary) of C1.



The completed prototype. Note that some tuning resistors are also soldered to the copper side of the printed circuit board (see photo p52 and table p56).

Playing the Electrochune involves the use of one finger only. If a second finger contacts another note while the first finger remains on a key the same note will still play. It is not until all fingers are released from the keyboard that another note can be played.

From time to time it will be necessary to clean off the keyboard (with a weak detergent solution) so that any build-up of grease and dirt does not prejudice operation by tending to turn on the CMOS keys. Do not use abrasive cleaners for this job.

The Attack and Decay controls are adjustable from about .005 seconds to about one second, giving rise and fall envelope times varying from almost instant to a slow rise time. Note that if the percussion is on with maximum attack and decay times, then just a "plop" will be heard. With the percussion off, the note will appear to respond only when the key is pressed.

Next month we hope to publish constructional details of a suitable cabinet for the Electrochune, together with a label for the controls.

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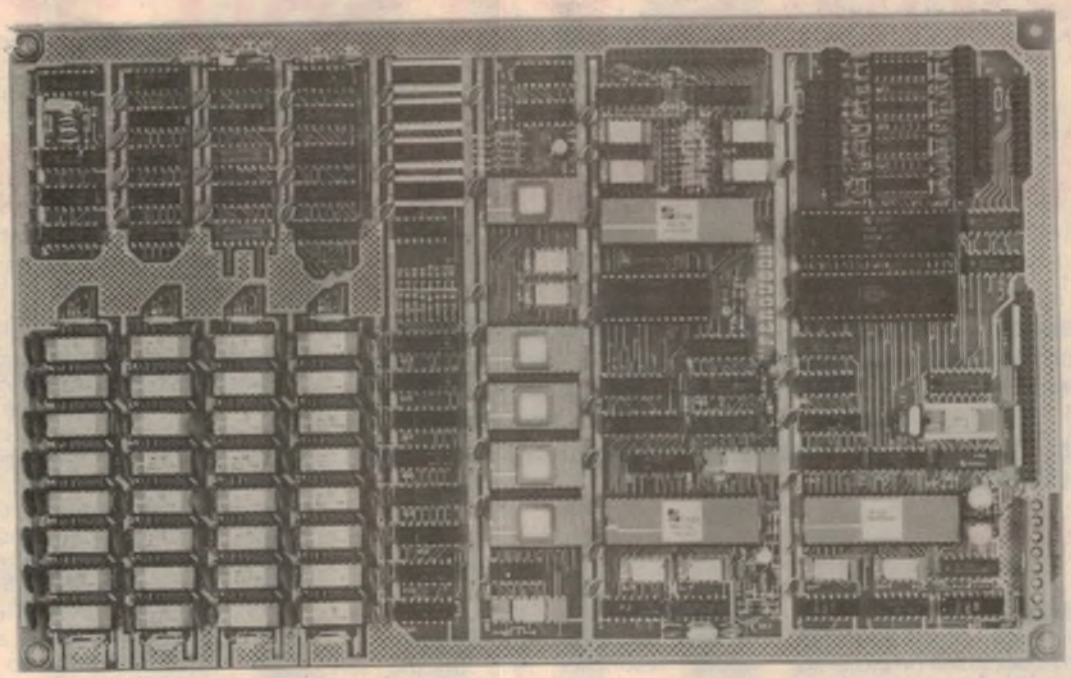

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EA 7/81

Two high-performance loudspeaker systems to build

Peerless PAS60 and PAS25 loudspeakers

This is the second of two articles presenting Peerless loudspeaker systems. For those who do not have the room or taste for the large PAS100 systems produced last month, we now present the PAS60, a three-way, 60 litre system and the PAS25, a two-way, 25 litre system. Both these systems represent very good value for money, particularly the PAS25.

by LEO SIMPSON

Let us talk about the Peerless PAS60 system first. This is still a relatively large system at 60 litres but it will be easier to accommodate a pair of these than a pair of the 100 litre PAS100 systems described last month. Another advantage is that the step-down in size does not mean a proportional step-down in performance. Far from it. Both the efficiency and power handling of this system are close to that of the PAS100. Efficiency is around 92dB (down 1.5dB from the PAS100) while power handling is 90 watts.

Dimensions of the PAS60 are 400 × 700 × 290mm, not including the grille cloth frame and mass is approximately 18.5kg.

As in any multi-way loudspeaker system, the major parameters of the 60 litre three-way PAS60 system are set to match those of the woofer which in this case is quite an impressive unit called the KP100WFX, it has a nominal diameter of 250mm and a large foam rubber roll surround which enables a low resonance figure of 28Hz to be achieved in free air.

As with other Peerless woofers in this series, the cone material is Peercone, a white moulded polypropylene material which has high tensile strength, low mass, high temperature stability and high internal damping. The resulting dynamic mass of the Peerless 250mm woofer is a mere 25 grams.

The woofer has a large ceramic magnet providing quite a high flux density of 0.95 Tesla (9500 gauss). This results in a Q-factor of 0.4 and a sensitivity of 92dB. As mentioned last month, this means that the woofer will produce a sound pressure level of 92dB at distance of one metre on its axis with a drive signal of one watt at a reference frequency which is probably 400Hz or 1kHz.

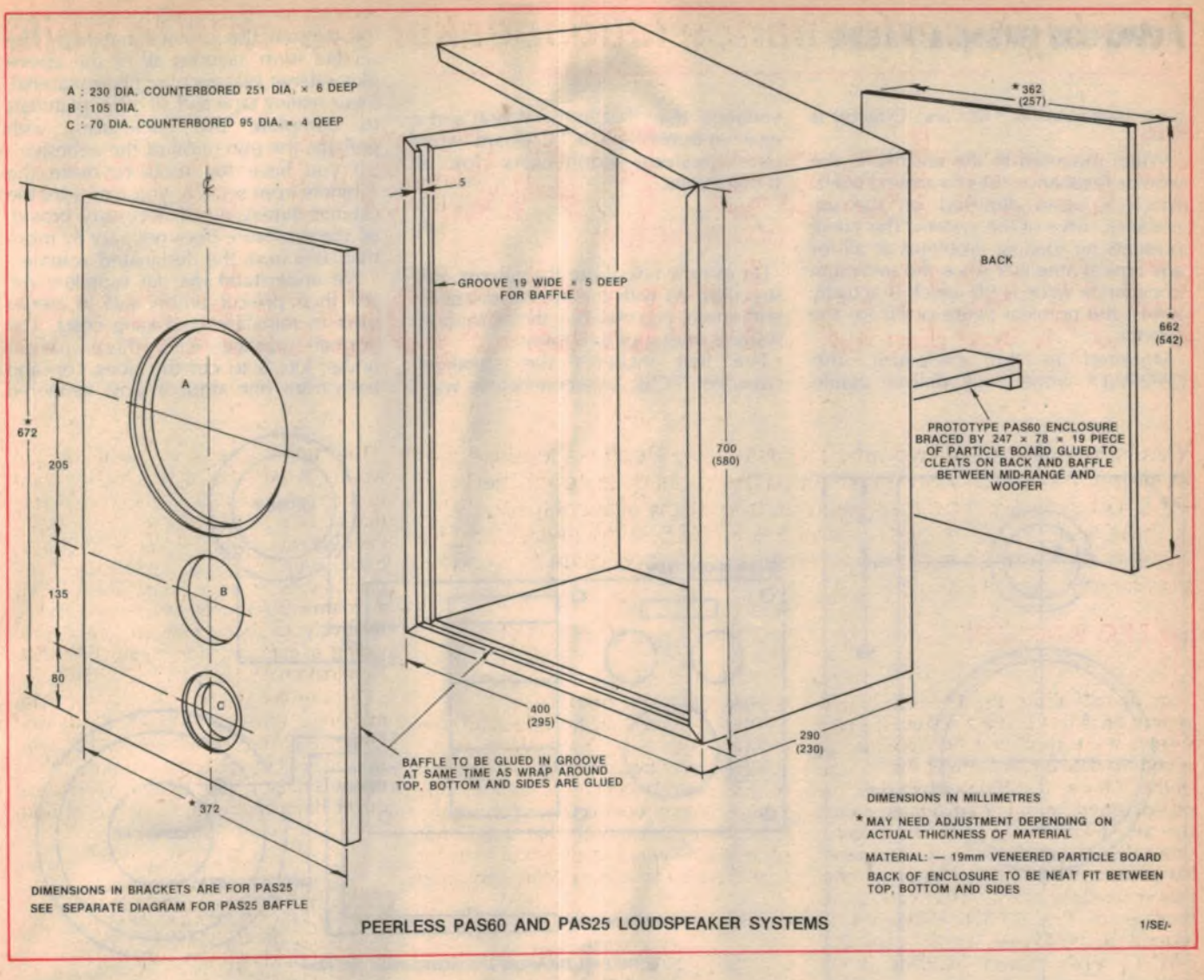
When mounted in the enclosure, the woofer resonance rises to the still relatively low figure of 50Hz, as shown by the impedance curve for the total system. While we are talking about the impedance curve note that it will not present any undue loading problems for typical stereo amplifiers. Minimum value of the PAS60 system impedance occurs at around 15kHz, with a value of just over 5Ω.

With the resonance of the woofer being around 50Hz in the enclosure, the resulting system has a usable bass response down to below 40Hz.

The upper frequency limit of the woofer is 2kHz but the crossover point to the midrange unit is an octave below that at 1kHz. The midrange driver is the Peerless KU45MRF which is an open-back unit with an effective cone diameter of around 75mm. This too has a foam rubber roll surround and a relatively large ceramic magnetic providing a gap flux density of 1.1 Tesla. Nominal efficiency is 91.5dB.

Fundamental resonance of the midrange driver is 90Hz and working range is from 600Hz to 6kHz with smooth roll-off at both extremes. Note that it is most important that a midrange driver have a smooth response at both extremes because typical crossover networks do not have an absolute cut-off at the nominal crossover frequencies. This means that the midrange is called upon to handle some signals outside its range (as set by the crossover network) at reduced power.

With grilles removed, the Peerless PAS25 (left) and PAS60 (right).



PEERLESS PAS60 AND PAS25 LOUDSPEAKER SYSTEMS 1/SE/-

Here are the dimensional details of the Peerless PAS60 with those for the PAS25 shown in brackets. Note that it is drawn in the upside-down position in which it should be assembled. A handyman carpenter building an enclosure from uncut sheets should work to the external dismensions, using internal cleats as necessary. The baffle and back panel dimensions would need to be modified to become a slide-in fit.

The open-back construction of the KU45MRF means that it requires a separate cavity which is isolated from the main enclosure which is subject to heavy bass sound pressure levels. Peerless make a suitable housing from moulded polystyrene which can be glued into place on the rear of the baffle before the midrange driver is installed. This is then damped with a small quantity of acoustic absorbent material.

Crossover from midrange to tweeter is at 6kHz with 12dB/octave roll-off for both drivers.

The tweeter is the Peerless LK10MDT which has a soft dome with a nominal diameter of 25mm and resonant frequency of 800Hz. Characteristic sensitivity is 91dB and frequency range is 900Hz to 20kHz.

At first sight the crossover network for the PAS60 system looks a little unusual to those used to seeing separate parallel networks for each driver. Even though the woofer and midrange "look" as though they are in series, they are in fact independently driven, with isolation provided by the capacitors and inductors. In the same way, the tweeter is fed via the 36μF capacitor plus its associated 2.5μF capacitor and 0.22mH inductor.

As with the Peerless PAS100, all of the crossover components are mounted on a PC board which uses push-on connectors for all terminations to the three drivers. The capacitors are non-polarised electrolytics while the inductors are air-cored.

An option that some builders may want to incorporate is a 3dB attenuating network for the midrange driver. We felt that this was desirable because the midrange does tend to dominate, making the system overly bright, particularly at around 4kHz to 5kHz.

Those constructors who wish to incorporate this option may do so by wiring two resistors across the midrange unit itself. A 2.2Ω resistor should be connected in series with one of the feed wires to the midrange driver while a 22Ω resistor should be connected across the midrange driver terminals. Both resistors should have a rating of at least 1W.

By comparison with the PAS60, the Peerless PAS25 looks to be only half the size and indeed as its dimensions indicate, it is. But it compares very favourably with the other two systems in terms of sound quality and it is easily the best in terms of value for money. It has generous power handling capacity of around 50 watts and efficiency of 90dB.

Dimensions of the PAS25 are 295 × 580 × 230mm, again not including the grille cloth frame and mass is approximately 10kg.

The PAS25 uses the KP825WFX woofer which has nominal diameter of 210mm and an effective cone diameter of about 150mm. Again, it has a rubber roll surround which is treated with a viscous compound on the rearside of the roll to control spurious resonances. Free-air

cone resonance is 33Hz and Q-factor is 0.38.

When mounted in the enclosure, the woofer resonance rises to around 65Hz, which is again depicted on the impedance curve of the system. This curve presents no loading problems at all for any typical amplifier since the minimum impedance value is 9Ω which is actually above the nominal figure of 8Ω for the system.

Mounted in the enclosure, the KP825WFX woofer will deliver usable bass response down to 50Hz and below, a figure which is adequate for the great majority of music although it may seem a little lacking for pipe organ fans.

Upper frequency limit of the woofer is 3kHz and crossover frequency to the tweeter is set at 1500Hz. The tweeter is the Peerless LK10MDT, the same unit as used in the PAS60. This unit is actually more efficient than the woofer but by virtue of the attenuation provided by the crossover network, seems to be particularly well matched to the woofer.

The crossover network is more conventional than that in the PAS60 and is again mounted on a PC board which uses push-on connectors for all terminations.

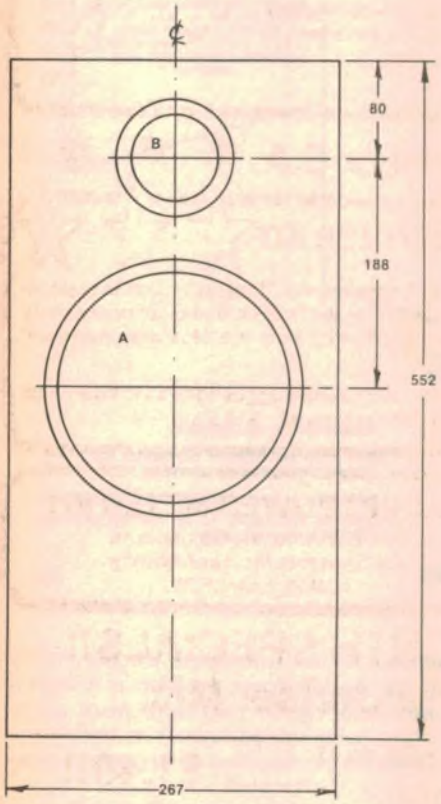
CONSTRUCTION

Let us now talk about the cabinet construction. As with the system discussed last month, you may buy the kit for both systems in one of two forms.

The first includes the speakers, crossover PCBs, interconnecting wires and rear terminal panels for a stereo pair but without the cabinet materials. The second form includes all of the above plus cabinet kits, acoustic filling material, foam sealing tape and all other materials to complete the enclosures, with perhaps the exception of the adhesive.

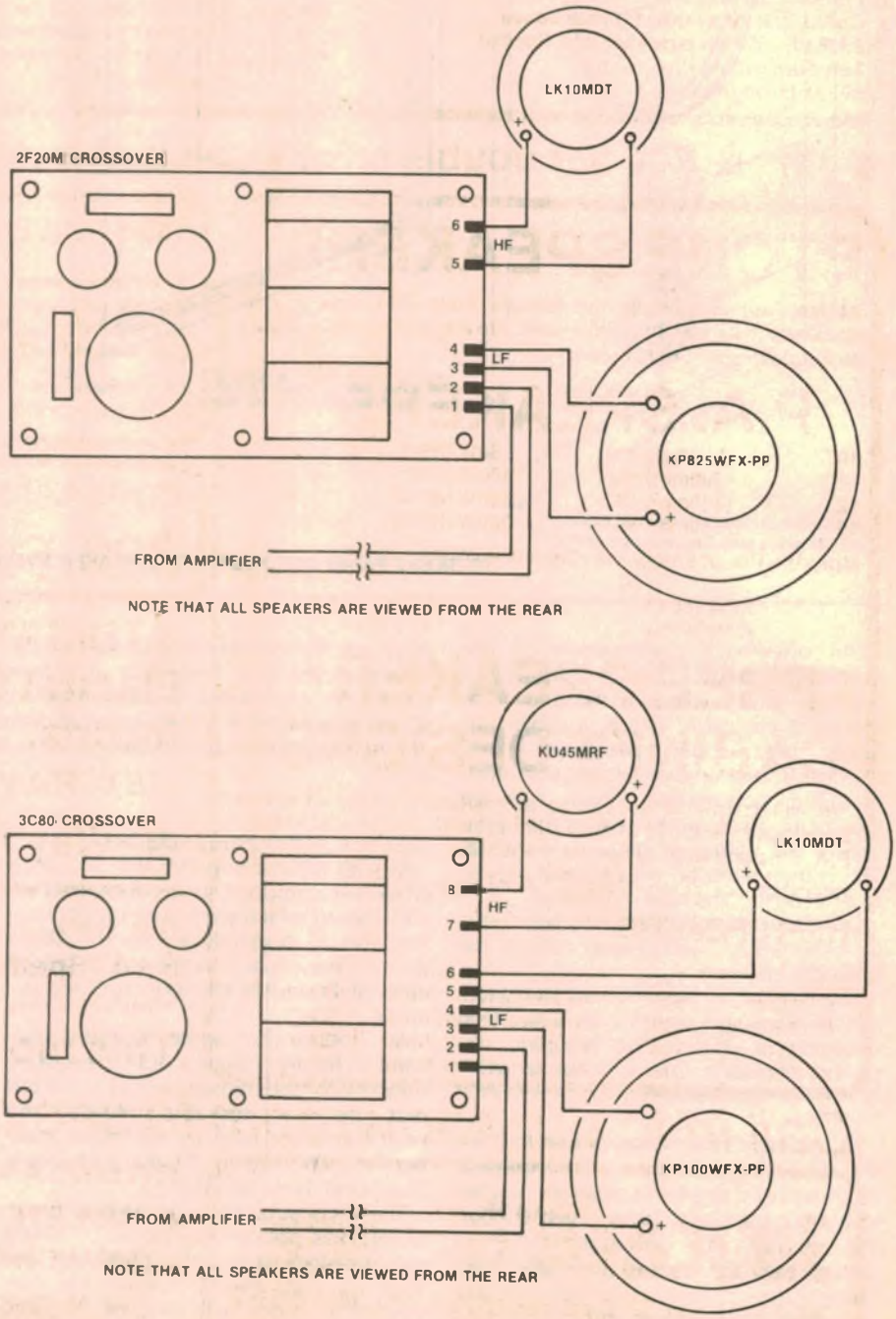
If you have the tools to make the cabinets from scratch, you may vary the cabinet dimensions if necessary provided the enclosure does not vary by more than 10% from the designated volume.

We understand that kit suppliers will sell their pre-cut timber kits in stereo pairs to minimise packaging costs. The normal practice with these pre-cut timber kits is to cut the sides, top and base from one strip of vinyl veneered



A : 188 DIA. COUNTERBORED 210 DIA. × 5 DEEP
B : 70 DIA. COUNTERBORED 95 DIA × 4 DEEP
MATERIAL: — 19mm VENEERED PARTICLE BOARD
PAS25 BAFFLE

This diagram gives the dimensions of the PAS25 baffle to be used in conjunction with the diagram on page 65.



These two diagrams show the connections from the crossover networks to the various drivers in the PAS60 and PAS25 enclosures.

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10" (250mm)	108	Woofer 50W (RMS)	$33.00
12" (300mm)	518	Woofer 100W (RMS)	$49.00

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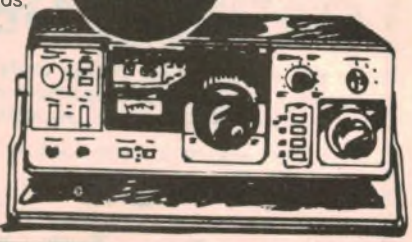

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board. Ninety degree grooves are milled where the joints will be, leaving the segments held together only by the vinyl veneer. An additional groove is milled to take the baffle and rear panel. When adhesive is run into the grooves and the sides folded around the baffle, a rigid potentially airtight enclosure is formed.

While the surfacing material provides a surprisingly effective "hinge", allowing the panels to be folded and unfolded, we suggest that you don't tempt fate by idly demonstrating to yourself or to anyone else how it all goes together. Leave that until you are ready to do the job.

Before starting, make sure that you have available a large tube of PVC adhesive ("Aquadhere" is fine), some adhesive tape, and clear space on the floor covered with paper, in case you spill some glue. Oh, yes, and a scrap of clean cloth to wipe off any surplus.

Open the cabinet timbers full length on the floor and tentatively stand the baffle, tweeter end down, in what will ultimately be the top of the enclosure. The idea is that, when the panels are folded around it, the join where the two outer ends ultimately meet will be at the bottom, resting out of sight on the carpet.

Remember also that the rebated side of the baffle is the front face.

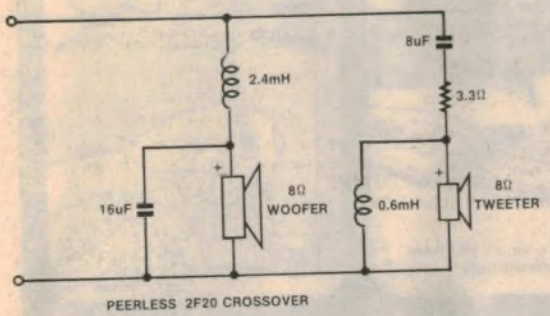
Having worked out how everything will fit together, put the baffle aside and apply adhesive to all the 45° surfaces and to all surfaces of the rectangular slot for the baffle. Apply enough adhesive so that, when spread with a finger, it will wet all surfaces thoroughly and evenly. Wet the butt edges of the baffle all around and, for good measure run a thin, extra line of glue in the bottom of each V and in the bottom of the rectangular groove.

This done, slip the baffle into position, tweeter end down and rebated face to the front, without pushing it too hard into the groove. Now fold the sides and bottom carefully up around it, allowing the baffle to slip into its natural position, without straining either "hinge". Bump the panels into place with the ball of the hand, bringing the two free edges tightly together. Hold them in this position with as many strips of adhesive tape as seem necessary.

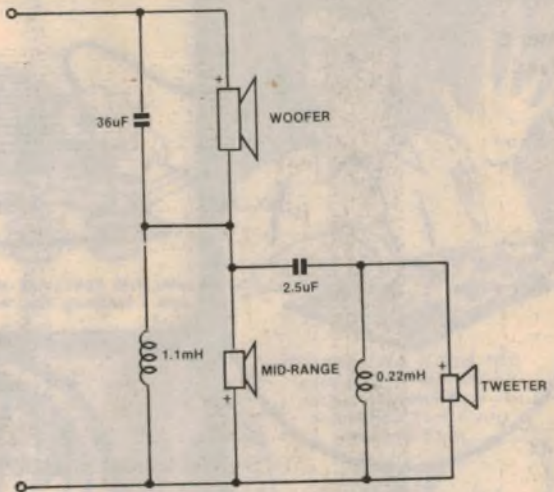
Wipe away the surplus adhesive which will have been squeezed from the joints and put the enclosure aside overnight for the joints to set hard.

The second enclosure can be assembled in a similar manner.

If you want to be doubly fussy, prop the two enclosures so that they are resting on one edge. Run a line of glue on the inside of the join, bridging the side and bottom. Allow the glue to dry and repeat the procedure for other edges to ensure an airtight seal.

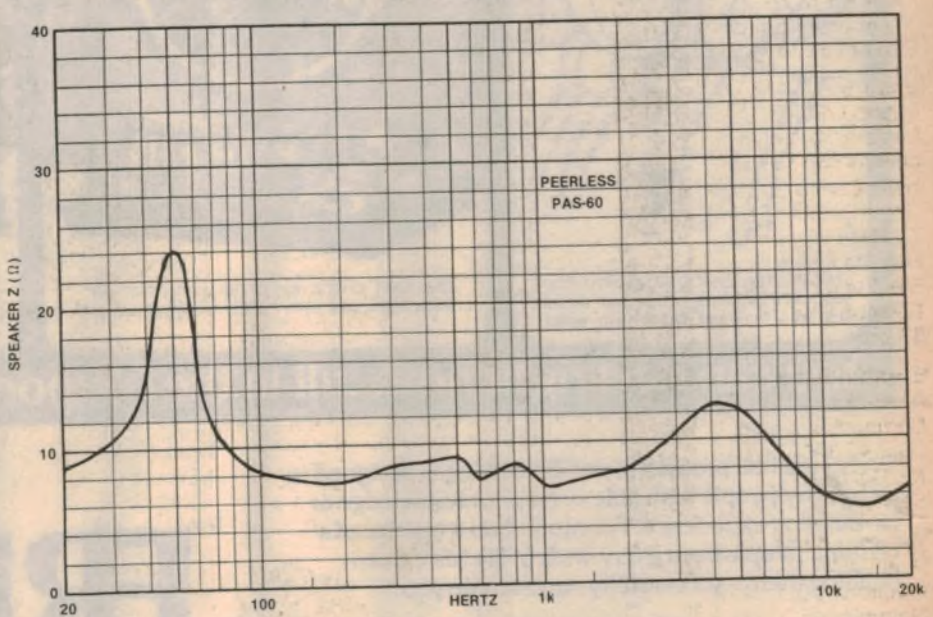


PEERLESS 2F20 CROSSOVER



PEERLESS 3C80 CROSSOVER

Above and above right are the circuits of the PAS25 and PAS60 while pictured below is the LK10MDT tweeter, common to both systems.



Above is the impedance modulus curve for the PAS60 system.

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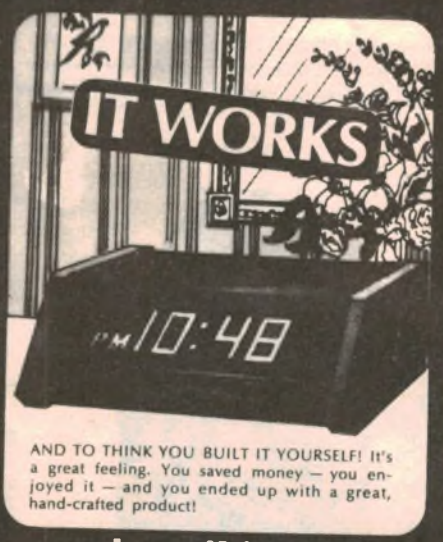

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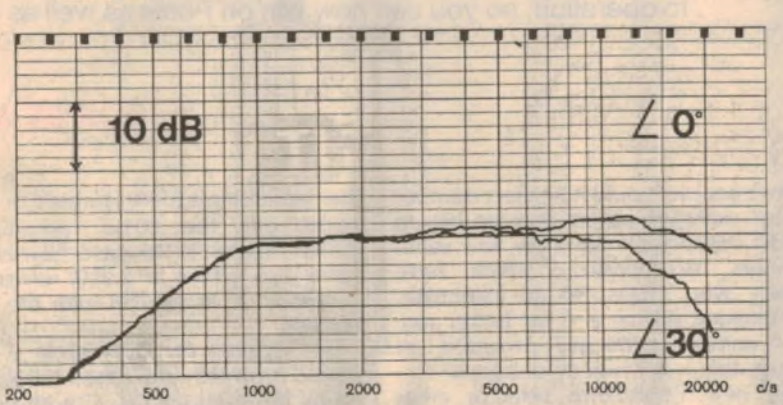


Above is the frequency response curve of the LK10MDT tweeter while below right is the impedance modulus curve for the PAS25 system.

Next, the back can be inserted and glued in position, but not before securing a brace with suitable cleats, to run between baffle and rear panel (as shown in our diagram). Then fix the rear terminal panel in place, making sure that the connecting wires are attached. In the case of the PAS25 cabinets, this brace is not necessary.

Now attach the crossover network to the underside of the brace mentioned previously in the case of the PAS60 or to one of the cabinet side panels in the case of the PAS25. Then attach the leads from the tweeter (and midrange driver in the PAS60). Diagrams in this article show how the connections are made.

Mounting the tweeter is straightforward. Drill the four pilot holes required for the self tapping screws, run foam tape around the rebate for sealing and drop the tweeter into place, having first attached the connecting leads. Then screw it down.

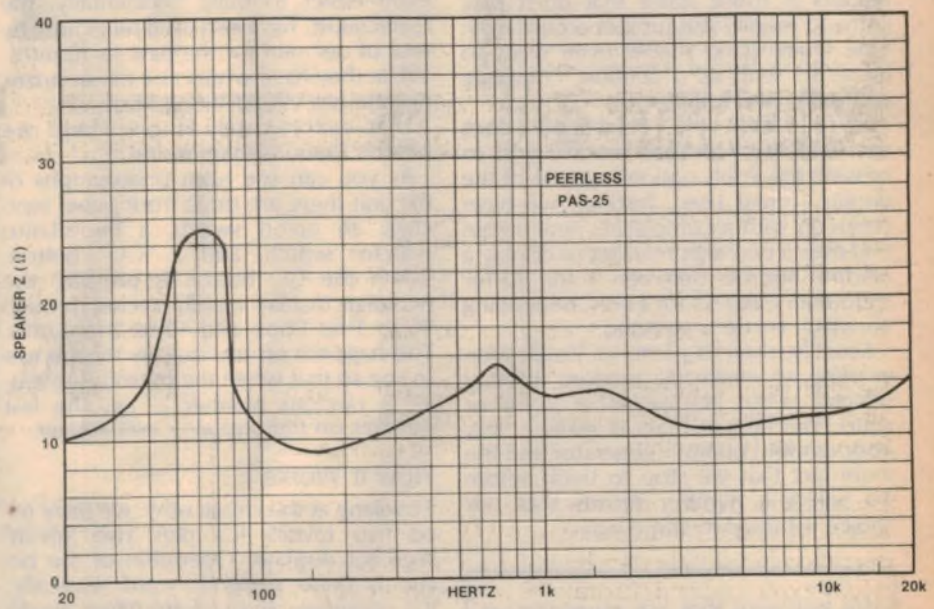
Next, push about half of the supplied filling material (Danfil or bonded acetate fibre) into the top section of the enclosure and make sure that it occupies the space evenly.

Follow the same procedure as for the tweeter when mounting the midrange driver for the PAS60 but do not forget to glue the polystyrene pressure chamber in place before doing so. This chamber should be lightly filled with Danfil (or BAF) and the leads brought through and connected (and optional attenuator network installed) before screwing the midrange unit down.

The woofer is held in place by means of four screws and four small metal brackets. Once again, drill pilot holes for the screws and run foam tape around the woofer rebate to aid sealing. Now push the rest of the acoustic filling material into the enclosure, making sure that it will not pack around the woofer. Then connect the wires from the woofer to the crossover PC board and fix the woofer in place.

All that remains then is to fit the grille cloth frame. Probably the simplest way to do this is to use Velcro fastenings.

After that, you can relax and enjoy the results of your handiwork.



Where do you buy these kits? Initially, in Sydney, they will be available from Electronic Agencies, 115-117 Parramatta Road, Concord, phone (02) 745 3077. In Melbourne, contact G.R.D. Group Pty Ltd, 698 Burke Road, Camberwell, phone (03) 82 1256.

Pools/Lotto Selector

now you can win on Pools as well as Lotto

Following on from the success of our "Selectalott" project we now present a Pools/Lotto number selector. It features a two-digit LED display and switch selectable Pools/Lotto operation, so you can now win on Pools as well as Lotto!

by RON DE JONG

Australians have always been "mad keen" gamblers and, it seems, "Electronics Australia" readers are no exception. So when we described an electronic Lotto selector last December, it quickly established itself as a popular project.

But the "Selectalott", as we called it, had one drawback: it didn't provide a Pools option. This immediately resulted in a stream of correspondence from readers in those states that don't play Lotto to modify the project accordingly. One Queensland reader even went so far as to send us a petition, complete with offer of a bribe!

Unfortunately, the "Selectalott" does not lend itself to easy modification to provide the Pools option because of the display format used. Instead, we have come up with a completely new design that uses a two-digit readout to display a random number between 1 and 40 for Lotto and 1 and 55 for Pools, depending on which mode is selected.

Actually, there is plenty of justification in using an electronic random number selector when playing either Pools or Lotto. The human brain is really a very poor random number generator and the mere fact that we stop to think before we select a number means that our choice is biased in some way.

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

$25

Including sales tax.

Some people would not select number 13, for example; others may be biased against consecutive numbers, low value numbers, or numbers which have already won prizes. So an inanimate, non-thinking device is a far better random number generator provided, of course, that it is properly designed

Our new Pools/Lotto selector costs about the same as the "Selectalott" (ie about $25), offers more features and is even easier to build. Incidentally, the "Selectalott" has been used religiously by four of our staff for the past six months. While they have won some minor prizes no one has yet hit the jackpot.

That, unfortunately is one "bug" we haven't found a solution for!

As you can see from photographs of the unit there are three front panel switches: an on/off switch, a Pools/Lotto selector switch, and a "GO" button. When the GO button is pressed, the two-digit display rapidly cycles through 55 to 1 for Pools and 40 to 1 for Lotto. This happens far too quickly for the eye to see so that when the button is released a random number – i.e. the last number on the display – will appear.

How It Works

Looking at the circuit now, we have used five CMOS ICs plus two seven-segment displays. Operation of the circuit is quite straightforward. Basically, IC1 comprises an oscillator which clocks a two-digit BCD counter consisting of IC2 and IC3. Outputs from these counters are decoded by IC4 and IC5 to drive the two seven-segment displays.

The oscillator circuit is a standard three-gate CMOS oscillator comprising IC1a,b,c. Normally, the time constant (ie, the oscillator frequency) would be determined only the .001μF capacitor and 220kΩ resistor. In this case, however, we have also added a 2.2kΩ resistor and series diode in parallel with the 220kΩ resistor.

This reduces the duty cycle – ie the period for which the output is high divided by the total period – to around 2%. While this has no effect on the counters it is important for the displays as we shall see later.

Output from the oscillator is taken from pin 6 of IC1c and this passes to IC1f when the GO button is pressed, to drive the two BCD counters, IC2 and IC3. When the button is not pressed, the input to IC1f is pulled high via a 22kΩ resistor and counting is inhibited.

IC2 and IC3 are 4029 CMOS up/down binary/decade (BCD) counters – to give them their full title. As the name implies, these can be used to count either up or down in binary or BCD mode by setting the appropriate control pins. In this case, the 4029s have been programmed to count down in BCD (or decade) fashion, ie 9, 8, 7 . . . 0 then back to 9 again.

Since we require IC3 to count in units and IC2 to count tens, we have configured the counters in a parallel clocking mode with the carry out pin of IC3, pin 7, connected to the carry in pin of IC2, pin 5. This works as follows: the carry out pin will go low only when the IC3 is at count 0 and the carry in pin of IC2 must be low to enable counting. So the tens counter, IC2, will only be clocked when IC3 is zero; eg when the count is "50", the next clock pulse will decrement both IC2 and IC3 to give "49".

So far we have the counters counting continuously from 99 down to 0. Now to

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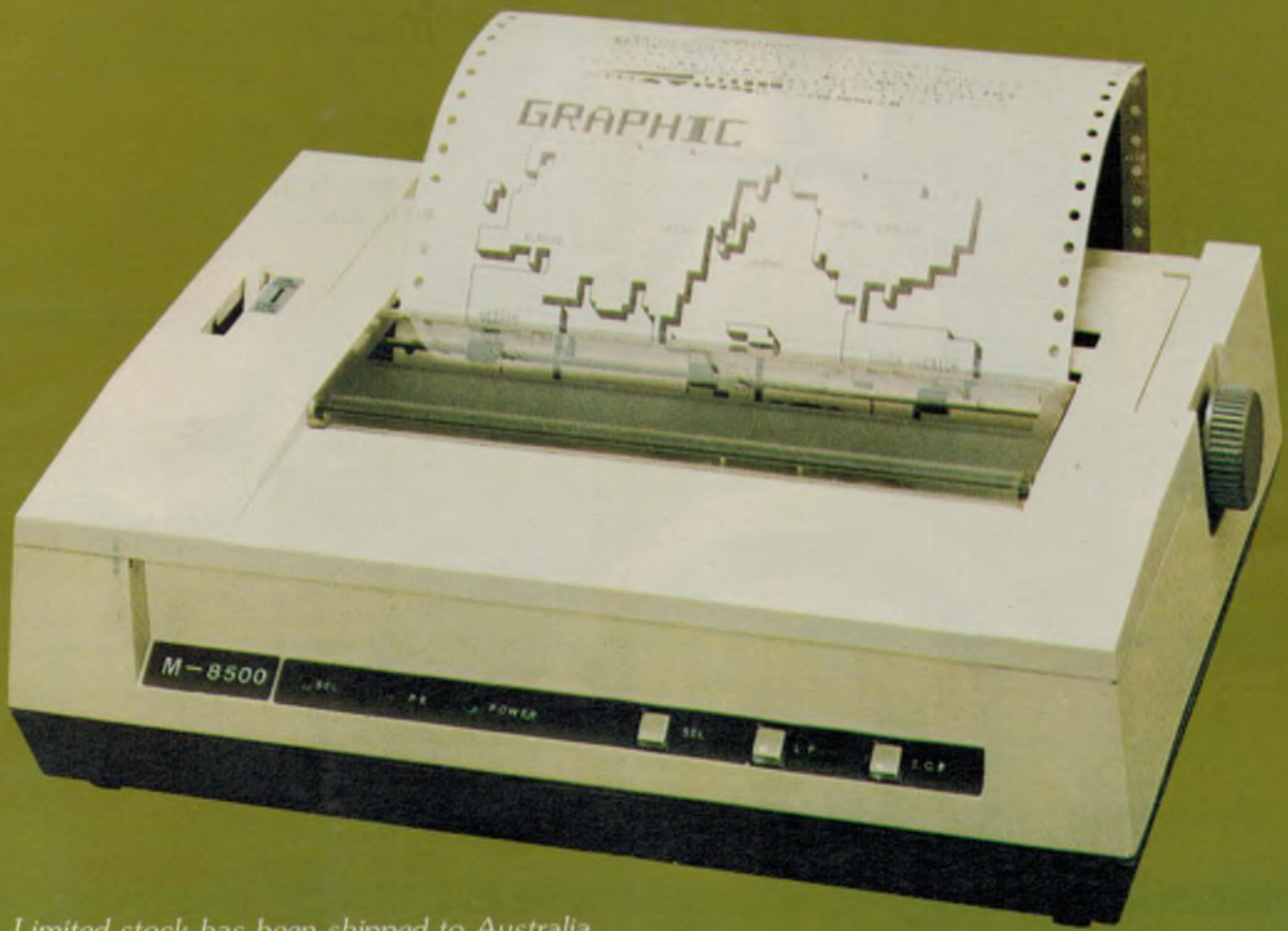

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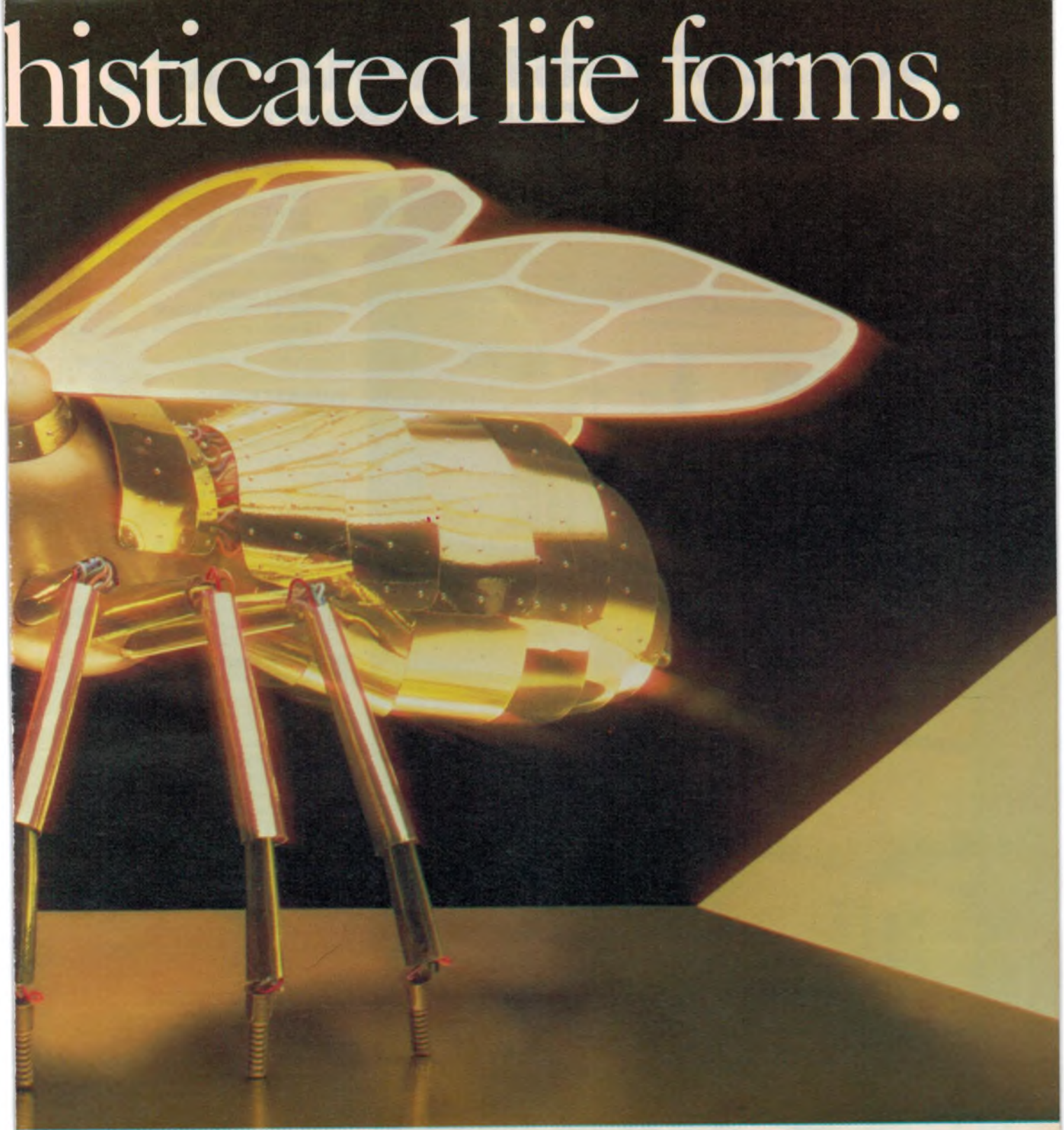

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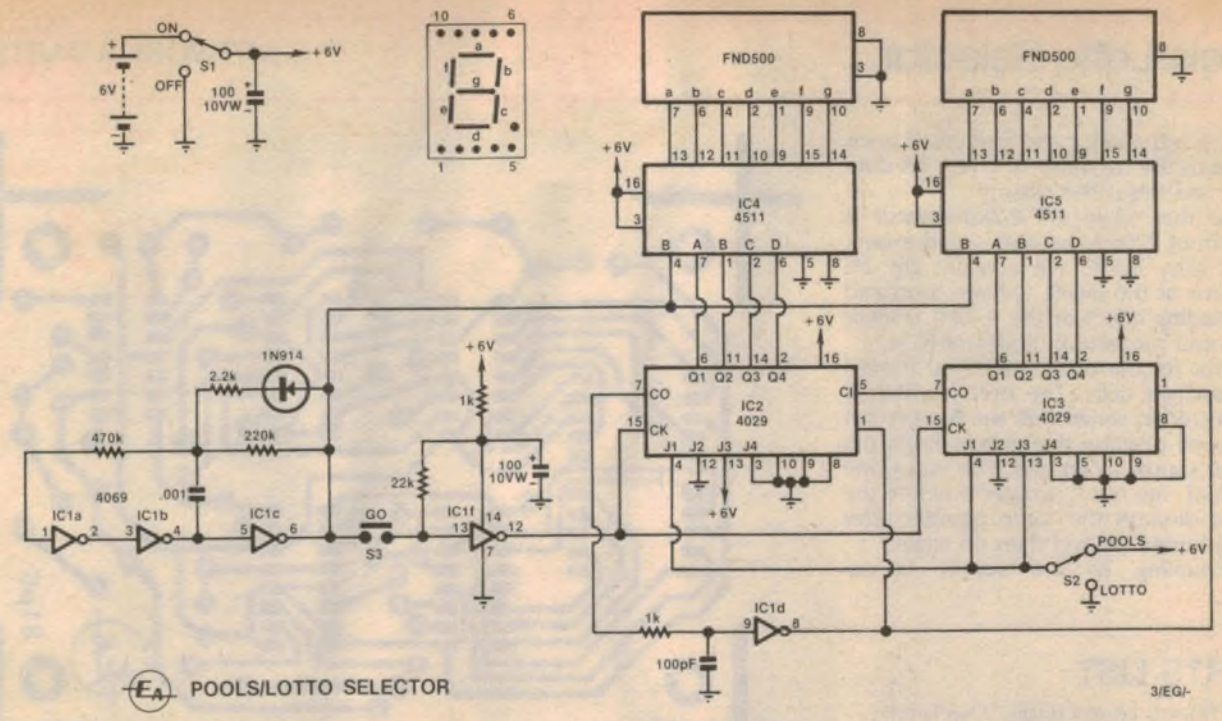


POOLS/LOTTO SELECTOR

3/EG/-

make them count from 40 to 1 or 55 to 1 we use the preset enable (pin 1) on each counter to load the BCD data at the parallel inputs, J1 to J4, into the counter.

Both preset enables are connected to IC1d which inverts the carry out from IC2. This carry out is low only when both counters are 0; thus as soon as the 0 count is reached, IC1d goes high to load the parallel inputs into the counter.

For Pools the parallel inputs are set to 55 – ie a 5 is loaded into each counter – while for Lotto a 4 is loaded into IC2 and a 0 into IC3 to give 40. Those data bits which are common to 55 and 40 are hard wired, eg, J2 and J4 on IC2 go to ground and J3 to +6V, while the bits which have to be changed are switched to 0 or +6V via switch S2, depending on whether Pools or Lotto is selected.

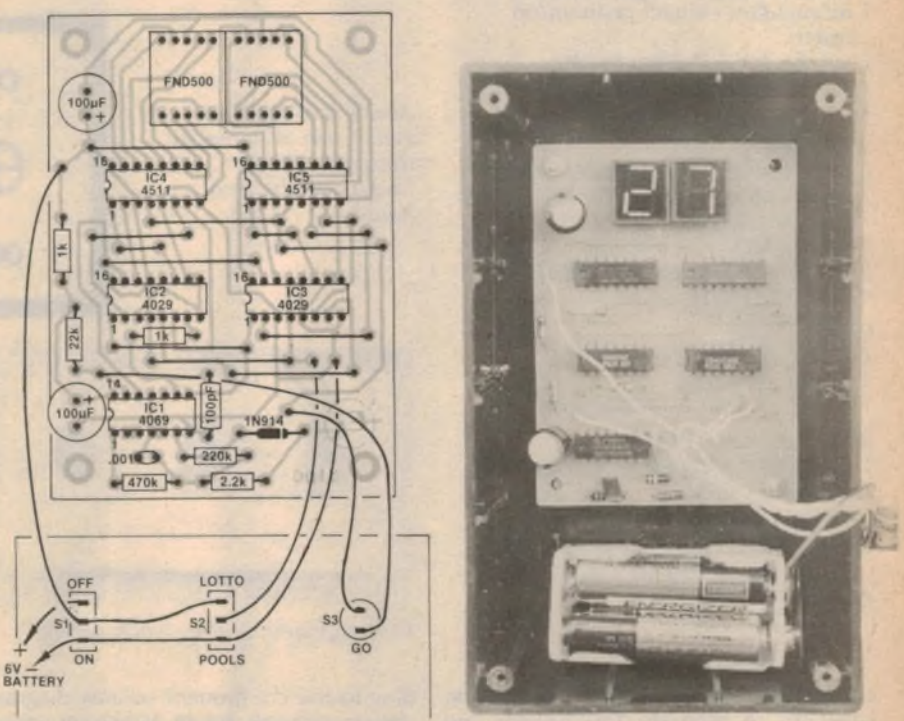
One point not mentioned so far is that a 1kΩ resistor and 100pF capacitor deglitching network is included in series with the carry out pin of IC2 (pin 7). This removes a timing glitch caused by the delay in the carry out from IC3, which would otherwise result in premature resetting of the counters at the count of 10.

To explain further, at the count of 10 the carry out of IC3 (pin 7) goes low and clocks IC2 to 0. As there is now some delay before pin 7 of IC3 goes high again, IC2 will generate a brief carry out pulse. This pulse would cause premature resetting of the counters unless filtered by the deglitching network.

The BCD outputs from IC2 and IC3 are applied to IC4 and IC5, both 4511 CMOS seven segment LED decoder drivers. These directly drive two FND500 common-cathode displays without segment resistors. Normally, this would result in a very large segment current and a very bright display – at least until either the 4511s or FND500s failed. We avoid this problem by using the blanking input on the 4511s, pin 4, to turn off the display for 350μs and on for only 7μs; ie a 2% duty cycle.

This has the same effect as multiplexing the displays and considerably reduces power consumption for the same apparent display brightness. In fact you may find it hard to believe that the total current consumption is just 20mA– it literally runs on the smell of an oily rag (well almost). Other benefits include very low power dissipation in the 4511s and FND500s.

The blanking input signal to which we referred is the clock signal from pin 6 of IC1c. We mentioned earlier that an addi-



Construction is easy – just follow the wiring diagram (left) and the photograph at right. The board is mounted using brass standoffs.

tional 2.2kΩ resistor and diode had been added to the oscillator to give a 2% duty cycle and this is the reason.

Note that while the 2.2kΩ resistor is 1/100th of 220kΩ and one would expect a 1% duty cycle, we actually get 2% because of the diode voltage drop and the loading effect of the 470kΩ resistor and input protection diodes of IC1a.

Power for the unit is obtained from 4 AA penlight cells. The on/off switch is connected in series with the battery but in the off position the switch shorts the power supply to ground. This was done to avoid "memory" problems where the circuit displays the same number after being turned off and then on again.

Decoupling of the supply is accomplished by a 100μF electrolytic capacitor. A separate 1kΩ resistor and 100μF capacitor decouple the supply to the oscillator IC1 to avoid biasing due to variations in supply voltage. This occurs because of the variation in current drawn by the displays during the counting sequence.

PARTS LIST

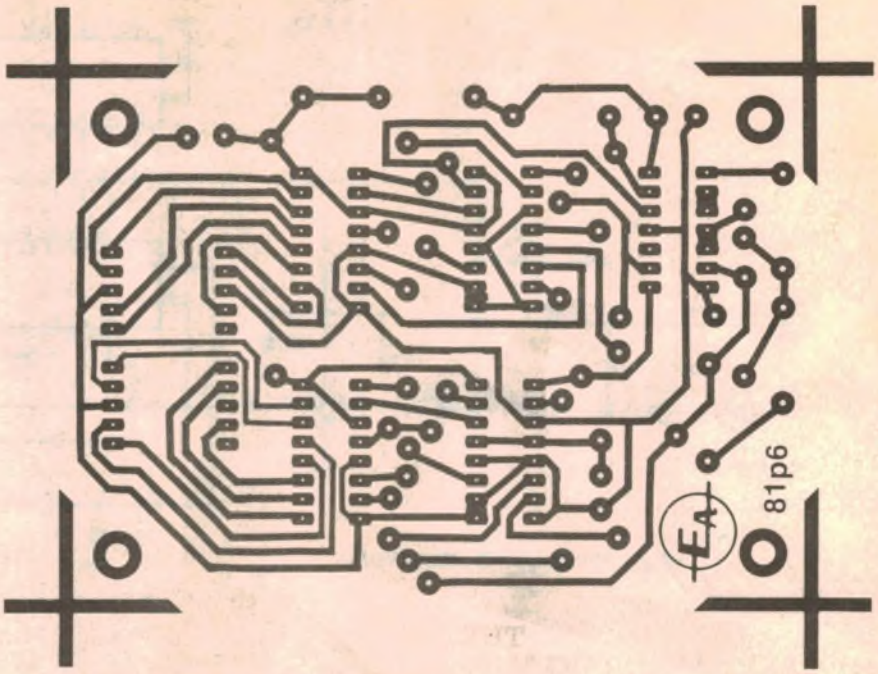
1 PC board, coded 81p6, 97x69mm.
1 zippy box, 96x159x51mm
1 piece of perspex, 89x153mm
2 SPDT miniature toggle switches
1 momentary contact pushbutton switch
1 square 4xAA battery holder
4 AA Penlight cells
1 battery clip to suit holder

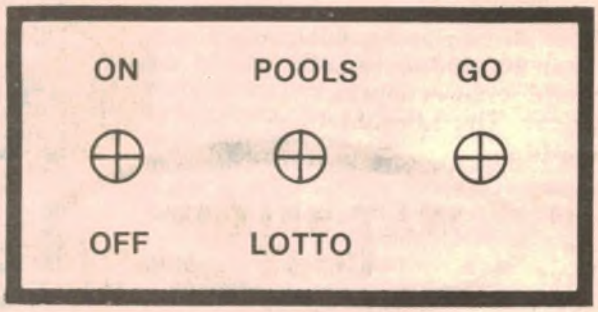
SEMICONDUCTORS
2 4511 CMOS latch decoder drivers
2 4029 CMOS up/down binary/decade counters
1 4069 CMOS hex inverter
2 FND500 7-segment LED displays
1 1N4148, 1N914 diode

CAPACITORS
2 100uF 10VW PC electrolytic
1 .001uF greencap
1 100pF ceramic or polystyrene

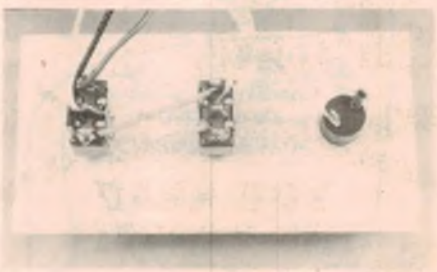
RESISTORS (all ¼W, 5%)
1 x 470kΩ, 1 x 220kΩ, 1 x 22kΩ, 1 x 2.2kΩ, 2 x 1kΩ

MISCELLANEOUS
Screws, nuts, hookup wire, tinned copper wire, solder, four brass standoffs.





Above and right are actual size artworks for the printed circuit board and the front panel.



Close-up view of the switch wiring.

CONSTRUCTION

Well that covers the circuit description. Construction is quite simple with most components being mounted on a single printed circuit board (PCB) coded 81p6 and measuring 97x69mm. Mount the links, resistors and capacitors first according to the component overlay diagram shown with this article. When mounting the CMOS ICs take the usual precautions against damage due to static electricity.

The FND500 displays are also mounted on the board. The correct orientation of the displays is with the decimal point (just visible behind the red plastic filter) in the lower right hand corner. The top of the displays can also be identified by corrugations.

We housed our unit inside a plastic zippy box measuring 96x159x51mm. To simplify construction and add some novelty to the project we replaced the aluminium lid with a clear perspex lid. The board is mounted on the bottom of the box using brass standoffs. Holes for the three switches can be drilled in the perspex using the photographs of our unit as a guide, then the switches mounted and wiring completed using the wiring/overlay diagram as a guide.

Actual size artwork included with this article can be photocopied and glued to the inside of the box to provide labelling for the switches.

With that completed the wiring and orientation of components etc should be checked. If you are satisfied that all is well switch on and check out the operation of the circuit. Note that one or both of the displays may be blank when the unit is first turned on because an illegal BCD digit from the counters (ie a value, greater than 10) causes the 4511s to blank the display. This is not a problem in normal operation because the counters will always count in BCD.

When the "GO" button is pressed the display will show what appears to be 88, but, this is actually the counters counting rapidly through the numbers 55 to 1 or 40 to 1.

If the unit checks out you will be one step closer to the jackpot.

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The Serviceman

Some sets have more than their share of faults

How many faults does one expect to find on a service call? Single faults make up the large majority of case histories, with a few minor faults sometimes needing attention. But, once in a while, a job turns up in which there seems no end to the faults; from the antenna to the convergence — which was literally true in one recent case.

The story started with a call from a customer who had just moved into the district and was in strife with his colour TV set. His location was not a particularly good one and he suggested that, among other things, the antenna system might need attention.

When I arrived and looked at the system, and the general location, I had no doubt that he was right. He was on the southern fringe of the metropolitan area, where the signal was beginning to weaken and, more importantly, was well down in a gully. I had no doubt that a decent antenna system would give satisfactory reception, but this one was a long way short of what was needed.

Apparently the system was one installed by the previous owner and the new owner had no idea of what to expect from it or the location. In fact, it was a pretty shocking mess. The antenna was on a tall mast and had originally been fitted with open wire feeder, but this had been cut off as high up as someone could reach from the roof and replaced with conventional ribbon.

A ROUGH JOB

That was bad enough, but the ribbon had been run under the house, with a couple of unterminated branches spliced into it and run to other rooms. All the joins had been made by simply twisting the wires together, not very tightly in some cases, and all were badly corroded. As I said; a mess.

The effect on the picture – such as it was, due to other faults – was predictable; a weak image behind lashings of snow. Open wire feeder is not something I normally have much need for, but I had found a small roll and had put it on board before I left. Now I was very glad I had.

I spent some time ripping out the old ribbon, replacing it with the open wire feeder, and splicing this to the existing feeder. The extension runs were discarded, as the owner had no need for them. Again the result was predictable: a virtually snow free picture.

This brought me to the set itself which, as I have already hinted, had its own problems. It was a Kriesler set, fitted with a 59-1 chassis, and the immediately obvious fault was very poor horizontal sync. The picture would tilt slowly first one way and then the other, with brief moments when it appeared normal; but it was obviously not properly locked.

Fortunately, this was during the morning when a test pattern was available, and it revealed a second fault; a quite serious convergence error, mainly red/green error on the vertical lines, suggesting the need for cross-over and parabola adjustment.

The effect was quite severe and I suspected that it was in some way due to failure of the correction circuit. To confirm this I waited for one of the brief stationary periods of the picture and quickly twiddled the appropriate knobs. In fact, they had no effect whatever.

By now I had seen enough; this was no job for the customer's lounge room; it would have to go back to the shop.

"It's funny, yer know, Sam. Some TV sets seem like they're jinxed!"

When I advised the customer of this, I learned a lot more about the set's history. It seemed that it had never been very reliable and developed a number of faults over the years, some of them intermittent.

Some of the service work had been done in the manufacturer's own service department but, unfortunately, the customer was rather vague about the various symptoms, which had been spread over several years. Well, at least I was on guard.

AND SO TO WORK

Back at the shop I plugged the set in, pulled out the appropriate service manual, and prepared to track down the missing sync. A logical starting point appeared to be a sub-board called the line control unit (CU701). This consists of a noise gated sync separator, a line discriminator fed from a phase comparator (fed, in turn, with pulses from the line output stage) and the line oscillator.

The noise gated sync separator is an IC (TBA240B), as is the line oscillator (TBA720). The line discriminator and phase comparator circuits are made from discrete components. Both ICs are mounted in sockets. which makes checking them relatively simple.

Combined luminance and sync pulse signals are fed to the noise gated sync separator via pin 16 of CU703, and the first thing to check was that the signals were, in fact, reaching this point. The CRO quickly confirmed that they were, so the trouble was obviously further down the line than this.

The CRO also confirmed that sync pulses were emerging from the sync separator IC, while the line oscillator IC was checked by replacing it temporarily with a known good one. All of which seemed to clear most of the board of suspicion.

Another essential signal into this board is a line pulse of about 4V p-p derived from pin eight of the line output transformer, and fed to pin nine of the sub-board via a 4.7kΩ resistor (R729). This was where I found my first clue, because the CRO indicated that there were no such pulses at this point,

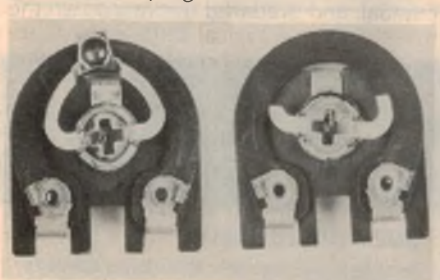
although they were present, at somewhat higher amplitude, at pin eight.

The resistor was checked and found to be intact, leaving only the possibility of a dry joint somewhere, or a fault in the copper track itself. In fact, the latter appeared to be the more likely, because the board was already well equipped with patches on a number of copper tracks; short lengths of tinned copper wire soldered over what were, presumably, other breaks in the track.

Included in these patched tracks was the one in question; a rambling track at least 30cm long. I went over every centimetre of this track with a high power glass, but could not detect any break. But I proved that there was a break by bridging the entire track with a clip lead, whereupon the picture locked up immediately.

So then began the job of scraping spots of lacquer off the track at various points and checking with the CRO, until I had narrowed the fault to a few centimetres of track. Even then I could not detect it visually, but bridging it with a wire patch confirmed that it was there.

So that was one down and one to go. With a stationary picture, I was now able to tackle the convergence fault. A logical check point was at one of the inputs to the convergence board, which supplies waveforms to the controls which I had already established were not working. These are fed to the board via pins two and three of plug and socket 806.



Presumably, a faulty die had produced a batch of failure-prone tab pots, as pictured. Cracks were clearly visible in the example on the left, while the unit on the right fell apart at the lightest touch by the serviceman.

In fact, there were no waveforms at these points and back tracking took me to pin one of socket 701 and pin seven of socket 705, both on the main board where I had already encountered the faulty copper pattern. And, not to make too long a story of it, it was the same thing all over again.

Both tracks had a fault, quite invisible even under a glass, and which could only be tracked down with the CRO. And, as before, I simply narrowed down the location to the point where I could conveniently fit a bridging wire.

All of which took a lot longer to do than it does it tell, but I eventually had the convergence controls working and was able to set up a good picture. At this point I heaved a sigh of relief, rubbed my hands together with the satisfaction of a job well done, and pushed the set to one side.

But not without some reservations. After all, the set had a nasty history of failures very similar to those I had just encountered. How could I be certain I had found the last one? In addition, the owner had indicated that he wasn't in a hurry, if a little extra time would fix the set once and for all.

So I decided to let it run for a few days. I set it up in a corner of the bench and fed it with a cross hatch pattern. That way, I would have an immediate indication of any loss of either sync of convergence.

At the end of three days, with no sign of trouble, I was ready to believe I had fixed it. But when I switched it on the next morning, lo and behold, no horizontal sync. I reached for the CRO lead and made for the suspect copper track, only to have the sync come good before I could get to grips with it.

FURTHER FAILURE

Fortunately, it failed again a few hours later and this time it held long enough for me to tackle it. It turned out to be another invisible crack not far from where I had bridged the previous one. I removed my original bridge and fitted a much longer one; about 20cm long in fact and which I hoped might take care of any more faults in the immediate vicinity.

Naturally, the set went back into the corner for another trial run and for the next several days behaved faultlessly, at least as far as the sync was concerned. The convergence was not quite so satisfactory, showing some signs of minor drift.

The main error involved R849, a 2.2kΩ tab pot controlling red/green parabola. On attempting to re-adjust it I found it to be quite touchy, but imagined it was simply dirty. This seemed to be confirmed when I rotated it back and forth a couple of times and it appeared to come good.

Unfortunately, it didn't stay good for very long and when I tried adjusting it again, it was just as touchy as before. This time I took a closer look, imagining that there might be a dry joint at one of its tags.

I also checked the tension of the slider by slipping a fingernail under it, and that's when I found the trouble. The slider simply broke off (see photo) apparently due to a manufacturing fault in the metal stamping.

I replaced the tab pot, set it, and let the set run for a few more days. Again I noted convergence drift, this time involving the red/green crossover adjustment, R867, another 2.2kΩ tab pot. Applying the fingernail test produced exactly the same result as before; the slider snapped clean off.

Thoroughly suspicious now, I went over the convergence board and checked every other tab pot, finding one

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more, R881 (10kΩ) red/green horizontal top and bottom. This slider did not actually break off, probably because I was being a little more gentle now, but it lifted clear of the track and was obviously about to fail. It is also shown in the photo.

With the tab pots replaced – and the convergence adjusted yet again! – I let the set run for several more days, during which time it never missed beat. Finally I returned it to the owner, with the warning that he should contact me immediately if more trouble occurred. That was several weeks ago and a phone call to the owner has just confirmed that it is still going perfectly. So I'm keeping my fingers crossed.

The most puzzling aspect of this story is the failure of the tab pots. All three failed in exactly the same place in a manner which, were it possible, one would attribute to metal fatigue. Yet this is hardly likely. After all, tab pots live a relatively peaceful life, seldom being disturbed more than two or three times in their lifetime.

But, in any case, such movement as does occur does not unduly stress them in this manner. The only other solution I can offer is that it was a faulty metal stamping due, in turn, to a faulty die. In which case, I wonder how many more tab pots with a similar weakness are out there in the field, waiting to drive someone up the wall.

The multitude of cracks in the printed board are also somewhat disturbing. While one can understand how a board with such subtle faults could get through factory inspection, I do feel that when the extent of the trouble became evident in the manufacturer's service department – as it must have done – it would have been sound policy to cut the losses and fit a new board, rather than try to patch the old one.

Fortunately, multiple failures like this are extremely rare – I don't recall seeing anything like it before – but this would be all the more reason why the manufacturer could have afforded to be a little more generous, if only for the sake of his own reputation.

SAVED FROM THE DUMP

My last story was really the follow-on to a service call recounted some time ago but it was dropped for reasons of space. The point of it was simply to illustrate the unkind and sometimes premature fate that often awaits ailing black and white TV receivers.

In this case, I had just finished the other job and was about to pack up when the lady of the house mentioned, rather diffidently, a spare TV set which had failed during the previous evening:

"But, of course, it's a black and white set and my husband thinks it wouldn't be worth spending money on. He'll probably take it to the tip. It's a pity, in a way . . ."

She looked so crest-fallen that I offered to have a quick look at it. It turned out to be a quite modern looking 19-inch HMV table model, probably one of the last of their valve series. Before the arrival of colour, it would normally have been someone's pride and joy.

"We were watching it, last night" she explained "when my husband mentioned that someone must have their incinerator going. We could smell paper burning. But, in fact, the smell was coming from the set, so we switched it off.

"Of course, it's had a funny line along the top of the picture for some time . . . about this wide (she indicated a quarter-inch or so) and it kind of blinks all the time!"

NO TRAUMAS!

By this time, I had the back off the set, looking for a charred transformer, or something, but everything seemed to be in order.

So I reached over and switched on, waiting for something to happen. And it did so immediately. A tiny column of smoke curled upwards from a small component near the line output system. It was a smoke signal that an Indian brave might have been proud of!

It turned out to be a .039μF 400V capacitor and the nearest I had with me was .047μF 600V; it would have to do. When I put it in and switched on, up came the picture normally, with no sign of smoke of distress.

At least the picture was normal except for the "blinking" line. As you've probably guessed, the set was underscanning vertically, exposing the frame blanking area which, these days on some channels, is occupied by the teletext signal. I must admit that it would have been very annoying to anyone trying to concentrate on the picture.

Fortunately, Channel 0 was on air with a test pattern and I was able to increase the height and, at the same time linearise and centre the pattern. That done, the picture on other channels was back to normal. This for the cost of a capacitor and a quarter hour's extra labour.

The good lady was happy, I had done my good deed for the day and a still useful TV set had received a reprieve from the local dump.

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.

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Circuit & Design Ideas

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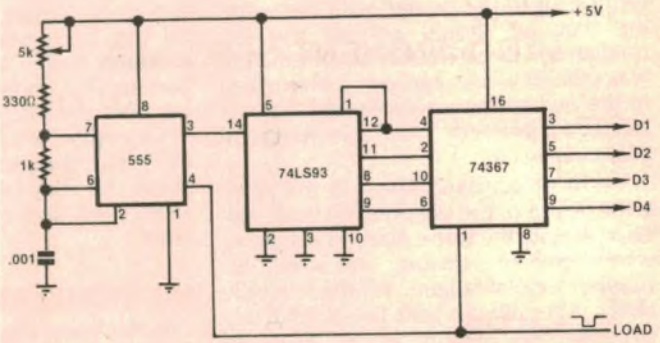
Bliss is a random number generator with 3 ICs

From experience with many "pseudo–random" number programs it has been found that most are not sufficiently random to provide universal application. Here is a design for a random number generator. which may be used with almost any microcomputer.

It will be seen that the 555 timer is connected as a free-running multivibrator, whose output is applied to the input of 74LS93 4–bit binary counter. By connecting its Qa output (pin 12) to its B input (pin 1), it functions as a divide-by-sixteen counter, with its binary outputs being fed to four data inputs of a 74367 Tri-State hex buffer.

Normally the 555 is oscillating freely with the device counting through the numbers at a high speed; if suddenly stopped the resulting number is truly random. If accessed by a computer, a negative load pulse is applied to the system such that it simultaneously inhibits oscillation of the 555 (via its RESET input), and loads the random number onto the data buses – through the load pulse being fed to the control input(pin1) of the Tri–State 74367.



This circuit generates random 4-bit numbers which can be loaded directly onto a computer data bus.

G. Hausfeld,
Gunnedah, NSW.

One transformer, two secondaries, three supply rails . . .

Some devices such as the 710 comparator and 1496 balanced modulator need three separate supply rails, with differing current requirements.

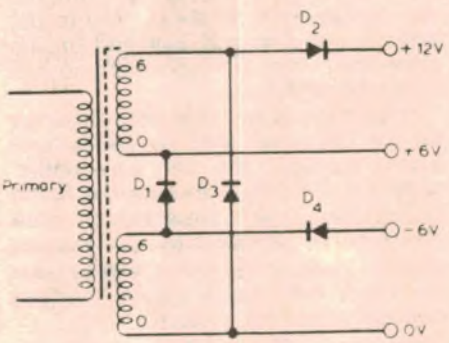
In order to solve this problem a more complex and therefore more costly power transformer is often required, or alternatively the use of two separate transformers.

The accompanying circuit shows a method whereby a transformer with only two secondary windings can provide the three rails required.

In the circuit shown the positive six-volt rail can provide substantial current whilst the other two rails cater for smaller loads. It can be seen that during positive half-cycles the lower winding feeds the +6V rail via D1, and the two windings in series feed the +12V rail via D1 and D2; whilst diodes D3 and D4 are biassed off. During negative half-cycles D1 and D2 are biassed off. The upper winding now feeds the +6V rail with a return via D3, whilst the lower winding feeds the –6V rail via D4.

Therefore the +6V rail is fed during both half-cycles by the two secondary windings alternately, ie full-save rectification; and both low current rails are fed on alternate half-cycles only, ie half-wave rectification. Naturally the voltages shown increase when filter capacitors are added to provide an adequate ripple margin for the ensuing regulators.

From "Wireless World",
March, 1980.

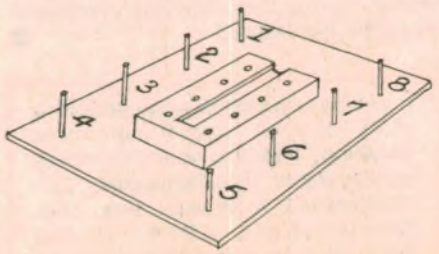


Hey diddle diddle, it only costs a little . . .

DIL sockets mounted on 50mm squares of scrap copper-clad pc board, with the board being etched to connect each contact of the socket to pins or turret lugs at the perimeter of the board, make useful gadgets for the experimenter. No mechanical damage is inflicted on the integrated circuit, so that it can be salvaged for use in the final product.

These "diddle boards" may be interconnected with clip leads whilst experimenting, and allow for instant changes to the circuit. It is advisable to fabricate several boards in both 8, 14 and 16 pin DIL, and also 8 and 10 pin TO configurations, so that full use can be made of this "diddle" system.

From "Break-In" (NZART journal),
December, 1980.



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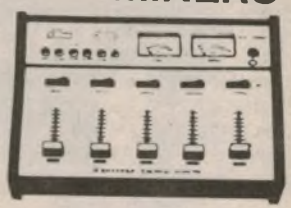

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by GERALD COHN

With a certain amount of modification, the circuit could also be made to imitate the deeper, more resonant sound of a ship's foghorn or even the mournful sound of a factory siren. Why not give it a blast?

Steam whistles work in a particular way which we should discuss before looking at the circuit.

For a start, when the steam valve is opened, the sound intensity appears to rise to a constant level over a short period. In other words, it has a certain rise time. Also, during this rise time, the frequency of the whistle tends to fall slightly.

Now consider the effect as the steam valve is closed. The steam in the whistle will take a short time to escape (as the pressure drops). Thus the sound intensity fades over a short period or, in other words, the whistle has a short decay time.

Finally, we have to consider the background hiss of the steam which is used to operate the whistle and be able to simulate the complex tonal structure of the whistle itself.

THE CIRCUIT

The circuit presented here effectively imitates all of the sound features described above, with the exception of the slight drop in frequency during the rise time. It uses two phase-shift oscillators (Q1 and Q2), a white noise source Q3, a gated amplifier Q4, and a power amplifier stage (LM380). Let's find out how it all works.

Each phase-shift oscillator is implemented using a single transistor, together with a few resistors and capacitors in a feedback network. The transistor is used as a common emitter amplifier, and thus produces a 180° phase-shift between its input and output. For oscillation to occur at a particular frequency, however, a further 180° phase-shift must occur, and this is produced by the RC feedback networks connected to Q1 and Q2.

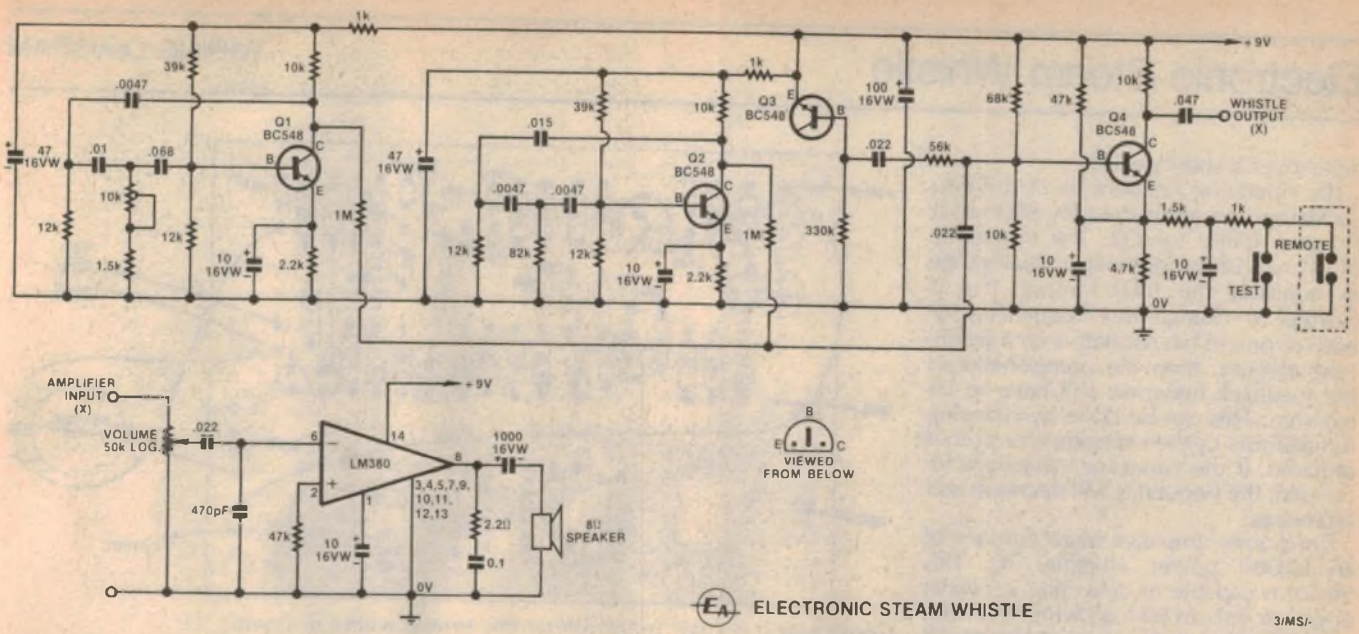
A reactance such as a capacitor can have a phase-shift of between 0 and 90°, but never more than this. It is for this reason that we have used three RC stages in each feedback loop, each stage contributing to the overall 180° phase-shift.

The configurations shown in our circuit are what are known as a phase lead networks. The opposite, a phase-lag network, has the capacitors and the resistors transposed. Usually the values of the resistors are all equal, as are the capacitor values. In our circuit we have not met this general criteria, but instead have used resistors and capacitors with different values.

The effect of varying the component values is to vary the degree of phase-shift from one stage to another. In other words, the phase-shift is not equal for each of the three sections. Using this approach we can obtain frequencies which are normally awkward to obtain using standard component values.

The supplies to each of the two oscillators in the circuit are independently decoupled from the main supply line using 1kΩ resistors and 47μF electrolytic capacitors. This has been done to assure a stable frequency of oscillation despite supply line variations.

The outputs of the two oscillators are



The circuit uses two phase-shift oscillators, a white noise source, a gated amplifier, and an LM380 power amplifier.

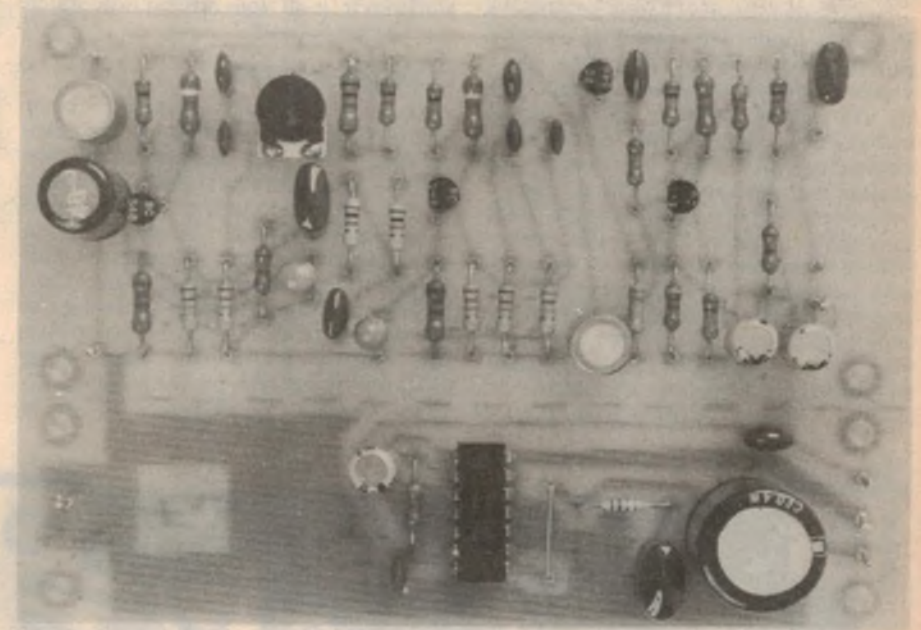
taken from the collectors of their respective transistors and mixed resistively using two 1MΩ resistors. The value of 1MΩ has been used to minimise loading on the oscillators.

The steam sound is implemented using white noise generator Q3. This consists simply of a reverse biased BC548 emitter-base junction, arranged so that avalanche breakdown takes place to produce a substantial amount of noise. We used the transistor here because its emitter-base junction has a lower breakdown voltage than most PN junction diodes.

The output from the noise generator is now mixed with the mixed output of the two oscillators, but this time the mixing is capacitive rather than resistive. This gives us a signal consisting of the outputs of the two oscillators combined with the signal from the noise source. The signal is then fed to the input of gated amplifier Q4 which amplifies the signal, but only does so when enabled. The operation is as follows:

Q4 is normally gated off by a voltage divider network consisting of the 4.7kΩ resistor in the emitter circuit and the 47kΩ resistor to the positive rail. To gate the amplifier on it would be sufficient to shunt the emitter resistor with another of suitable value. However, we can provide the required attack and decay times by adding suitable time constants to control the rate at which the amplifier is gated on or off.

The time constant circuit consists of the 1.5kΩ and 1kΩ resistors and the two 10μF electrolytic capacitors in the emitter circuit of Q4. The total resistance of 2.5kΩ is that required to gate the amplifier on, but the rate at which this can happen is determined by the rate at which the capacitors can be charged or discharged through their associated



View showing the assembled PCB. The bottom section of the board containing the power amplifier stage can be cut off and used separately.

resistors. The 10μF capacitor across the 4.7kΩ emitter resistor also functions as a bypass to maintain a higher level of amplifier gain.

With the test button pressed, the lower leg of the voltage divider to the emitter of Q4 becomes approximately 1.6kΩ. However, before the stage is biased on, the emitter bypass capacitor must discharge through the emitter resistor and the parallel gating resistors, while the other capacitor must discharge via the 1kΩ resistor.

Thus the output of the gated amplifier rises to a constant level over a short period, as the capacitors discharge. We have now introduced the required rise time for the whistle simulation. The rise time can be made longer by increasing the values of the capacitors or the resistors. The converse is true if the rise time is to be made shorter.

It should be noted, however, that increasing the resistors in the gating network can lead to the stage not being biased on. It is therefore preferable to vary the values of the two capacitors instead of the resistors.

The same capacitors used to provide the rise time are used to give us the decay time. When the test button is released, the emitter bypass capacitor charges via the 47kΩ resistor, while the other capacitor charges via the 1.5kΩ resistor before the amplifier is biased off. Thus the output from this amplifier stage

fades over a short period.

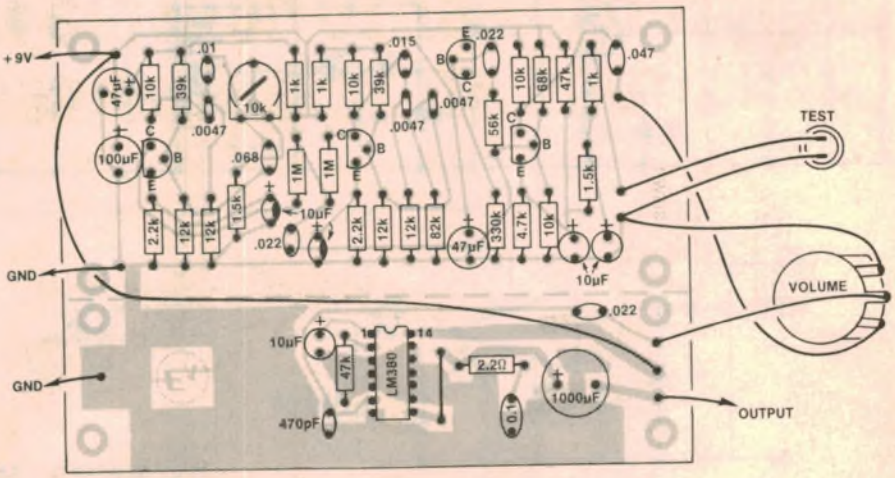
The operating frequencies of the two oscillators are approximately 600Hz for Q1 and 400Hz for Q2. The frequency of Q1 can be varied over a small range by adjusting the 10kΩ trimpot. If it is desired to change the frequencies of both or one of the oscillators by a significant amount, then the components in the feedback networks will have to be adjusted. This can be done by changing the resistors or the capacitors, or both if required. If the capacitor values are increased, the frequency will decrease and vice-versa.

The power amplifier stage consists of an LM380 power amplifier IC. This device is capable of delivering 2.5 watts of power into an 8Ω load when run from a 22V supply rail. The output power will be somewhat lower in this particular application because we are using only a 9V rail.

The signal from the gated amplifier is fed to the input of the LM380 via a 50kΩ potentiometer which functions as a volume control. The input is AC-coupled to the signal source via a .022μF capacitor. The 470pF capacitor connected between the input and ground is to ensure amplifier stability.

Current drain of the circuit in the quiescent state is about 7.5mA and rises to 30mA when the amplifier is gated on (this assumes an unclipped output). The maximum drain occurs when the volume control pot is set for full volume (output signal is clipping) and is 77mA. Considering these sort of currents it would be advisable to use a 9V plug pack adaptor where possible. If a 216 type 9V battery is used, then expect a reasonably short life from it. It all depends on how much the whistle is used.

WIRING DIAGRAM



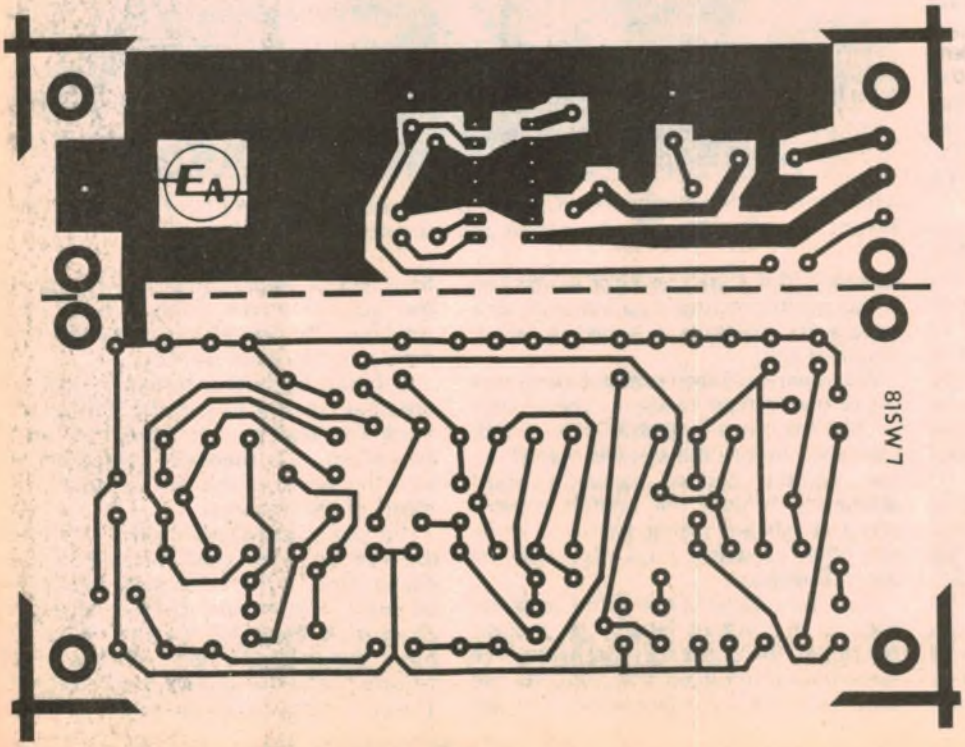
Construction is easy! – just follow this simple wiring diagram.

CONSTRUCTION

We have designed a printed circuit board (PCB) onto which all of the components, with the exception of the volume potentiometer and pushbutton switch, are mounted. The usual precautions should be taken when assembling the board, in particular with regard to polarised components. Care should also be taken when soldering the transistors to the board as excessive heat can destroy them. The same thing applies to the LM380 power amplifier IC. The "remote" pushbutton switch is optional.

The PCB has been designed in such a way that the power amplifier stage can be cut away from the rest of the board and used separately if desired. If this is done, then the power amplifier can also be used for other projects at a later stage. All that need be done to separate the two is to cut along the dotted line on the PCB.

We suggest that PC stakes be used for all external connections to the board. These connections include those to the loudspeaker, the potentiometer, test switch and the battery or power supply. If this approach is adopted, then the pads on the PCB will survive repeated lead connection and removal, should this be necessary.



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

$18.00

This includes sales tax, but not the power supply.

At left is an actual size reproduction of the PC pattern. Ready-made boards are available from the usual retail outlets.

Our new Systems Technician Apprenticeship scheme is more than just an Apprenticeship.

Applications close 3 July, 1981

Opportunity to work in electronics.

Tomorrow's aircraft and ground electronic systems will be highly complex, to say the least.

That's why we're looking for young, alert people interested in electronics and aircraft to be trained as Systems Technicians.

It's a highly specialised field that not only requires an analytical approach to problem solving but the potential to move into a management position very early in your career.

Areas of involvement include flight, propulsion, environmental, navigation, weaponry, electronic warfare, radar and computers.

Opportunity to receive a higher than normal standard of training.

After completing your certificate of Technology/Trade Training course, you'll spend four to five years gaining practical field experience as Tradesman. Then, if selected, you'll undertake a specially designed six months RAAF Systems Technicians programme that includes developing your management and communication skills plus further specialised systems instruction. On graduation you will be a fully qualified Senior Non Commissioned Officer Systems Technician in either the Aircraft, Avionics or Ground Electronics fields.

Opportunity for promotion.

Imagine, you could be a Commissioned Officer in your early 30's with great future prospects in the Engineer Branch of Today's space-age Air Force.

Opportunity to get valuable work experience.

These days, successfully completing an Apprenticeship doesn't automatically guarantee you a secure, well-paid job. We do!

Opportunity to travel and make more friends.

Initially, you'll go to Laverton (Vic.) or Wagga (NSW) depending on your specialised field.

Then you could find yourself working at any one of our many bases.

Wherever you are, there'll be excellent sports and social facilities at your disposal.

Opportunity to do something for yourself now!

If you're aged between 16-21 years, have Year 11 (Year 12 preferred) education with passes in Mathematics, Physics and English, are an Australian citizen and can meet our other entry requirements, talk to an Air Force Careers Adviser now! Alternatively, send the coupon and we'll send you the facts.

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Melbourne:	61 3731	Wollongong:	28 6492
Newcastle:	2 5476		

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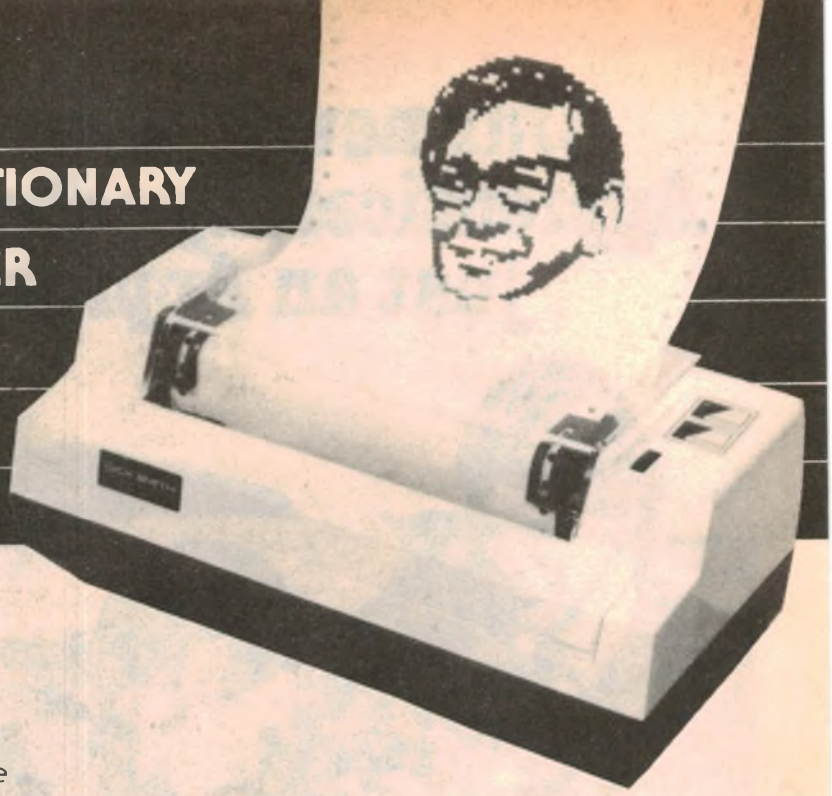
INTRODUCING A REVOLUTIONARY DOT MATRIX PRINTER WITH JUST ONE HAMMER. AT AN INCREDIBLE PRICE— JUST $495.

Cat. No. X-3252 P&P $5.50

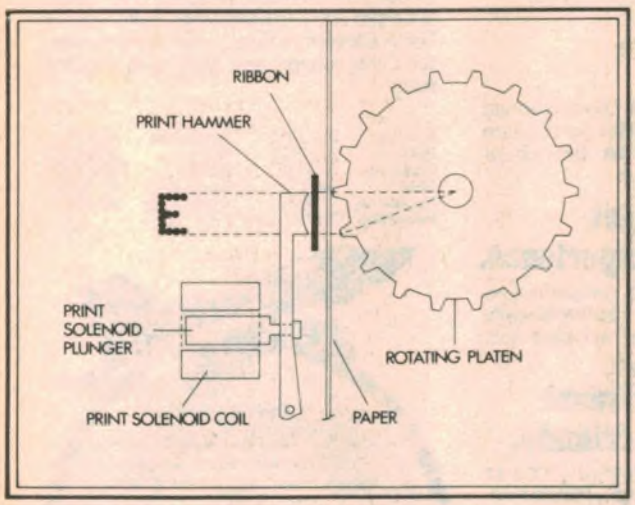


The Uni-Hammer Replaces Seven . . . or More.

Revolutionary? We don't know what else to call it. An impact printer with a single rugged hammer, rather than the seven or more individual solenoids and print wires found in conventional dot matrix printers.

At an incredible unit price of $495!

Because of the unique Uni-Hammer design, the X-3252 is smaller and simpler than other dot matrix printers yet costs considerably less. Which makes it a natural for the personal or small business user who wants a quality, reliable impact printer at the lowest possible price.



A Product of the Seiko Group

It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

How the Uni-Hammer Works

The X-3252, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

A Complete Printer

The X-3252 has features comparable to printers selling for thousands of dollars. These include upper/lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

Centronics Interface

The X-3252 DOT MATRIX PRINTER has a Centronics-type parallel data interface and is compatible with System 80, TRS-80, Sorcerer and Apple computers etc.

Fan Form Paper

2,000 sheets continuous fan form paper to suit printer

Cat. X-3254 .... $27.50

Replacement Ribbons

Cat. X-3253 $6.95

EXCLUSIVE TO DICK SMITH STORES

SEE OUR OTHER ADVERTS FOR STORE ADDRESSES.
Available by mail order
(P. & P. $5.50 from
P.O. Box 321, North Ryde)

"That siren was a test. We wanted to determine whether you were awake and watching our program." (From "Radio-Electronics".)

When you have completed the assembly of the board, go back over the construction making sure that all the components have been placed in their proper locations and that all polarity sensitive components (transistors, IC and electrolytic capacitors) are correctly oriented. Check also for dry solder joints and solder bridges between tracks. If everything appears to be OK, you are ready to test the unit.

Apply power to the board (assuming that the potentiometer, loudspeaker and test button have been connected) and then press the test button. You should hear two tones in the loudspeaker, together with a hissing sound. The hissing sound is that produced by the noise generator, while the two tones are produced by the two phase-shift oscillators. The frequency of the first oscillator can be shifted by varying the preset potentiometer on the PCB. You will find that the most pleasing sound occurs when the two oscillators are running at harmonically-related frequencies.

Well, there you have it, a stream whistle that can be used with your model railway layout. It will add just that much more realism to the whole thing. Happy whistling!

PARTS LIST

1 printed circuit board, code 81sw7, 121 × 85mm
1 8Ω loudspeaker
1 50kΩ potentiometer
1 momentary contact pushbutton switch

SEMICONDUCTORS
4 BC548 transistors
1 LM380 power amplifier IC

CAPACITORS
1 1000μF 16VW electrolytic
1 100μF 16VW electrolytic
2 47μF 16VW electrolytic
5 10μF 16VW electrolytic
1 0.1μF metallised polyester (greencap)
1 .068μF greencap
1 .047μF greencap
3 .022μF greencap
1 .015μF greencap
1 .01μF greencap
3 .0047μF greencap
1 470pF ceramic

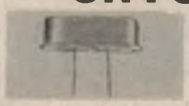
RESISTORS (all ¼W, 5%)
2 x 1MΩ, 1 x 330kΩ, 1 x 82kΩ, 1 x 68kΩ, 1 x 56kΩ, 2 x 47kΩ, 2 x 39kΩ, 4 x 12kΩ, 4 x 10kΩ, 1 x 4.7kΩ, 2 x 2.2kΩ, 2 x 1.5kΩ, 3 x 1kΩ, 1 x 2.2Ω, 1 x 10kΩ trimpot.

PROJECTS & CIRCUITS
NUMBER TWO
27 DO-IT-YOURSELF PROJECTS FROM ELECTRONICS AUSTRALIA

Available from:
"Electronics Australia",
57 Regent St, Sydney.

PRICE $3.00 OR **$3.70** by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014.

BRIGHT STAR CRYSTALS



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AND OVEN OSCILLATOR UNITS

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WESTEST ELECTRONICS, Perth
Phone (09) 337 6393

BRIGHT STAR CRYSTALS
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Telephone 546 5076
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And you thought your System 80 was just for playing games...

THESE PROGRAMS WILL ALSO RUN ON A 16K TRS-80 MODEL II

Most people think the same way. Personal computers – ho hum. Great for playing 'Space Invaders' . . . but what else can you do with them?

How would you like to do your 1981 Income Tax return by computer?

AUSTRALIAN INCOME TAX, 1981

YES! You can now use your personal computer to accurately and properly complete your personal income tax return! 'Austax 81' goes through each vital step of the tax form, making sure you don't miss anything! Calculations are done for you – automatically – and you can add, delete or change any entry at any time: the program automatically adjusts all the figures to suit! As far as we know, this is the ONLY program available for the 1981 income tax form, written specifically for a personal computer!

Program suitable for form 'S' available June; program for 'A' form available July. 'AUSTAX 81' Cat X-3762 $29.95

TYPING TUTOR

With our new 'Typing Tutor' program, you can learn to touch type in less than 8 hours! The computer is your teacher: it will tell you if you are making errors; even concentrate on the keys that are giving you problems! And it's so much cheaper than doing a typing course! 'TYPING TUTOR' Cat X-3682 $19.95

UNIVERSAL DATA FILE

Catalogue your stamp collection. Or your butterflies. Or recipes. Or even keep your club's membership records in order!

Dick's brand new 'Datfile' is an all-purpose data storage and processing program. You can store virtually anything you can write down in 'Datfile' – and then add to it. Delete it. Modify it. Sort it. Process it. Extract it or portions of it. In fact, you can use 'Datfile' to process information in just about any way you can imagine. Disk based. 'DATFILE' Cat X-3760 $99.00

SPEED READING COURSE

Time is always pretty short these days: why waste it by taking longer than necessary to read? Read everything faster, and with greater comprehension, with this unique program. 'SPEED READING' Cat X-3692 $19.95

MUSICAL COMPUTER

You've always regretted stopping those piano lessons! Now here's your opportunity to learn to read music – even though you can't play a note! It will teach you all the basics – from note recognition through to tempo.

'MUSICAL COMPUTER' Cat X-3640 $34.95

76 USEFUL PROGRAMS

Loan repayments, interest, mortgages – through to geometry, algebra, calculus, trigonometry . . . all those things you learnt at school but have long since forgotten. When you need to work something out, let your computer do it for you.

'COMMON PROGRAMS' Cat X-3665 $19.50

AND FOR THE KIDS . . .

A set of three programs designed to help them learn. They learn faster because learning becomes FUN! Take your choice of maths oriented, spelling or word usage programs. They've all been written exclusively for Dick Smith.

$9.95 EACH

'SCURVE INVADERS' (Basic Maths Drill) Cat X-3694
'HANGMAN/CONCENTRATION' (Spelling/words) Cat X-3696
'ALPHABET COUNTDOWN/RHYME TIME' (Manipulating words) Cat X-3698

AND YES . . . you can still use your computer to play games – including 'Space Invaders Game'.

FOR MORE DETAILED INFORMATION: Ask for a free data sheet at any Dick Smith store, re-seller or the Mail Order Centre.

AUSTRALIA'S FASTEST SELLING PERSONAL COMPUTER . . .

THE DICK SMITH SYSTEM 80

OVER 2000 COMPUTERS SOLD IN SIX MONTHS!

It's not hard to see why! Compare the System 80:
It is over $250 cheaper than a similar TRS-80 – and offers more features!
Features like a built-in cassette deck & power supply. 2 cassette controls instead of 1. S-100 bus compatability. Built-in video modulator (use with any standard TV set!)
Want to know more about the amazing System 80? Ask for free comparison & information data: available at your nearest Dick Smith store, Mail Order Centre or authorsied re-seller.

FROM ONLY

$695
(4K RAM)
Cat X-4003

16K RAM

$750
Cat X-4005

DICK SMITH ELECTRONICS

See our main advert in this issue for our store locations and authorised re-sellers

BANKCARD/TERMS AVAILABLE TO APPROVED CUSTOMERS

And now there's new software for even more versatility . . .

Get MORE with MMS FORTH

MMSFORTH is a powerful implementation of the popular FORTH programming language, designed for both professional and hobbyist use on System 80 & TRS-80 computers. Users can expand FORTH into virtually their own custom programming language. It comes on diskette complete with its own disk operating system, itself written in FORTH.

★ **MORE SPEED!**
FORTH is an incredibly versatile new language that operates 10 to 20 times faster than level II BASIC!

★ **Get more room . . .**
Forth has a compiled code plus VIRTUAL MEMORY which makes your RAM act longer!

★ **Get more instructions . . .**
Add YOUR commands to its large instruction set! Far more complete than most other Forths: single and double precision, arrays, string handling and more!

★ **Get more ease . . .**
Forth gives you an excellent full screen editor, structured & modular programming. It is optimised for your System 80 (or TRS-80) with keyboard repeats, upper/lower case display driver, single & double width graphics, etc.

★ **Get more power . . .**
Forth operating system interpreter AND compiler, internal Z80 disassembler; VIRTUAL I/O for video & printer, disk & tape.

Cat X-3668 **$85.00**

BASIC PLUS
ZBASIC, SIMUTEK'S BASIC COMPILER

Now you can have the best of both worlds . . . the ease of programming in BASIC, with the speed of machine language.
And your programs become VERY difficult to pirate!

Simutek's ZBASIC is what you need.

ZBASIC is an interactive compiler. This means it is resident while you write BASIC programs. You may compile your program and run or save it, in machine language form, without destroying your original BASIC version. In fact, jumping back and forth between your compiled code and the BASIC original is one of its best features.

The ZBASIC compiler allows saving your compiled programs to disk. Programs may then be loaded as a /CMD file from DOS. This makes it extremely hard for others to 'pirate' your programs.

And Simutek, the manufacturer, makes no royalty charge on programs that are compiled with ZBASIC – unlike some other companies which charge you up to $200 a year!

Some of the BASIC commands supported by ZBASIC:

FOR	NEXT	STEP	IF	THEN	ELSE	PEEK	ON GOTO
SET	RESET	POINT	CHR$	RANDOM	RND ( )	POKE	ON GOSUB
DATA	READ	RESTORE	END	GOTO	GOSUB	CLS	
PRINT	LPRINT	PRINT @	USR	SGN	INT	ABS	
SQR	LEN	ASC	VAL				
INT. MATH		AND OR SQR					

Why use a complicated 'Assembler' to write machine language programs when you can write them in ZBASIC?

Cat X-3570 **$140.00**

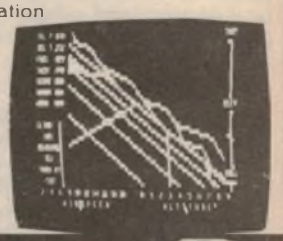
Learn to fly . . . by computer!
FLIGHT SIMULATOR

Thanks to fast animation and accurate representation of flight, the non-pilot can now learn basic flight control, including take-off & landing!

And experienced pilots will quickly recognise how thoroughly they can explore the aircraft's characteristics: without risk!

Computer and aviation experts call this program a marvel of modern technology: you'll call it fantastic! Once you've acquired flight proficiency, you can engage in the exciting British Ace 3-D Aerial Battle Game included in the package.

Features:
- 3-frame per second flicker free animation
- Out-of-cockpit view of flight
- Constant feedback cassette loader



$34.90

Cat X-3684

ASK AT YOUR NEAREST DICK SMITH STORE FOR A FULL PROGRAM LIST!

A low-cost printer from Dick Smith Electronics

Up until now it has not been possible to buy a dot matrix printer for under about $1000, but this situation has changed with the release of a new low cost printer onto the market by Dick Smith Electronics, at a cost of $495.

The new Dick Smith GP-80 is a very compact unit and as such is quite an attractive proposition for anybody requiring a hardcopy device. The external appearance is neat. The cover is moulded from a white plastic and the base is moulded from brown plastic. A clear plastic cover goes over the top to act as a sound shield and does reduce the noise level quite effectively, although it is still fairly noisy. Two LEDs are mounted in the top right hand corner; one for power indication and the other to indicate a function error.

The printing mechanism in this printer is quite different to other impact type dot matrix printers. Instead of using seven hammers moving across the paper to form the character, this one uses only a single hammer. Behind the paper is a splined shaft which is synchronised to the hammer by the on-board microprocessor. The splined shaft spins while printing is in progress and the hammer hits onto the shaft through the paper and the inked ribbon to form the characters.

The angle of rotation of the spline shaft at the time the hammer strikes determines the dot that printed to form the character. If a graphics character consisting of 35 dots (5 × 7) were to be printed for example, then the hammer would have to be used 35 times. Each time the angle of the spline shaft will be different. The microprocessor senses the positions of the splines by using an optical sensor, and when the appropriate angle occurs, it actuates the hammer to print a dot on the paper.

A natural result of this type of printer operation is a somewhat slower throughput (30 characters per second) in comparison to the seven-hammer types, but if speed is not the all important factor, then this won't worry you.

The printer supports the full 96 character ASCII set. The lower case characters do not have descenders though, not that this is of any major consequence unless you require letter-quality print. In the latter case you would probably opt for a daisy-wheel printer anyway. An added bonus (particularly at the price) is dot-addressable graphics. This mode allows the user to print almost any graphics image by having control over each and every dot.

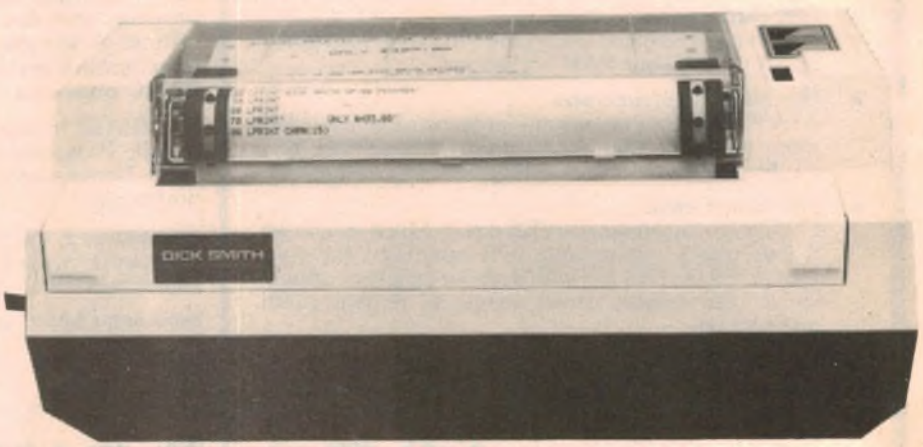
There are two very handy features offered by the graphics mode. The first is a character repeat function. Let's assume that you are designing a form and need to print a series of horizontal lines across the page; what do you do? The answer to this is simple. The repeat function allows you to do this by specifying the character to be printed and then the number of times that it is to be repeated. This function is implemented by means of a control code (1C). The control code, 1C, is first output to the printer to select the repeat mode, followed by the character to be printed, and then finally by the number indicating the number of times the character is to be repeated.

The second feature in the graphics mode allows the user to specify the start of a line by loading in a dot address. The dot address can range from 0 through to 479, which represents the number of graphics print positions on a single line.

Both of the features just mentioned are very handy when it comes to writing software for a graphics printout in that they allow a lot of simplification. If a character is to be repeated, it does not have to be output to the printer over and over again. Instead three simple instructions do the job. The latter feature allows forms to be designed and printed with a minimum of fuss.

Another feature offered by the printer is a double-width font. Here the characters are printed out double width resulting in a very bold type. This is handy for headings or where text has to be highlighted.

All of the functions can be mixed and used on a single line. If it is desired to print some graphics characters followed with text in the standard size font, and then in the larger font, all that needs to be done is to send the appropriate control codes to the printer just prior to the block of text being printed out. An example of this appears elsewhere in this review.



This compact printer uses a single hammer and a splined shaft as the print mechanism.

The instruction manual that comes with the printer details the various aspects of the unit. It does not however, describe the operational aspects as clearly as it should. The graphics operation in particular, lacks suitable discussion. This problem has been overcome by means of a Technical Bulletin which is available from Dick Smith Electronics at their North Ryde Head Office.

The paper used by the printer is of the fan-form type, each sheet measuring 200 × 150mm (8" × 6"). The sprocket holes are punched into the sides of the forms

```
HERE IS THE FULL CHARACTER SET OF THE PRINTER.
NOTE THAT THIS DOES NOT INCLUDE ANY  OF THE GRAPHICS
CHARACTERS.

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdef9hiJklmnoP9rstuvwxyz{|}~

----------------------------------------

THIS IS THE SAME CHARACTER SET IN DOUBLE SIZE PRINT

!"#$%&'()*+,-./0123456789
:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdef9hi
Jklmnop9rstuvwxyz{|}~

DOUBLE SIZE CHARACTERS
```

This sample printout is reproduced actual size. Note the whimsical graphics output.

and these can be removed since the sides, as well the forms have been perforated. The paper comes in boxes of 2000 sheets at a cost of $27.50.

The printer comes with a standard Centronics compatible interface which is suited to most personal computers currently available.

The instruction manual makes mention of other types of interfaces that are available for the GP-80, but these are not being handled by Dick Smith Electronics. Fortunately most computers will interface to a centronics type printer.

We had the printer hooked into a System-80 computer and ran quite extensive tests on it. The most noticeable thing about the quality of the print is a slight "furiness", but this tends to disappear as the ribbon ages. The print also tends to smudge a little while the ribbon is still new, but again, this problem disappears after a while.

All in all we found the printer to be good value for money. For the person involved with software development or for the small business, this is an ideal printer.

For further information contact any branch of Dick Smith Electronics. (G.C.)

COMPUTER SYSTEMS (AUST.)

Microcomputers?

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Associated with QT Inc. - USA

S = 100 Bare Boards

- **SBC + 2/4 SINGLE BOARD COMPUTER** **$ 60.00**
  Z80A 2/4 MHz, EPROM & 1K RAM, 1 serial & 1 parallel ports, DMA & Shadow mode (64K) operation, 2 clock timers.

EXPANDABLE + II 64K MEMORY **$ 75.00**
Run at 4MHz, 4 banks of 16K each, 24 IEEE address lines, Z80 or on board refresh, 40 (HEX) bank ON/OFF select, 3 Watts.

- **DOUBLE DENSITY DISK CONTROLLER** **$ 85.00**
  On board Z80A & 1793 double density controller, bootstrap ROM for CP/M 2.2, compatible with Shugart 800/850. BIOS and UTILITIES are available.
- **SILENCE + MOTHER BOARD (8 SLOTS)** **$ 27.00**

SALES TAX AND DELIVERY CHARGES TO BE ADDED IF APPLICABLE

QTV/7582B

Coming Next Month*

The Super 80 Computer—at last

YES, *it's finally here (note the name change, though). Presentation of the first article was delayed, but this highly competitive single-board Z80 computer is most definitely "on", and will be introduced in the August issue.*

The Super 80 has features not found on computers costing twice as much. A powerful BASIC interpreter, up to 48K of RAM on board, a full-size keyboard, RF modulator for TV display and built-in S100 expansion capability are just some of its good points!

Musicolour IV

A rather special 4-channel colour organ, this one will really light up your music! Our new Musicolour design may be driven from a hifi amplifier or its own internal microphone, and can also be used as a sound triggered light chaser, with four distinctive patterns. It can handle a total of 2.4kW.

AND MUCH MORE – including TWO free catalogues, one from Sheridan Electronics and one from Altronics of Perth. Don't miss it!

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

MAKE THE MOST OF YOUR COMMODORE

HIGH-RESOLUTION GRAPHICS

Now you can give your PET/CBM an High-Resolution Graphics capability with the MTU Graphics Hardware and Software Packages. The Hardware is easily installed and the new graphics board provides five EXTRA ROM sockets and 8K RAM MEMORY EXPANSION which can be used for program or data storage when graphics are not required. A powerful graphics Software Package is included and contains many extra BASIC commands for drawing lines, defining shapes, etc. The Graphics Hardware does not affect normal operation of the Commodore.

— for 2000 Series 8K PETS: **$529**
— for 3000/4000 Series 16/32K CBMS: **$587**
— for 8000 Series CBMS: **$660**

RS232 TESTSET

The RS232 TESTSET is a small hand held device that connects inline with the interface cable, the terminal, or the modem and monitors the line signals. The TESTSET passes all 25 lines through and so can be left connected without affecting communications. It is completely portable as no batteries are required since power is derived from the interface signals. Each indicator circuit is current limited to meet the requirements of the RS232 Interface Standard. Also the voltage range for activating the bright LED display corresponds with this standard and thereby reduces troubleshooting to a "GO NOGO" problem instead of trying to measure active signals to determine voltage levels. One 2-pin and one 3-pin jumper is included.

PRICE: $150

EXTRA BASIC COMMANDS

Add extra commands to your Commodore's BASIC:—
Programmers Toolkit — AUTO, RENUMBER, FIND, TRACE, APPEND, DELETE, DUMP, STEP, HELP —
for BASIC 1.0 Old ROM PETS: **$75**
for all others: **$56**
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Letters to the editor

Feedback on negative ion generators

I have just had the opportunity to read your article on negative ion generators in the feature "Forum" which was published in the May issue of "Electronics Australia". I found it to be interesting and generally objective on a subject which has produced a substantial amount of biased writing in the past, these biases either being heavily for or against the beneficial health effects of negative ion generators.

You may be interested to know that two serious experiments are underway here as part of my medical physics research and teaching program which have as their aim an objective testing of the possible health benefits to be gained by restoring the depleted negative air ion concentration inside rooms to normal outdoor unpolluted levels.

The first of these experiments is looking at the connection to asthma and is being conducted by a group of professional scientists including a hospital-based medically qualified asthma specialist, physicists, a psychologist and a medical physics research student. It is being carried out in an exacting double blind manner with quantitative measurements of the effective lung parameters of the patients to remove any doubt as to the realness of any effects which may be observed.

The second experiment is directed at uncovering what improvement if any in mental alertness is experienced by secretaries here when negative ion generators are operated in their rooms in real work situations. Alertness is tested in the first instance by simple reaction time measurements.

In both cases, concurrent measurements of the actual air ion concentrations are being made using a well-known imported air ion analyser. It is hoped that both experiments will be complete by the end of this year.

While we are all keeping an open mind on the outcome of these experiments, I nevertheless have personal experience of the beneficial effects of these devices when used by individuals here in Canberra with other health problems, eg migraine. It would be unwise and indeed unscientific I think to dismiss the subject until the results of carefully conducted local trials are known.

A. J. Mortlock, MSc, PhD, FAIP,
Reader in Physics,
The Australian National University,
Canberra, ACT.

Our heartiest congratulations on your article in the May edition of EA, regarding negative ion generators.

The vast scepticism regarding these machines is well founded, and the primary blame lies with the majority of the marketing companies. Being in the field for almost 12 years, we have discovered that claims, and in many instances unfounded claims, are made with the sole purpose of promoting the sale of the ionizer currently on hand.

From our own personal experience, we have found that from the vast number of marketing and manufacturing companies that exist in the world today, only a handful put anything into research and development. The almighty dollar appears to have first preference.

Your article points out dramatically just how vulnerable the negative ion science is and how standards, especially for ozone emission and electrical safety, are missing.

From our extensive library, we can read about the fantastic effects that negions have and yet in other studies, these effects are denied. The reason is simple. Parameters and standards are confounded with the inability of researchers to establish a basis or a standard to measure their results and until this is done, negative ions will remain in the category of witchery and gobbledy gook.

The public must be made aware that there are inherent dangers and a regulatory body should be appointed to set standards for manufacturers and importers.

Negative ions are beneficial to a significantly high degree and, therefore, they are important enough to further study their effects, especially in the fields of asthma, hayfever and other respiratory ailments, together with the fields of worker productivity and environmental conditioning.

In conclusion, may we suggest that if anyone is interested in owning a negative ion generator, please let them contact experts in the field, and not just rely on untrained, inexperienced shop assistants.

Joshua Shaw,
Managing Director,
Bionic Products Pty Ltd,
Rose Bay, NSW.

That famous scientist

Editor's note: A reader who does not wish to be identified has sent a photostat copy of a paper which identifies the scientist who in 1932 observed the alleged effects of negative and positive ions (Forum p31, May 1981). The relevant item reads as follows:

In 1932, at the Rocky Point, Long Island Laboratory of RCA Laboratories, Dr Hansell observed that an electrostatic generator produced powerful effects upon a sensitive individual, an engineer, who was working in the room. Positively charged air produced physical, mental, and emotional depression whereas negatively charged air produced a physical, mental, and emotional uplift. The effects were so powerful that they could not pass unnoticed, so that an investigation of the cause was made. This resulted in more care being taken in the operation of the machine and in the carrying out of a number of experiments relating to air ionization.

Electronics exhibition for Grafton

Grafton Chapter of Jaycees is currently planning an "Electro-80's Exhibition" to be held in Grafton on September 18, 19 and 20, 1981.

The purpose of the exhibition is to allow local and national firms to display products to a wide cross-section of the rural public who would not ordinarily have the opportunity to view them. This includes a wide range of electronic home and industrial equipments – microcomputers, industrial lighting, large screen, TV receivers etc are not readily available on the North Coast.

Exhibitors will be charged a nominal space rental fee and a package advertising campaign can be arranged if required by individual firms. The bulk of money raised by the exhibition will be donated to the local Year of the Disabled Persons Committee whose goal is to erect a hostel on land already donated. A further donation will be given to the Grafton Base Hospital towards the provision of ultrasonic diagnostic equipment.

This is the first venture by the chapter into an exhibition with an electronic theme, although it has successfully run trade fairs in Grafton for the past 12 years. As with the trade fairs, this exhibition will be preceeded by an extensive regional radio, newspaper and TV campaign.

It is hoped that we can bring the exhibition to the attention of your advertisers and readers. We are issuing invitations to

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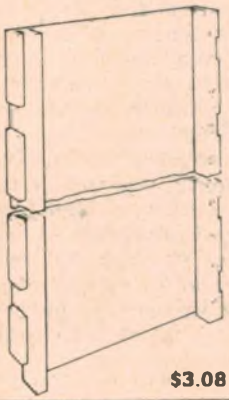

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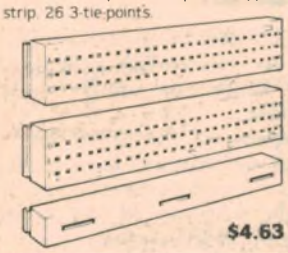

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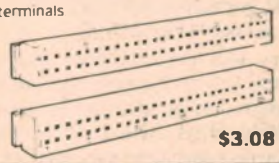

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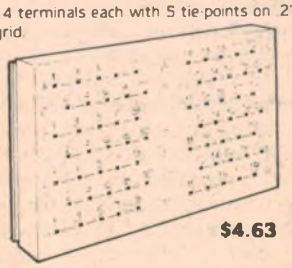

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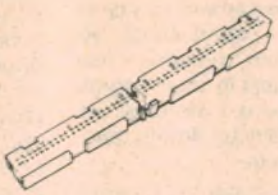

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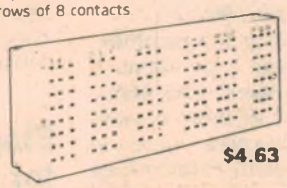

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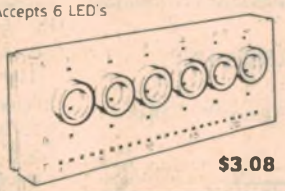

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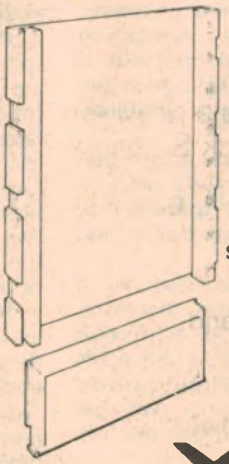

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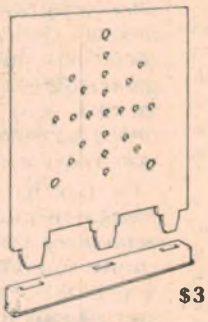

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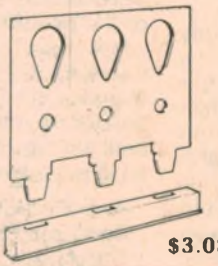

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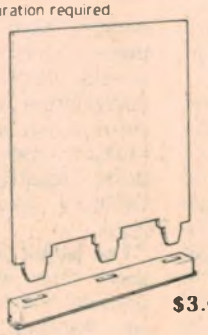

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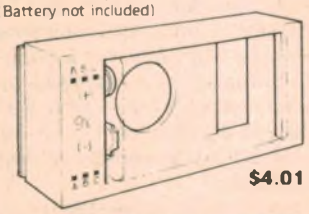

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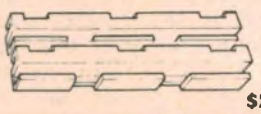

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Problems with wind generators

In an article entitled "Windmill Power for Australia: Part 2" ("Electronics Australia", July 1978, p 42), John Andrews described how to rewind a Bosch 12V car alternator, for use in conjunction with a direct drive 2m-diameter two-bladed propeller windmill.

In general, car alternators are designed to work in the range of 1000 to 10,000rpm. Consequently, it is necessary to change the characteristics of the alternator, if it is to be used in wind-generator applications where rotational speeds of 300-1000rpm are frequently encountered.

Since 12V car alternators are readily available, John Andrews' article aroused considerable interest among several members of the recently formed Australasian Wind Energy Association (AUSWEA). In particular Peter Cole (Colepower Marine Engineering, Brooklyn, NSW, 2253) rewound several Bosch alternators, for use in conjunction with 2m-diameter propellers.

In December 1980 we purchased a rewound alternator from Peter Cole and subjected it to several bench tests. The results obtained may be of interest to your readers. Unfortunately the measured power outputs are disappointingly low in the frequency range 300-1000rpm.

The rewound Bosch alternator was a nine-diode alternator of the LJ series, rated at 420W. It is equipped with a solid-state regulator which adjusts the current through the excitation coils until the output reaches the required 12V for battery charging. In the tests, the regulator was removed in order to allow clear recognition of the alternator's characteristics, free from feedback effects. Because of this it was necessary to supply the static excitation coils with a separate power supply.

The results of our tests are as follows:

- The magnetic induction produced by the excitation current begins to saturate at currents above 2A. In general, therefore, there is little point in using excitation currents much in excess of 2A at low rotational speeds;
- Maximum power transfer occurs when the load resistance is approximately 5 ohms;
- Maximum power output increases almost linearly with rotational speed, reaching 400W at approximately 2500rpm;
- The net power output of 13W for a rotational speed of 417rpm is disappointingly low;
- There is a substantial drop in power output when the alternator is used in the self-excited mode. In this regard, it should be noted that an external power source, such as a battery, is necessary to initiate the excitation current for a short time during run-up. Once the unit is producing power, the battery can be disconnected.

In summary, we believe that the rewound Bosch alternator is still essentially a high speed device and is therefore not well suited to direct drive wind generators. One way of improving the situation would be to equip the alternator with a 3:1 speed increaser. This would bring about a substantial increase in power output (approximately 400W at 800rpm), while at the same time relieving the generator of axial thrust, for which it is not designed.

However, for the beginner, the incorporation of a 3:1 speed increaser represents a severe hurdle, since it requires a suitable support structure and oil-tight seals.

Unfortunately we do not know of a suitable direct drive "multiple generator" in the 100-500W range, which is easily accessible in Australia and would be compatible with the wind generator described by John Andrews in his article. If any of your readers know of such generators, we would be very pleased to hear from them.

G. J. Bowden, School of Physics,
University of NSW, Kensington, NSW.

RAMs, ROMs, bits bytes & gobbledy-gook

I have been receiving your magazine for about three years now, and find it most interesting and informative except for the sections on computers. These sections are obviously intended for readers who are already owners and users of computers, and consist of pages of "gobbledy-gook" unintelligible to the ordinary reader.

Terms such as RAMs, ROMs, EPROMs, bits, bytes, glitches and pixels only confuse prospective owners and users who want to know what a certain computer will do, or, more to the point, what it will NOT do. For instance, take a certain computer selling for $599.

Correct me if I am wrong, but it seems to me that this machine will play "Noughts and Crosses", perhaps "Lunar Lander", but definately NOT "Space Invaders" or chess.

It would possibly be capable of working out the tax refund of an average worker but the bookkeeping of my small farm would be completely beyond it. For this I would apparently need something costing about $5000 which seems a lot to pay for a machine to do what I now do with an exercise book and a $10 calculator.

Perhaps you could pass on my remarks to your advertisers as their ads are about as informative as your column.

R. H. Hansen,
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AMATEUR RADIO

by Pierce Healy, VK2APQ

New transmission techniques for old modes

In part, item three of the amateur code reads: "The amateur is progressive; he keeps his station abreast of science . . ." This aspect is clearly evident today in the increasing amount of solid state technology being incorporated in amateur station equipment.

Amateur radio is becoming a whole new "ball game". This fact may not be noticed by those who have joined the amateur ranks within the last four or five years, but those with experience beyond that period will recognise the changing pattern.

The solid state era has brought many changes in design, performance, and reliability to amateur radio equipment. Now the microprocessor is well to the fore in providing the once thought nigh impossible.

This aspect is clearly evident from on-air discussions, and from technical articles appearing in amateur radio magazines. The MPU technique is now enabling innumerable functions to be incorporated, readily available at the touch of a button or switch.

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Microprocessors are also being used in several modes of transmission.

Computers, once looked upon as business office machines are now being programmed to interface with amateur station equipment to send and receive Morse code, radioteletype, slow scan television, or to keep the station log, print QSL cards etc.

But what about the new transmission techniques for old modes? Here are a few brief comments to whet your curiosity.

● TELEPHONY: Recently the Department of Communications approved narrow band voice modulation (NBVM) experiments by full or limited licencees. Parameters given in the 1979/1981 ARRL handbook are acceptable. The Department would welcome feedback through the WIA of any significant technical development trends.

● TELEGRAPHY: In the May 1981 ARRL magazine "QST", is part 1 of an article on coherent CW (CCW). The introductory heading reads: "Would you think that you could decrease your transmitter output power by a factor of 10 and increase signal readability by the same amount — simultaneously? It's being done now."

The author, Charles Woodson, W6NEY states that extrapolation of data on tests carried out between JR1ZZR, Japan, and W6BB, USA, on 14.049MHz indicate an estimated 13W CW signal as equivalent to a 0.1W CCW signal in communication effectiveness, or a 21dB superiority for CCW.

● SLOW SCAN TELEVISON: In CQ magazine April, 1981, is a review of the "Volker Wraase SC-422 Two Memory SSTV Converter and KB-422 Keyboard" by Mike Stone, WB0QCD. It is claimed by the reviewer that this is the last word in amateur SSTV equipment presently available. Any picture in the memory of the SC-422 can be used as a background for alphanumeric information generated by the KB-422 keyboard. Regarding on-air performance he comments:

"You should see the amazement when I return the sending station's self-portrait with his callsign and name typed in with the picture. The usual response is 'What type of computer are you using?' "

● RADIOTELETYPE: In addition to the many dedicated solid state RTTY units on the market, considerable progress has been made in devising programs to allow popular low priced computers to be used as RTTY terminals for both Baudot and ASCII systems.

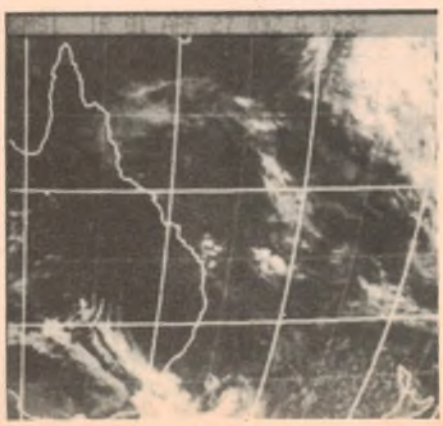
Incorporating two pre-programmed microprocessors, another RTTY system designed by J. P. Martinez, G3PLX, called AMTOR (Amateur Microprocessor Teleprinter Over Radio), has caught the interest of RTTY operators in Sydney.

Attention was drawn to this system by an article in the RSGB publication "Radio Communication" August, 1979, which outlined the principles of AMTOR. A further article in the June/July, 1980, issue gave circuit diagrams and description, construction, testing and operating details. A postscript gave details of kits for the home constructor.

The system is unique for amateur radio in that it has an error correcting facility involving synchronisation of the two stations in contact.

"Home-brew" earth station

A NSW reader has built himself a satellite ground station, and the photographs at right show the result of his efforts. Mr T. J. Matulevicius of Goonellabah built the station entirely from "home-brew" gear, some of it to the design of Les Wilson of Macquarie University (EA, May 1979). The station picks up signals from the Japanese Geostationary Meterological Satellite GMS-1, a weather satellite parked 35,800km high over the equator to the north of West Irian.



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AMATEUR RADIO

More details of the AMTOR system are available from the Australian National Amateur Radio Teletype Society, PO Box 860, Crows Nest, NSW 2065.

A worldwide increase in radioteletype by amateurs seems to be due to the availability of solid state equipment. On-air contacts indicate that an increasing number of "home computers", commercial and home constructed, are being used among amateurs as part of RTTY stations.

A point that has been raised in relation to these new techniques asks will the trend create specialists who know only one mode, and will amateur radio lose participants able to communicate with each other as readily as in the past?

Such questions may arise as: How to readily identify the type/mode of emission? How to readily identify intruders into the amateur bands? Will sub-division of amateur bands for various techniques become a necessity? Will a computer become an essential unit in an amateur station?

The examples given are only the "tip of the iceberg". There is still pulse, facsimile and high speed digital types of transmission to be considered, not forgetting the possibilities created by the next generation of amateur satellites.

Amateur's ingenuity will provide an answer. It could be that a standard fitment in an amateur multi-mode transceiver will be an inbuilt microprocessor to instantly identify and visibly indicate the mode of the received signal; or it could be programmed to accept only the mode selected by the operator.

Maybe, in the future, amateurs will still, as now, transmit in whatever mode they wish, but the receiver will accept the signal and process it into whatever mode the listener chooses; the ultimate in cross-mode operation.

Is this being Jules Verne(ish)? Maybe! But how true his "fiction" has become!

SOLAR POWERED ISLAND STATION

Problems experienced by some amateurs and the willingness to help a fellow amateur is exemplified by this story – a Motorola corporate press release which appeared in QST December 1980.

The high cost of fuel oil nearly forced Tom Christian, VR6TC, off the air, until a fellow amateur came to the rescue with a solar-power unit.

By late 1979 the cost of fuel oil to run Pitcairn Island's diesel generators had risen to nearly $US200 per barrel. At that price islanders could afford to have power for only about two hours a day, and Christian's operating time was limited.

Escalating fuel costs and the fact that only a few ships call at the island each year had been frequent subjects of conversation between Tom Christian and the amateurs who talked to him. One of these amateurs was Thorn Mayes, W7HWA of Phoenix, Arizona. Mayes and his wife were planning to visit Pitcairn via an island hopping ship out of the Fiji Islands and wanted to help Tom Christian with his power problem.

Solar energy seemed like a reasonable long-term solution, so Mayes contacted the Semiconductor Group at Motorola Inc. Solar systems personnel agreed to help and three 61cm square solar-power modules were assembled and packaged so that Mayes and his wife could take them to Tom Christian.

The Mayes left Phoenix in late October, 1979, and a month later the three solar panels were installed on Tom Christian's antenna tower on Pitcairn.

The modules contain 36 solid state photovoltaic cells, which convert sunlight directly into electricity. Sun generated power is stored in batteries which allows VR6TC to be on air almost anytime of the day or night.

Hopes are that all the island's power needs eventually can be provided through solar-power. Even at today's high cost, photovoltaic power, when amortised over a 20 year period, is almost competitive with the island's cost of generating power by diesel generator. The cost of a solar-power unit of that size is more, at present, than the islanders can afford. But maybe one day Pitcairn will get all its power from the Sun.

BITS AND PIECES

COMPUTER QSL CARDS: "CQ" May 1981, in an article by Phil Anderson, W0XI, gives "A 39 step BASIC program" for printing your own QSL cards. The article states that 102 × 152mm index cards thick enough for postal use can be purchased for this use.

LITTLE GIANT ANTENNA: Looking like the coils on the back of a domestic refrigerator, this antenna is basically a compressed half-wave system with the Yagi elements collapsed into S-shapes using a slider adjustment on the loading/impedance matching coil. The 40-metre version is 686mm high, 559mm wide and 102mm thick. The range covers 80 metres to 10 metres.

The inventor and manufacturer is Stan Byquist, K8VRM.

UOSAT: An amateur satellite being constructed at the University of Surrey, UK, and supported by AMSAT, RSGB, and British industry and research organisations, is scheduled for launch by NASA into a synchronous orbit in September, 1981.

RSGB publication "Radio Communication", February 1981, has an interesting and informative article on this spacecraft.

RADIO CLUB NEWS

RADIO AMATEURS OLD TIMERS' CLUB: The club had its eighth annual dinner at the Science Centre, Melbourne, Victoria on March 5, 1981. One hundred members attended, including a number from interstate. RAOTC now has close to 500 members in Australia, New Zealand, the United Kingdom and the USA. Membership is open to any amateur who has held an amateur transmitting licence for 25 years or more and applications to join are invited.

Upon enrolment, the club offers an attractive membership certificate together with a member's lapel badge. Cost of membership, which includes the certificate and badge, is a one time $5.

Application for membership should be made to the Secretary, RAOTC, Harry Cliff, VK3HC, PO Box 50, Port Lonsdale, Victoria, Australia 3225.

GOULBURN AMATEUR RADIO SOCIETY: This group meets on the second Wednesday of each month at the Goulburn Police Boys' Club, commencing at 8pm. A club net is held every Sunday night at 9pm, on 3615kHz, under the call sign VK2BTZ. Postal address is PO Box, Goulburn, NSW 2580.

ILLAWARRA AMATEUR RADIO SOCIETY: Like most amateur radio clubs, the IARS publishes a monthly newsletter containing information and items of interest to members. Here is an item from "The Propagator" May 1981.

"Telephone enthusiasts who have installed one of the much advertised (but illegal to use) cordless telephones, may be in for a shock when they get their next phone bill.

"It seems 'phone jockeys' have been parking outside houses known to have cordless phones, and using their own hand held units to access the phones from the street. Trunk calls are then a cinch (and very cheap for the man in the street).

SO YOU WANT TO BE A RADIO AMATEUR?

To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Correspondence Courses are available at any time. Personal classes commence in February each year.

For further information write to

THE COURSE SUPERVISOR, W.I.A.
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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.

The Australian CB SCENE

The disabled — an activity for CB clubs

The reason for the above heading is found in the paragraph immediately below, and in others which follow later. With their cars and their two-way radios, CBers are in an ideal position to share simple pleasures with disabled folk — and to polish the CB image in the process!

GROUP OUTING: In May, the Brisbane and Districts Radio Club organised a convoy of cars to take a group of handicapped children from the Montrose Home in Corinda, an inner Brisbane suburb, down to Sea World at the Gold Coast for the day. As it turned out, the date coincided with Mother's Day, and I was unable to attend myself due to prior family commitments. There were three NCRA cars in the convoy, along with about 10 others, and it appears that the kids really enjoyed themselves both with the day at Sea World and also in using the CB sets in the cars during the drive. I sincerely urge other CB groups to remember that this is the Year of the Disabled and to try to help out with this type of thing Australia wide. Congratulations to the BAD Radio Club and the people concerned with the convoy for their efforts.

CB MANUFACTURING: Things aren't too healthy in the area of CB manufacturers at the moment, although there is hope that conditions will improve. A recent issue of the "Australian Financial Review" says that, of the 15 to 20 US CB radio makers who were around in the heyday of the mid 1970s, there are only five survivors; Tandy, Dynascan Corp, Midland (a subsidiary of Beneficial Corp), General Electric and Pathcom. One thing to bear in mind, however, is that a lot of sets are now getting on in years and things may look up again when these old sets finally give up the ghost and their owners are forced to replace them. I certainly hope that this will be the case.

FROM BRITAIN: The UK has finally obtained a CB Service, but I use the term loosely. I do not consider FM on 27MHz and FM on 930MHz with a maximum output power of two watts to be much of a CB Service. The "Service" is still being called "Open Channel", and AM and SSB transmissions are still to be illegal. I will be watching events in the UK with interest.

CB AND STATE POLICE: Correspondence between the NCRA and the Department is really flying these days in relation to the position where State police officers seek to enforce the WT Act. The Association has always argued that State Police are really in no position to determine whether or not the Act is being breached. A classic example of this came about when two operators well known to me were interviewed by Queensland Police officers in April in relation to a 23-channel set (licenced) which they were operating in their car. The police officers told the fellas that they had read the Minister's statement concerning the new Import Restriction on non type-approved sets, and that 23-channel equipment was no longer legal. The operators tried to explain to the officers that this applied only to sets coming into the country, and that all 23- channel sets currently licenced were quite legal. This had no effect and they were told to disconnect the set or it would be disconnected for them. Needless to say, they complied with the "request" and then lost no time in contacting the NCRA about it. Thanks to the quick work of Mr Ross Ramsay, the First Assistant Secretary of the Radio Frequency Management Division, DOC, all State Police Commissioners will by now have a copy of the letter which was sent to the National Director explaining the intent of the Minister's press release. It makes one wonder, though, just how often this kind of thing goes on without anyone being told about it. This is the kind of thing which the NCRA wants to know about so that it can help you. All you have to do is write.

CORRESPONDENTS, PLEASE: It won't be Ken Upton's fault if I am not kept posted with CB doings in NSW. This time, 11 pages plus a photograph. I would be delighted to find regular correspondents in other states, so that I could present an Australia-wide picture.

FROM LIVERPOOL, NSW: I understand that the meeting held at the Liverpool Town Hall in March was a success. The purpose of the meeting was to allow the clubs in NSW to meet with the NCRA representatives and a representative from the Dept of Communications. I would like to thank the organisers of the meeting, the Chairman, Reni Barnes, Mr Christensen of the Dept (no relationship to yours truly) and the clubs and individuals who attended for making it the success that it was.

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CHARITY EFFORT: In March, the Big Wheels Radio Club Aust Ltd put on the Nev Nicholls Truck and Road Show in conjunction with the Charity Queen and the Community Volunteer Bush Fire Brigade Appeal. I understand from Ken that Bob Saint and the LA Club put a lot of effort into this event and that it went off tremendously.

OLBIS INDUSTRIES CONTEST: I have received lots of entries for the Australian CB Scene-Olbis Industries Contest and, by the time you read this, the winners will have been decided and will have been notified. They may even be using the equipment. As soon as possible after that we will give details of the winners and the entries which won them the prizes. I must say that Bernie and I will have a hard time deciding the winners, because there have been so many entries. I would like to thank you all for helping to make the competition a success.

OMEGA CLUB, RED CROSS: Main event on the calendar of the Omega Club was the Red Cross Appeal which unfortunately I was not able to advertise in this column due to the deadline. The whole thing rested on the shoulders of 17 members of the Omega Club, and I feel that their work deserves recognition. Three bases operated in the Sydney metropolitan area from Friday March 27 through to Sunday 29th. Steve, Omega 73 operated the base at Ermington; Barbara, Omega 28 operated the base at Merrylands, and Pat "Pegasus", operated the base at Granville. They were aided in the capacity of mobile or relief operators by the following: Phil, Bert, Ken, Dave, Mark, Geoff, Eric, Daryl (1), Kim, Gary, Daryl (2), Warren, Carol and Jack. The main money maker was the CB-A-Thon Cash Donation Collection. In addition, there was a Disco at the Parramatta Town Hall, a Car Wash at the Golden Fleece Service Station, Clyde Street, Granville, and a Ten Pin Bowling Competition at the Leichhardt Alley. To fill in their spare time (??) they also collected cash at the traffic lights at the corner of Silverwater and Victoria Streets, Auburn. The final total for the fund raiser was $776.04. Those concerned can feel justifiably proud of themselves. Thanks must also go to the Lima Mike Club of Emerton for giving the appeal air time on their Sydney Sunday Morning Broadcast.

Well that's about it for another month. If you have anything which you feel would be of interest to the other readers, please send it in. After all, this is YOUR column. I just put all the information together.

The address is: Jan Christensen, Australian CB Scene, PO Box 406, FORTITUDE VALLEY, 4006.

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MicroAce Z-80 computer kit from the USA

There is no question that the prices of computers are dropping all the time. It is now possible to obtain a complete computer in kit form which can be programmed in BASIC for under $200. The MicroAce is the system in question and it can be connected to any standard TV set.

We reviewed the Sinclair ZX80 computer in our December, 1980 issue. While reporting on some shortcomings of the system, our reviewer concluded "Clearly the biggest feature is its very low cost. It is easily the least expensive BASIC personal computer which interfaces with a TV set. On that score, it just cannot be beaten by any other computer on the market." At that time the Sinclair ZX80 was selling for $295.

Things move quickly in the Micro world, and today our statement is no longer true. MicroAce, the United States licensees of Sinclair Research, have come out with a kit computer which is identical in every respect to the Sinclair ZX80, but which Dick Smith sells in Australia for $199.

Since the MicroAce computer uses the same hardware and software as the ZX80, readers can refer to our December review for these details. The plastic case of the MicroAce is black, the Sinclair machine is white – this is virtually the only difference between the two, except for the price!

For those who haven't seen the previous review, the MicroAce is housed in a plastic case measuring 175mm × 35mm × 218mm (W × H × D), and all up it weighs just 340g. An integral touch-sensitive keyboard occupies 70mm of the PCB, and sockets at the rear of the case provide for DC power and cassette connection. A video modulator on the board allows the computer to be connected to any TV set, and there is a 46-way expansion connector carrying the ZX80 address, data and control lines.

Versions of the computer are available with either 1K or 2K of RAM. The BASIC interpreter resides in a 4K ROM and makes extensive use of code compression techniques to make the most of the limited memory available. Program statements are entered with a single keystroke, and the computer is programmed to catch syntax errors at the time the program is entered, rather than at execution time.

In addition to circuit board, components and case, the MicroAce kit includes a UHF modulator, an antenna splitter which allows the family television set to be switched between the antenna for normal program reception and the computer video output, and cables and plugs for making connections to a cassette recorder. A VHF modulator is available for use with a television set without a UHF tuner. Also separately available is the 9V plugpack for DC power.

Accompanying the kit is a BASIC manual which also includes intructions for assembly, circuit diagrams and an introduction to the MicroAce. The assembly instructions are general, without step-by-step procedures, but the experienced constructor should have no trouble putting the kit together. The beginner will need to brush up on soldering techniques before starting assembly.

This is what the finished unit looks like. All you need to build it is some solder and a small soldering iron.

As a kit the MicroAce is very well presented. The 205mm × 158mm circuit board is of heavy duty fibreglass, and is double-sided with plated through holes. White outlines and labels on the component side of the board identify the position of each part, and a solder mask prevents problems caused by splashes of solder etc. Sockets are provided for all but three of the ICs in the kit.

All in all the MicroAce kit looks like a winner. Its 4K integer BASIC, keyboard program entry and "error-proof" syntax indicators make it well-suited for those just learning programming, and certainly the price is right.

The MicroAce kit is available from Dick Smith Electronics branches and re-sellers in all states.

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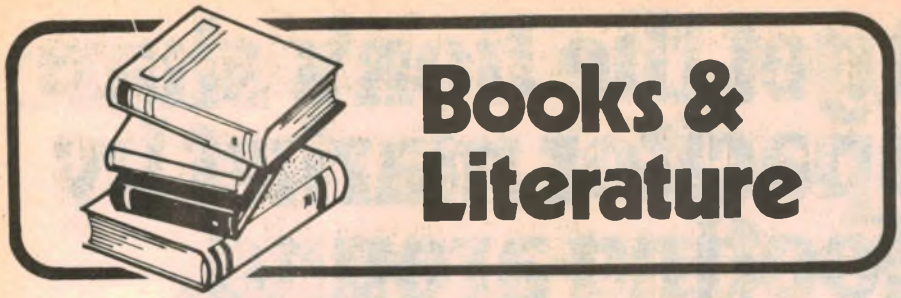

Books & Literature

Transformers Design

PRACTICAL TRANSFORMER DESIGN HANDBOOK: by Eric Lowdon. Published 1980 Howard Sams. Soft covers, 213mm x 279mm, 240 pages. Illustrated with numerous formulas, diagrams, graphs and tables. Price: $29.75.

Books on transformer design are about as common as Germanium ICs so this particular volume is very welcome – and not just to design engineers.

While the average reader may not actually want to design transformers this book provides an excellent insight into the properties and limitations of transformers that is invaluable for the circuit designer or hobbyist – so read on.

The author, Eric Lowdon has considerable practical experience in transformer design and this is reflected in the contents of the book. The first few chapters cover basic theory: units, Ohms law, form factor, Reluctance, MMF, voltage current transformation, transformer ratings, ie Volt Amperes and Watts. Chapter four discusses transformer losses such as iron losses, comprising hysteresis and eddy currents, copper losses, while equivalent circuits, regulation and efficiency are also covered.

Chapter five focusses on the core and covers such aspects as permeability, hysteresis, saturation, electrical resistivity and coercivity and then goes on to look at practical materials. This is done firstly in general performance terms and then with actual graphical data showing iron losses in watts per pound of core material against maximum flux density and frequency. The various types of core are also mentioned such as C-cores and toroids.

In a logical sequence the next chapter covers the windings and gives a table of data concerning wire gauge, diameter including insulation, resistance, weight and turns per inch squared. The maximum VA rating which can be obtained from a transformer ultimately depends on the maximum allowable transformer power dissipation and hence operating temperature. Practical formulas are given for calculating cooling surfaces, temperature gradients and so on.

All the formulas and theory developed in the previous chapters is summarised in Chapter seven and general observations made. The remaining chapters are quite extensive and cover the actual design of power transformers, design requirements for rectifiers, transformers for inverters, inductors and current transformers. The final chapter covers the actual salvage, and construction of transformers, ie, homebrewing.

Our only criticism of the book is that it is written in the old foot-pound-second system so much of the data would have to be converted to metric to be of use. Otherwise we can highly recommend this book to any hobbyist or engineer.

The review copy came from the Technical Book & Magazine Co, 289-299 Swanston St, Melbourne, 3000. Phone (03) 663 3951. (R.deJ.)

BASIC Programs

Mostly BASIC; Applications for your TRS-80; Applications for your Apple II; Applications for your PET. By Howard Berenbon. Published by Howard W. Sams & Co Inc, Indiana, USA, 1980. Soft covers, spiral bound, 218mm x 280mm, 158 pages. Price: $14.75 each.

These three books may be conveniently treated as a group. They contain identical text and programs adapted to run in Basic on each of the three computers. The one exception is the TRS-80 book, which contains an assembly language listing of a telephone dialler program absent from the other two.

The programs are organised into six sections, covering real time applications, Educational programs, Business and Investment, Home applications, utilities, and "The Unusual".

The first program in the book is a telephone dialler. Circuits for a simple relay interface are given, and the book reminds us that "This device . . . is not intended to be connected directly to a subscriber's telephone set without compliance to local telephone company regulations". Also included in the first section of the book are programs for a combination lock interfaced to the computer, a digital stop-watch using programmed time delays, and a program using the computer as a 24-hour digital clock and timer – which seems an expensive way of doing the job.

Among the educational programs is "The Dungeon of Htam", an Adventure-type game where the player must answer maths questions as he wanders through the corridors of a dungeon. Others include language flash cards in French, Spanish, Italian and German, maths and spelling tests, and a guide to identifying star constellations of the Northern hemisphere.

Under "Business and Investment" are a House-buying guide, a depreciation calculator and a program for calculating a schedule of payments for loans at specified interest rates and re payment periods.

"Home Applications" include a program for conserving electrical energy which "will indicate differences in electric usage from one year to another, so that you can see possible imbalances in usage, and correct them". In this section also there are programs for keeping a record of medical expenses, a recipe amount calculator, a diet program, and a program for calculating your car's petrol consumption.

The section on "Utilities" describes some programming techniques in Basic, including random number generation and time delay loops, and a hexadecimal to decimal conversion program (which won't accept, for example "F" as a digit in hex – it must be entered as 15, and so on).

Representing "The Unusual" is a Tarot Card reader program, based on the ancient 78 card deck used in fortune telling. This program is the longest in the book, requiring almost 16K to run. The space is taken up by statements containing the meanings of each card in the pack.

All in all there are twenty-eight programs, covering a wide range and of varying degrees of interest and usefulness. Each program is fully explained in the accompanying text, and listings and sample runs are provided.

My one criticism – after seeing the three books together – is that little advantage is taken of the distinctive features of each computer. There is little mention of the colour capability of the Apple II, or the PET's graphics, for example. Indeed, for the most part the programs are interchangeable.

If you own one of the three computers, or are thinking of buying one, these books are worth a look – but one of

(Continued on page 106)

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Books & Literature

from p104

them is enough. Our review copies came from McGill's Authorised Newsagency, 187-193 Elizabeth Street, Melbourne, 3000. (P.V.)

Electronics Reference

PRACTICAL ELECTRONICS HANDBOOK by Ian Sinclair. Published 1980 by Newnes Technical Books, London. Stiff paper covers, 186 pages 210mm x 137mm, illustrated by circuits and diagrams. Price in Australia $11.00.

In the brief preface, Author Ian Sinclair observes that data books frequently err by giving either too little or too much connective text. His object here is professedly to strike the happy medium. The merit of the end result will be very much in the eye of the beholder.

Perhaps it was the result of a too cursory examination of the book but I did not gain the impression of it as presenting a flow of data at a uniform, meticulously planned level.

That is not to say that it does not contain a lot of useful reading and data. It does. But I can well imagine the reader treating the contents rather like a smorgasbord lunch – selecting the morsels that entice and passing over the platters in between.

There are five major headings: Passive Components – Active Discrete Components – Discrete Component Circuits – Linear ICs – Digital ICs. Appendices cover the standard metric wire table and a bibliography, and are followed by a general index.

There is one serious problem with the book in that it has errors of concept and omission. For example, on page 23, the author's brief reference to the use of "k" in capacitor labelling shows that he has not heard of or misunderstood the IEC capacitor code. Similarly, on page 59 there is a statement that "crossover distortion is an example of a fault which causes zero gain" and on page 69 there is a Triac circuit with a snubber network which is said to be an interference suppression network.

I suggest you have a look at the book yourself, if possible. It may be superfluous to your needs, or exactly what you've been looking for! Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. (W.N.W.).

Personal Computers

THE PERSONAL COMPUTER BOOK by Robin Bradbeer. Published by Cassell Australia, April, 1981. Soft covers, 136mm x 214mm, 200 pages including appendices. Illustrated with photographs and cartoons. Price: $5.95.

The author starts by discussing what a computer is all about and how we can put such a machine to work. The second chapter, entitled "Where do I start" deals with such things as computer awareness, the help that can be gained from people involved with computers, right through to the purchase of a system.

In the third, fourth and fifth chapters he takes a look inside a computer, and without going to any great technical depth, tells the reader about the internal workings of the machine. This I feel he does rather well, and without leaving the reader light years behind.

The sixth chapter is the one I feel will be the most useful since it is here that Bradbeer takes a look at the types of systems currently available on the market. The range of equipment presented here is quite staggering, and a great deal of research seems to have been done. I do though, have one criticism to make here, and that is the fact that some of the information presented is already dated. This can be put down to rapid pace of technological advancement. As a result, the information regarding any of the systems should be verified by a prospective purchaser of a computer.

The last chapter deals with uses for the computer, whether it is for playing games, for use in education, business or

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whatever. A few examples are given of how people have put these systems to practical use. This section should certainly spark off the imagination of many readers.

The final section of the book contains six appendices covering such things as binary, octal and hexadecimal arithmetic, bus standards, international computer magazines, a bibliography, a glossary of terms and finally some hints regarding kit-built systems.

At the quoted price of $5.95 it represents reasonable value for money. Our copy for review came direct from the publishers, Cassell Australia, 44 Waterloo Road, North Ryde, NSW 2113. Phone (02) 888 7422. (G.C.).

CP/M Primer

CP/M PRIMER: By Stephen M. Murtha and Mitchell Waite. Stiff paper covers, spiral binding, 92 pages, 215mm x 282mm, illustrated with diagrams and drawings. Published by Howard W. Sams & Co Inc, Indiana, USA, 1980. Price: $15.95.

This book from Howard Sams is an aptly named "primer" for the CP/M system. It contains an introduction to CP/M for first time users, together with a chapter on basic hardware and software concepts needed to understand the operating system. Another chapter gives the details of starting up and using a CP/M system. Chapter Four covers the initialisation of the system, and explains how data is stored on diskette and how to copy and modify the CP/M system.

The next four chapters cover the use of the system Utilities. STAT and PIP provide for management of program and data files on disk. A chapter describes the use of ED, the CP/M editor, used for creating programs in whatever language the user is working in. Other chapters cover ASM, the Assembler, and DDT, the Dynamic Debugging Tool for developing and debugging assembly language programs. Each chapter on the utility programs provides an introduction to the particular program, examples of basic and advanced uses of the routines, and descriptions of sample sessions with the utility described.

Three lengthy appendices conclude the book. The first is a detailed description of the internal workings of CP/M, explaining the structure of the System calls which underlies the operating system. Appendix B is a partial list of suppliers of software for CP/M systems, listing programs divided into accounting, general, industrial, utility and systems applications. The last Appendix is a handy reference guide to the CP/M commands and utilities, giving the command format and brief definitions.

Our copy came from McGill's Authorised Newsagency, 187-193 Elizabeth Street, Melbourne 3000. (P.V.)

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New Products

Sabtronics 9-digit 1GHz Frequency Counter

Sabtronics have recently extended their range of test equipment to include a 600MHz and a 1GHz frequency counter. The 1GHz version features an input sensitivity of 30mV at 1GHz, gating periods of 0.1s, 1s and 10 seconds.

In appearance the new Model 8000 1GHz counter is similar to the DMVs and other equipment in the Sabtronics range and consists of a moulded plastic construction with a tilting stand. Overall dimensions are 203 × 165 × 76mm and weight without batteries is 590 grams. Power consumption is 300mA from 4 "C" cells (which may be rechargeable) or the unit can be powered from a DC plugpack.

Front panel controls include three slide switches for Power, Range (10MHz, 100MHz, 1000MHz) and Gate Time (0.1s, 1s, 10s), an input sensitivity control, 1MΩ BNC input for the 10Hz to 100MHz range and a nominal 50Ω BNC input for the 10MHz to 1000MHz range. The frequency display consists of nine 92mm high seven segment LED displays and a small LED beneath the display which blinks in time with the gating pulse providing a useful indication of when the display is updated.

Perhaps the most important feature of this DFM is that it operates up to 1GHz with a sensitivity of 30mV, whereas many DFMs only go to 600MHz. Using a VHF signal generator we were able to determine that the model 8000 worked at least up to 300MHz, which is the upper limit of our generator.

The circuit used in the high frequency end consists of a VHF preamp in a DIP package followed by a divide-by-2 1GHz counter which then feeds into a standard 650MHz prescaler.

Input sensitivity is quoted as 15mV RMS from 10Hz to 100MHz which is essentially the figure we measured. Measurement accuracy is 1Hz + 1 digit ±1ppm from 0 to 40 C, the latter figure being the basic accuracy of the quartz crystal.

The Sabtronics 8000 has a 9-digit readout but is shown here with a 4-digit reading.

One feature worthy of comment is the 50Ω input for the 10MHz to 1GHz range. Due to transmission line effects it is necessary to have a low input impedance which matches the characteristic impedance of the coaxial input cable otherwise the impedance mismatch will generate reflected signals and falsely trigger the input circuitry. With the option of the 50Ω input, high frequency measurements are simplified.

Looking inside the unit, almost all the circuitry occupies a single board which is mounted parallel with the front panel while a smaller board contains the high frequency prescaler. The circuitry is considerably simplified by using a single frequency counter chip with the rest of the circuitry consisting of dividers and amplifiers. From a kit point of view the 600MHz version should be quite easy to assemble and it could well be worthwhile for the experienced hobbyist considering the $23 saving over the fully assembled price. The 1GHz version is not available in kit form.

An operator's manual supplied with the unit details the specifications, theory of operation plus circuit diagrams and component overlay diagrams. Operating suggestions are made and there are hints for fixing problems with RF pick ups, ringing on logic signals and harmonic distortion. Calibrations and troubleshooting are given a brief mention as well.

All up, the unit is well made and performs to specifications.

Quoted price of the unit is $563.50 fully assembled including tax. The 600MHz version, Model 8610, is priced at $202.40 unassembled and $225.40 assembled inclusive tax.

Further information can be obtained from Christie Rand Pty Ltd, PO Box 48, Epping, NSW 2121, phone (02) 477 5494. (Rdel.)

Informative brochure on static protection

The Charleswater organisation, which specialises in static protection of electronic devices, has prepared a four page brochure on the subject in question and answer form. Copies are available from their Australian distributor, Royston Electronics. With the increasing use of MOS and CMOS integrated circuits, protection from burn out or degradation due to static electricity is a vitally important subject to the hobbyist and manufacturer alike.

The need for higher densities in microelectronic components has led to the wide use of MOS (Metal oxide Semiconductor) techniques. While resulting in higher circuit densities and lower costs per unit, MOS technology also increases sensitivity of the devices to static charges. Even with the addition of buffer circuits on the inputs of MOS devices the output is left unprotected and vulnerable to damage.

Wrist straps for grounding personnel, anti-static mats and protective packaging all come under the heading of static protection devices. One example of the

Charleswater range of products is the CP302 conductive nylon bag, designed for packaging static sensitive products such as MOS and CMOS circuits.

Information on Charleswater products, and copies of their brochure, can be obtained from Royston Electronics, 27 Normanby Rd, Notting Hill, Vic 3149, or 15/59 Moxon Rd, Punchbowl, NSW, 2196.

Bar code reader from Anderson Digital

Anderson Digital Equipment Pty Ltd now has available the Intermec 9400 Portable Bar Code Reader, a battery operated data collection terminal designed specifically for "in-house" collection of bar code data by users of computer inventory and stock control systems. The new unit is housed in a rugged waterproof case and can store over 20,000 characters of code information in internal memory, handling all 128 ASCII characters.

Using a standard RS-232 interface the bar code reader can send data from its memory to another system and receive data and display it on a 16 character LED display. The interface can also be used for downloading of programs and data

The 9400 is designed for applications where bar code labels are used to identify all items, so that an ordinary keyboard is unnecessary. A bar code "paper keyboard" on the 9400 provides special control characters and all individual code characters, enabling the user to input data by scanning the keyboard with the bar code reader wand.

The portable bar code reader measures 279 x 55 x 139mm and weighs 1.1kg including rechargeable batteries. For further information contact Anderson Digital Equipment Pty Ltd, PO Box 322, Mt Waverley, Vic 3149.

Storage kit for Scope spare parts

Scope Laboratories, manufacturers of special purpose soldering tools for servicemen and technicians, has released a new spare parts storage kit for retailers.

The manufacturer is offering three sizes of the kit, each containing an assortment of spares in ratios based on frequency of demand. The kit is shipped in a plastic chest of drawers which doubles as a permanent storage cabinet, with parts numbers marked. The three kits are priced favourably compared to the cost of buying individual parts, and the first order includes the storage cabinet at no extra cost.

For further details interested retailers should contact Lorraine Frost, Scope Laboratories, 3 Walton St, Airport West, Vic 3042.

Sennheiser probe microphone

From R. H. Cunningham Pty Ltd comes news of an addition to the Sennheiser MD321 Probe Microphone. The MD321 is now available with a built-in amplifier so that only a pair of headphones is needed to complete the set-up.

The MD321-V is designed for acoustic measurements in hard to get at areas. It can be used for measuring noise produced by bearings and gears, engine noise and mechanical vibration. The integrated amplifier with headphone sockets makes the measuring microphone independent of an external amplifier and allows direct listening to the sound source.

Also available from R. H. Cunningham is the Neutrik K-Check visual audio lead tester. It is said to be ideal for fault-finding in PA and stage sound systems, and is designed for carrying in a pocket. It is about the same size as a disposable cigarette lighter. Visual indication of lead continuity is provided by four LEDs. One

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end provides a direct connection to XLR type connectors while the other end has a test probe. Power is supplied by an internal battery.

R. H. Cunningham also distributes the C-Ducer contact microphone. The contact microphone offers advantages in feedback reduction and sound separation when used with any instrument which has a sound board, such as pianos, guitars and drums. A small leather strap holds the microphone in contact with the instrument.

Further information on these and other products distributed by R. H. Cunningham can be obtained from PO Box 4533, Melbourne, Vic 3001, or PO Box 214, Neutral Bay Junction, NSW 2089.

Powerful new battery charger from A&R

A & R Electronics Pty Ltd are calling their new Arlec 200 battery charger "The Engine Start Charger". The charger is quite capable of delivering enough power to start a car engine immediately. Quite apart from this capability, the Arlec 200 is a highly efficient battery charger. It has a 25A continuous rating on both 6V and 12V outputs, a surge rating of 200A, and is fully protected by two completely independent circuit breakers.

Charger controls, consisting of a bank of six pushbutton switches, are mounted on the front panel. The switches select six and 12 volt outputs, low and medium charge rates, engine start and off functions. The low charge rate is approx-

imately 8A and the medium rate is 25A.

Size of the charger is 290 x 165 x 385mm (W x D x H) and weight is 16.5kg. The charger is housed in a steel case which is zinc sealed and colour bonded for resistance to corrosion from weather and battery acids.

Further information is available from A & R Electronics Pty Ltd, 30 Lexton Rd, Box Hill, Vic 3128.

Monaro Research

Monaro Research Laboratories Pty Ltd is an Australian company based in Canberra, and specialising in lasers, electro-optics, fibre optics, time and frequency standards, test equipment and vacuum equipment.

The company is the Australian distributor for Frequency and Time Systems Inc and can supply FTS Cesium Beam frequency and time standard instruments used in laboratory standards, high data rate communications systems, satellite terminals and offshore positioning and geophysical surveys. Both laboratory and field model units are available.

Also from FTS is a range of self-contained quartz frequency standards and the T-200 Satellite Timing Receiver, which provides hour, minute, second and a pulsed timing signal referenced to the UTC US Navy master clock. Timing signals derived from the Naval Navigational Satellite System are corrected for offsets and applied to an internal digital clock to provide precision time references on a world-wide basis.

Monaro Laboratories also distribute the Photodyne range of optical power measuring equipment. The Model 44XL optical power meter for example will measure light output from one nanowatt to two watts, over a wavelength range of 220 to 2000 nanometers. An LCD display provides a direct readout of optical power received from fibre optic cables, lasers and other light sources. The Model 88XL measures light power down to one picowatt and up to two watts, from DC to high frequency modulated sources. Interchangeable sensor heads are available for low light displays and fibre optic measurements, UV and infrared radiant power and visible LED measurements.

The Digital Ionisation Gauge Controller, Series 280 from Monaro, provides a direct readout of gas pressure in Torr, Millibars or Pascal units. For on/off control of system components in high vacuum processes, four process control relay outputs are provided with settable switching points. Automatic ranging is standard on all models, and an optional BCD output module allows ion gauge pressure data to be collected in a format compatible with standard logic interfaces.

The Hellige Inc "Lilliput" range of pocket pH meters is also available from Monaro. These compact pH meters are said to be ideal for field, laboratory, manufacturing and school use. Both digital readout and analog meter versions are available, both covering the range from 2-12 pH. The units feature "Perma-fil" sealed electrodes which contain a special gel reference solution, making re-filling and re-calibration unnecessary.

Further details of the Monaro Laboratories range of products can be obtained from Monaro House, 3 Lonsdale St, Braddon, ACT. The postal address is PO Box 1155, Canberra City, ACT 2601.

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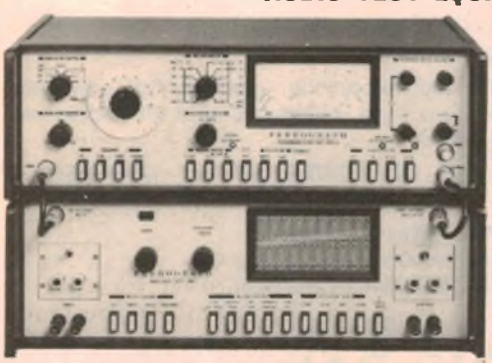

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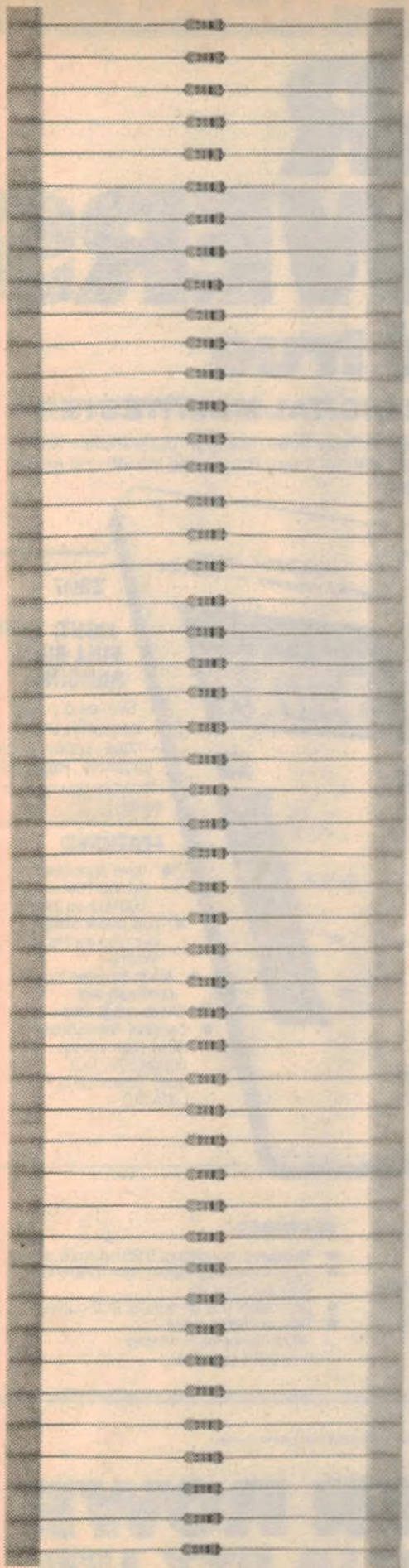

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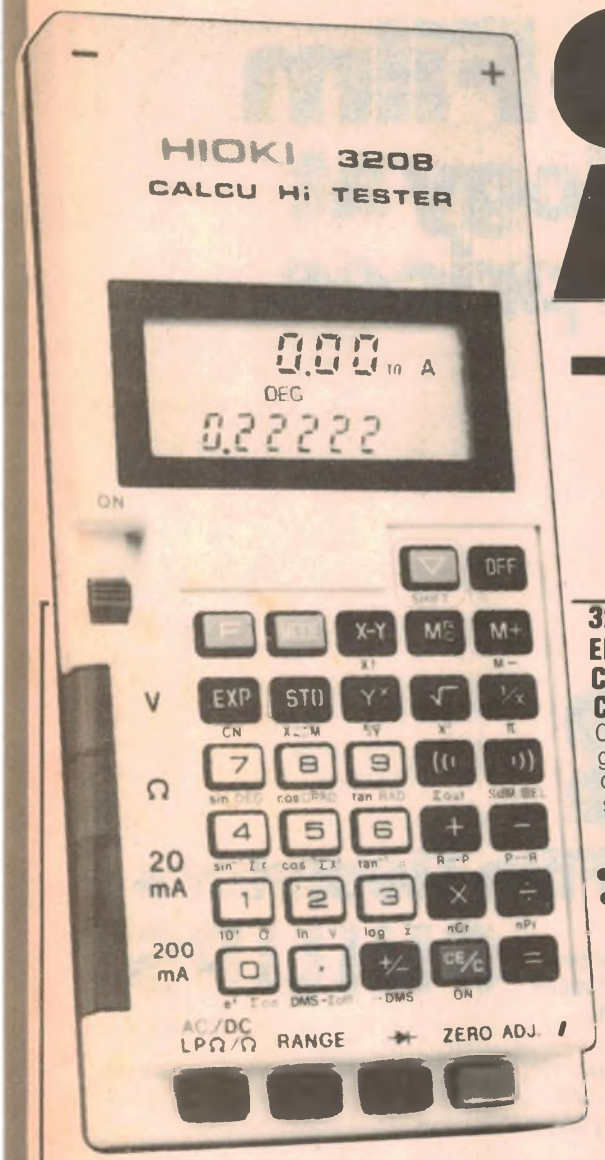

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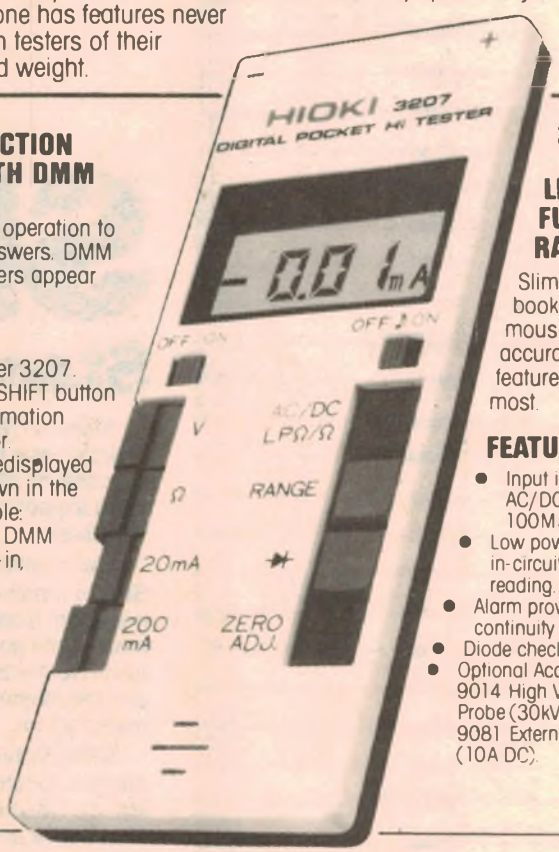

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Also from Philips is a new, compact digital cassette recorder, the PM 4201. The recorder is designed for high speed reading and writing of cassettes to ECMA 31/34 standards. An IEC 625 (IEEE-488) instrument bus interface allows direct connection to transient recorders, digital oscilloscopes, counters, multimeters and data loggers using the bus. Data can also be stored for later evaluation by computers, avoiding the need for tying up the computer in continuous monitoring of equipment.

Error rates for the recorder are claimed to be less than one in 10^9 bits thanks to special procedures such as read after write and automatic write repeat in the event of a fault. Additional features ensure data integrity in the case of a power failure.

For further information contact Philips Test and Measuring Instruments, branches in all capital cities.

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The Sawtron 200 Base Console for UHF CB is designed to control the operation of a base transceiver.

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REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

TCHAIKOVSKY, STRAUSS — and some mixed reactions to digital mastering*

*See also "Forum" elsewhere in this issue.

TCHAIKOVSKY — Piano Concerto No. 1 in B Flat Minor. Emil Gilels (piano) with the New York Philharmonic Orchestra conducted by Zubin Mehta. CBS Masterworks Digital Recording 7464-36660-1.

My first reaction to this album was one of overwhelming disappointment, after all the promising things I had heard about the digital recording process. My jottings, as I listened, ran something like this:

Too much reverberation — balance between soloist and orchestra all at odds — orchestral fortissimos hopelessly confused — dynamic range unmanageable, even in my very large listening room — with soft passages audible, loud passages deafening.

More than that — and this had nothing to do with the engineering — a tiresomely long period of applause at the end, due to the fact that the performance had been recorded live at the Lincoln Centre.

So I put the disc back in its sleeve and sought the advice of Editor-in-Chief, Neville Williams.

He made the point that, while a live recording may benefit by way of atmosphere and spontaneity, engineers do not have the opportunity to move microphones or consult with the conductor. Once the performance gets underway, their options are very limited.

At the same time, he found it difficult to accept that CBS would issue a "Masterworks Digital" disc that was as poor as I had described it. Could it be a problem with my pickup?

I pointed out that I had just had the stylus replaced, but while this was commendable in itself, it also raised the possibility that, in fiddling with the cartridge and arm, the playing weight adjustment might inadvertantly have been upset. If the tracking weight was too low, a digital disc, with its wide dynamic range would be the very kind of recording to suffer most.

If the stylus was indeed "rattling around" in the groove, fortissimos would be confused, loud passages would be rendered intolerable and one's judgement of the other matters would be unreliable.

Need I add that Neville Williams' speculation proved to be "spot on"? As far as I could judge, the playing weight had ended up at one gram or less, which is well under the figure recommended for my cartridge.

When I restored the playing weight to what it should have been, the result was gratifying. Congestion in the louder passages virtually disappeared, to be replaced by normal detail in the orchestral parts. Balance between soloist and orchestra seemed more natural and I was able to evaluate the performance in the ordinary way.

Reverberation was still on the high side, probably for the reasons mentioned earlier, to do with the "live" recording. And, even with the sound cleaned up, the contrast between soft and loud passages was as much as I could cope with in a home situation. I just don't go along with the call for even greater dynamic range; with the proposition that what is experienced in a concert hall (sound, sight and ambience) needs to be — or even can be — translated directly into a listening-only experience in a domestic lounge room.

I should also add that, while I ended up as being happy enough with the digital recording, I could not rate it as warranting any special enthusiasm. Quality may come more easily with the digital system, but don't be tempted to mentally write off the cream of analog releases.

As to the performance, Gilels plays with all the elan of his previous recording of the work. Some passages are again slower than is usually acceptible although they still make sense. However, they are sometimes so slow they seem to be drooled over. Some of the reverberation might even be due to the pedalling of the soloist. But his is always an attractive performance although in the Finale it often sounds like a race between soloist and orchestra. But it doesn't take long for Mehta to catch up with Gilels! (J.R.)

By way of contrast . . .

STRAUSS (RICHARD) — Also Sprach Zarathustra. New York Philharmonic Orchestra conducted by Zubin Mehta. Columbia Masterworks Digital Recording 7464-45888 - 1.

As distinct from the Tchaikovsky disc, reviewed above, this recording was obviously made under "studio" conditions, with everything under tight control. And, of course, my pickup had been readjusted.

As a result, the sound was beautifully clear, the cut-offs clean, the complex Strauss scoring beautifully stranded so that every voice could be identified.

The work itself is not one of my favourites. It has little Strauss hasn't said before except the noble "yea-saying" first phrase, now viciously debased by use in TV adverts for soap powder and toilet paper, or some such articles. Mehta makes it all sound ultra-Straussian. So did Strauss! And his occasional lapse into shocking vulgarity is exemplified by the violin solo in the second half, which is nothing but a thinly disguised Viennese waltz, placed diabolically in exactly the wrong place.

In this recording the extended dynamic range is an advantage — so long as your neighbour doesn't complain or try to get

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.).

even by playing modern pop at the highest possible level! Moreover, the separation of the many instruments used in the often heavy scoring is quite extraordinary. Apart from the Willi Boskowsky waltz interlude on solo violin, everything goes well. So, while one would not class the performance as the world's best, it is certainly acceptable.

But I repeat: don't get caught, inadvertently or otherwise, trying to play heavily recorded discs with too little playing weight on the stylus. Those who should know insist that, not only does quality suffer, but wear is actually increased if the stylus is allowed to "rattle" in the groove. (J.R.)

For connoisseurs

CHOPIN — 10 Mazurkas. Prelude in C Sharp Minor. Ballade in G Minor, Scherzo in B Flat Minor. Arturo Benedetti Michelangeli (piano). DGG Stereo Cassette 3300 349. Also on disc.

This is a real connoisseurs item. There are three ways of performing Chopin's music — the tinkling elasticised rubato boudoir style favoured by the late Samson Francois, the free but sustained salon style used by the composer himself and such disciples as Cortot and Rubinstein and the narrow jingoistic, patriotic assertions as exemplified by Roger Woodward's merciless bashing of the D Minor Scherzo in the Opera House not so long ago. This is called, by some, the "new Warsaw" style emphasising the love of freedom of all Poles, as if that were something new!

The true Chopin style, as described by informed musicians of his period, consisted of an expression of deep love of

his country expressed with French elegance.

This is the style used by Michelangeli. After a long stay in Warsaw, some time ago, he brought back with him some original editions, hitherto unknown in the West, that gave him an ever deeper clue to Chopin's original intentions than that already provided by Michelangeli's innate genius.

The result is the revelation of subtleties I have never heard before, with everything performed without any desire on the player's part for self-glorification, or the intrusion of his personality between the composer and the audience.

The Mazurkas are generally thought by musicians to be the most Polish of all Chopin's works. The mercurial changes in mid-paragraph, so to speak, their passion shared with French restraint, you'll find them all on this splendid cassette.

Then there is the enigmatic character of the player himself, about whom little is known but his wealth and his superb gift. He leads a hermit-like existence and has won a bizarre reputation for failure to fulfil engagements either in a packed concert hall or a recording studio. He is revealed only in his music and then, paradoxically, it is the composer rather than himself who is dominant.

In the recital under review the many subtleties of the music are countless, although always kept within the bounds of strict form, without exaggeration. Michelangeli's command of a variety of sonorities seems endless, his swift changes of mood just as prodigal. In the Mazurkas, you sense the characteristic accent on the second beat of the bar by his shaping of the phrase rather than by dynamic emphasis.

It is quite a magical effect, captured to perfection by the recording engineer on this cassette. Some of Michelangeli's runs flash so fast that they might almost be mistaken for glissandos.

In the Ballade, many listeners may well be surprised by the way Michelangeli brings out otherwise unheard component parts of the composition and, taking into account the meticulous nature of every bar, the passion he acquires in the climaxes. In the B Minor Scherzo, apart from the brilliance of his finger work, he wins plenty of volume without resorting to Woodward's ferocious bashing referred to above.

This whole recital left me breathless with admiration and all musicians, especially pianists, should acquire it, no matter who else you may have duplicating the items.

There is also, importantly, plenty of time (silence) between numbers to allow for the listeners' adjustment of mood, while the Mazurkas are not played in order of their composition but with suitable contrasts between each. (J.R.)

DVORAK/SLATKIN
. . . focus is on the music

DVORAK. SYMPHONY No. 9 In E MINOR, OP.95 "From The New World". Saint Louis Symphony Orchestra conducted by Leonard Slatkin. Telarc, digitally mastered, stereo, DG-10053. [From P. C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612]

Two things stand out in this latest and long-planned release from Telarc digital. One is the velvet-like smoothness of the sound, attributable possibly to Slatkin's approach, to the mic, placement and perhaps to the acoustics of the Powell Symphony Hall, a rebuilt theatre which is the home of the orchestra. The sound is very clean but there is no blare or zizz to proclaim that "this is hifi".

The second thing is the prolonged passages of simple folk melodies, which demand — and get — something approaching zero background from the tape and disc. At times, the pianissimos fade to a mere whisper, demanding the quietest possible listening room. No traffic outside, no ticking clock . . .

The double-fold album carries notes on the composer and the work, the conductor and orchestra, and the Soundstream digital mastering system. If some Telarc releases in the past have been notable for spectacle and pizzaz, this one is more concerned with music making and dwelling upon Dvorak's expression of the new world and the old. (W.N.W.)

☆ ☆ ☆

ESPANA — Trio Albeniz. Jose Luis Recuerdo (bandurria); Alejo Munoz (lute); Jose Armillas (guitar) in a recital of Spanish music by Albeniz, Sor, Falla, Haffter, Granados and Barrios. CBS Stereo Disc 73902.

All three performers play with great skill and the lutanist, who often provides the treble melodic line, sometimes plucks his strings so fast that the effect is that of a long-drawn-out uninterrrupted note. Their program is outstandingly well recorded although the continued similarity in colour makes it advisable to take it in smallish doses.

Some of the pieces are well known all over the Western world — Albeniz Sevilla, Granada and Castilla, for instance. Others you might hear for the first time. Of these is a suite called First Divertissement by Fernando Sor (1778-1839) which consists of three pieces; the first, a Cantabile, is pretty mediocre, the second very Mozartian and the finale, a waltz, sounds like a bit discarded by Chopin.

This is an unusual trio, consisting of three plucked instruments, a lute, guitar and bandurria, the last larger than the others and supplying the bass.

Although seldom heard elsewhere, the combination is common enough in Spain. I heard many of them in Spain a few years ago, most of them playing in the restaurant-filled old portion of

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Madrid posing as university students earning a few bob! Naturally none of these had the virtuosity of this group. Indeed they were often a damned nuisance coming up to the tables and making conversation impossible.

All the items in this recital are transcriptions of anything from piano pieces to full orchestral scores and all the transcriptions were made by the trio themselves.

The Miller's Dance from Falla's Three-Cornered Hat sounds surprisingly full when one remembers the original orchestration and displays the trio's really great virtuosity. And everywhere in their program the players manage to produce an unexpected variety of sonorities. A disciple of Falla, Ernesto Haffter, is featured in Shepherdess' Dance showing, however, little evidence of Falla's tutorship but effective enough as a pastoral piece.

I should particularly like to mention the really extraordinary clarity and fidelity of the recording itself. And, just by the way, the Albeniz piece called here Castilla used to be known as Seguidillas on a popular old 78 played by Alfred Cortot. I think the disc's primary appeal will be to players of plectrum instruments. (J.R.)

☆ ☆ ☆

BACH: The Musical Offering, BWV 1079. Academy of St. Martin-in-the-Fields, conducted by Neville Marriner. Philips stereo disc 9500 585.

This gigantic work, quite rarely heard, illustrates Bach's mastery of counterpoint. It was not written for any particular instrument or combination and performing versions offer an agreeable variety. On this occasion, the ten Canons, Trio Sonata and two Ricercares, have been edited by Mr Marriner in a most satisfactory fashion. He adds much colour by the use of a baroque organ where suitable, in place of the harpsichord, and has arranged the sonata for flute, violin and continuo, omitting other solo wind instruments favoured by some editors.

This version of the Musical Offering, based on the two-part fugue on a theme by Frederick the Great of Prussia, seems much less diffuse than others I have heard — in recordings, eg, directed by Menuhin and Munchinger — and makes coherent listening both possible and enjoyable. The ensemble playing is as good as I've heard and the recorded sound has excellent presence and balance. As is often the case with Marriner, he seems a little detached and (perhaps suitably?) bloodless, but not so as to bother one. My only positive regret is that Philips have found it necessary to split the sonata, forcing a break when one turns the disc after the first two movements. (P.F.)

Direct-cut or digital?

A NIGHT IN TUNISIA. Art Blakey and the Jazz Messengers. Stereo, digital mastered, Philips RJ-7483. [From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598].

If you suddenly get the feeling that we are repeating something, you will be partly right. This same performance was listed in our April issue, the difference being that the disc mentioned on that occasion was a direct cut version RJD-4. This one was made from a digital master tape, fed with the same signal. I can't say any more about the technical details, because the pressing, intended for the local market, carries sleeve notes in Japanese.

As noted previously, the recording was made in February '79 at the Victor studios in Tokyo, produced under the auspices of Nippon Phonogram and released on the Philips label.

The group itself features Art Blakey (drums), Davis Schmitter (tenor sax), Robert Watson (alto sax), Valery Ponomarev (trumpet), James Williams (piano) and Denis Irwin (bass). They turn on quite a session of high pressure jazz, seemingly not the least bit inhibited by the non-editable direct recording in progress outside.

Side one has a single long track: "A Night In Tunisia" (Dizzie Gillespie — Frank Paparelli). There are two tracks on side two: "Moanin" (Tommy Timmons — I. C. Hendriks) and "Blues March" (Benny Colson). The performance should please devotees of jazz; for others it might be a bit much!

As for the technical quality of the recording, I gave full marks to the direct cut version, which sells for $13. This digital version is equally commendable but, without being able to conduct a direct A-B comparison, I am not prepared to express a preference. A hifi enthusiast would be happy with either one (W.N.W.)

GEORGE GOLLA, My Favourite Guitar. Cherry Pie CPF 1041.

George Golla demonstrates his mastery of the acoustic guitar in this most enjoyable collection of eleven instrumental tracks, with backing from Dieter Vogt on acoustic bass and Stuart Livingston on drums. My favourite track is Lennon & McCartney's "Yesterday", but the whole record induces a mood of relaxation and enjoyment. Maybe that is what music should be about more often than it is!

The other tracks are: Watch What Happens — Lil' Darlin' — Little Girl Blue — Lagoa — For All We Know — Once I Loved — Chega de Saudade — Ain't It Lonely — Violets For Her Furs — Serenata.

The overall quality is excellent, with a great feeling of "being there". (N.J.M.)

JUMP DOWN, TURN AROUND. The Leonie Consort. Stereo, Cherry Pie CPF-1044. [Cherry Pie Records, PO Box 225, Pennant Hills, NSW 2120. Tel: (02) 819 6151.]

The Leonie Consort is a full-time professional vocal ensemble, Government funded, whose repertoire embraces music from renaissance times to the present day.

Nine in number, they present here a collection of 21 songs, mostly traditional and some quite brief. Without trying to list them all, here's just a sampling of the titles: Jump Down, Turn Around — Where Is John — Summer Is I-cumen In — Old John Braddlum — Shortnin' Bread — Botany Bay — Patapan — Haul Away Joe — Poverty Knock — Bourree For Bach — By and By. Commendably, a sheet of

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lyrics is included.

Except for a few percussive sounds, the songs are unaccompanied and are doubtless performed exactly as they would be before an audience. However, while the performance is impeccable, absence of the visual aspect must limit its appeal largely to those who by profession or inclination, are interested in this type of music.

Recorded at the Sydney Opera House, the sound quality is well up to normal standards. (W.N.W.)

☆ ☆ ☆

LOVE LYRICS AND ROMANCES OF RENAISSANCE SPAIN. La Romanesca. Stereo, Move MS-3034. (Move Records, Box 266, Carlton South, Vic 3053.)

La Romanesca is a dedicated group, based in Melbourne, comprising Hartley Newham (counter tenor), Ruth Wilkinson, Ros Bandt and John Griffiths (vihuela, baroque guitar, recorders, viola da gamba, percussion). They share a common interest in early music and historic instruments and each is an accomplished musician in their own right.

As per the title, the focus in this album is on music of Spain in the sixteenth and seventeenth centuries and, in support of the music, the double-fold jacket contains a detailed explanation of the historical background to the period, plus the words of the vocal tracks in Spanish and English.

I doubt that a listing of the 15 track titles would mean much but they are a mix of instrumental, love lyrics (simple folk love) and romances – lyrics, with a background of religion or history.

The sound is gentle, for the most part, and the performance what you would expect from a group with such a background. But the album is not one for casual or mood listening. It is for those who want to make the effort to listen, read and learn about music or other days. (W.N.W.)

☆ ☆ ☆

NIGHT RIDER, Kevin Johnson. Infinity L37530. Festival release.

Australian songwriter and composer, Kevin Johnson, displays his considerable talents on this great album, with the title track receiving considerable airplay.

All 10 tracks have music and lyrics by Kevin Johnson: Night Rider – The Sense Of It All – For The Good Of The Nation – The Waiting Game – He Was Just A Boy – Reasons – Can't Keep A Good Man Down – The Young Vaqueros Down Hill Run – Tonight. The lyrics are on the sleeve, most of them with a slightly sad or wistful note, but all enjoyable.

The backing group give Kevin Johnson excellent musical support and the Sydney made recording is characterised by excellent technical quality. (N.J.M.)

☆ ☆ ☆

SPYRO GYRA, Carnaval MCA 5419 Astor release.

On the accompanying hand-out this band is claimed to be the world's greatest jazz group, a claim that may well be disputed by many jazz enthusiasts. However they do put together eight tracks of well played music, with a mixture of Latin and semi disco styles that would appeal to modern ears.

The tracks are: Cafe Amore – Dizzy – Awakening – Cashaca – Foxtrot – Sweet And Savvy – Bittersweet – Carnaval.

A lot of the credit must go to the recording crew as the sound is very crisp and clean, with all the instruments easy to place. (N.J.M.)

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TRADE ENQUIRIES WELCOME

New devotional records

DION, INSIDE JOB Day Spring DST 4002. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

If you like your Gospel music with uncompromising lyrics and a solid rocking beat to most of the tracks, listen to this latest offering from Dion DiMucci.

There are nine titles, some of them fairly long, particularly "He's The One" and "The Truth Will Set You Free". The others are: I Believe – Centre Of My Life – Gonna Be Ready – Old Souvenirs – New Jersey Wife – Man In The Glass – Sweet Surrender.

Like most music from the Word studios, "Inside Job" has excellent musicianship and first-class technical quality, the backing coming from Paul Harris on keyboards, Jose Galdo on drums and percussion, George Perry on bass and Tony Battaglia and Dion on guitar.

The lyrics are the work of Dion and friends and carry a very simple, straight message. (N.J.M.)

☆ ☆ ☆

SING TO GOD 2. St Richards with St Andrews Junior School Choir. Stereo, Sacred SAC-5097. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

Formed in 1968, this joint school choir has since featured on British television several times during the Easter and Christmas seasons and at the Royal Albert Hall.

Despite the large scale exposure, they remain essentially a children's choir blending a natural happiness and spontaneity with their disciplined singing. The Gospel songs, all taken from the "Sing to God" collection, are a mix of newer and traditional Sunday-School and Y. P. numbers:

Jesus Christ Is Risen – There Is No One In The World Like Jesus – Tell Me The Stories Of Jesus – Medley – It Is A Thing Most Wonderful – Let Us Praise God Together – Fisherman Peter – Calypso Carol – Jesus Is The Name We Worship – God Who Made The Earth – Jesus, Humble Was Your Birth – Medley – Now Thank We All Our God – Kum Ba Yah – When He Comes.

Recorded and produced in England, the quality is good and, all told, this is a good one for family Gospel listening. (W.N.W.)

GUITARS AND WINE

GREAT GUITARS AT THE WINERY. Charlie Byrd, Barney Kessel, Herb Ellis. Stereo, Concord Jazz L-37514. (Festival release).

This recording was made last year at one of the annual (or thereabouts) get-togethers of the "Great Guitars" group. The venue for the occasion was outside the old Paul Masson winery on the hills outside Saratoga. Supporting the featured artists were Joe Byrd on bass and Jimmie Smith on drums. The guitars, as pictured on the jacket, were all electrically amplified and this, plus the outdoor venue, serves to give them a mellow sound rather than the percussive transient quality of a acoustic instruments, indoors.

But the emphasis here is on improvisation and good-natured musicianship, in which the audience shares with bursts of spontaneous applause – also muted by the outdoor location.

Starting point for the tracks are the titles: Broadway – Air Mail Special – Body And Soul – You Took Advantage Of Me – So Danco Samba – Sheik Of Araby – Straighten Up And Fly Right – Just In Time – The Talk Of The Town.

For the reasons mentioned earlier, the sound does not sparkle but is very clean and, if you have an ear for skilful pickin', as distinct from noisy dynamics, you'll enjoy this performance. (W.N.W.)

GAUCHO. Steely Dan. MCA Records MCA6102. Astor release.

Steely Dan is the collective "person" of Walter Becker and Donald Fagan. They have had several huge selling albums and their latest will undoubtedly join the others.

"Gaucho" has been precisely arranged and the overall standard is extremely high. An excellent production consisting of rhythm and blues and ballads.

The seven tracks on the album are: Babylon Sisters – Hey Nineteen – Glamour Profession – Gaucho – Time Out Of Mind – My Rival – Third World Man. (D.H.)

☆ ☆ ☆

JERMAINE. Jermaine Jackson. Motown M8948. Astor release.

Jermaine Jackson is a member of the Jacksons, formerly known as Jackson 5. He is recognised as a talented songwriter, producer and performer and his latest solo album will be well received by rhythm and blues and pop listeners. The musical arrangements and vocals are mixed superbly.

The nine tracks on the album are: The Pieces Fit – You Like Me Don't You – Little Girl Don't You Worry – All Because Of You – You've Changed – First You Laugh, Then You Cry – I Miss You So – Can I Change My Mind – Beautiful Morning. (D.H.)

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Comparison Chart

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Built-in Video RF Modulator	Yes	No
Capacity of BASIC ROM	12K	12K
Cassette Recorder Ports (basic machine)	2	1
Motor Control for Cassette Recorders	Yes(2)	Yes(1)

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Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

The Sixth West Coast Computer Fair

The Sixth West Coast Computer Fair was held in San Francisco in April, attracting some 36,000 visitors with 344 exhibitor stands. Former EA Editor Jim Rowe (now Technical Director of Dick Smith Electronics) visited the Fair and filed the following report.

Although held at the same venue as last year's Fair, (the San Francisco Civic Auditorium and Brooks Hall), the Sixth West Coast Computer Fair was significantly larger. There were no less than 344 exhibitor stands – they were not only in the two main halls, but had spilled over into the corridors and a small adjacent hall as well. And when the organisers announced the final attendance figure, this turned out to be almost double that of last year: over 36,000 people paid their $10 fee to shuffle around and look at the latest hardware and software.

More stands, fewer exhibitors

But it seemed to me that although there were more stands this year, the average stand was somewhat smaller. There were fewer "big manufacturer" stands, and more from small software and periheral suppliers. Whether this was due to a tougher commercial climate or just to a proliferation of the smaller firms was hard to tell – everyone I asked seemed to have a different explanation.

In many ways it was full of surprises. Some of the things which I for one had expected to find in much larger numbers than last year were hardly in evidence at all, while other things I didn't expect to see were there in significant numbers.

For example small Winchester hard disks were not nearly as evident as I had expected. In fact I learned that only one of the small Winchester drives has so far been available in any significant quantities (the Seagate Technology ST-506 drive). Larger and more expensive units are now available from firms like Corvus and Morrow, but I really had to search around to find a packaged sub-system using the Seagate drive. I finally found one at the stand of a small company called Micro Mainframe: a 5-megabyte add-on for the TRS-80, it sells for around $4000. Needless to say when I asked various other firms they told me that they were working on similar products, but had struck troubles – including delivery of drives. I believe some of the new systems are likely to be anounced at the NCC show in Chicago.

The Japanese are coming

The only computers I expected to find were the first of the "new wave" machines from Japan. And there was one, from NEC. Yet in many ways it was eclipsed by three new machines from US firms.

Perhaps the one that produced the most comment was a portable, disk-based system from a new company set up by Adam Osborne, the author-entrepreneur who is well-known for his series of tutorial books on microcomputers. According to his advertising and sales literature, the new "Osborne 1" has been designed to provide "a major price breakthrough": it will supposedly be selling for around $1800 complete, including CRT and dual floppy disk drives (single density).

In appearance the Osborne I is very different; in fact the prototypes looked as if they belonged more on the battlefield than on the office desk or lab bench. About the same size and shape as a small "Esky" drink cooler, it opens up to reveal a keyboard inside the lid, and a small (about 10cm) CRT screen squeezed in between two disk drives. The screen is so small that it is not easy to read the display. Osborne is already talking about a supplementary 23cm monitor!

Around the fair reactions to the Osborne 1 were very mixed. Many people I asked either were skeptical that it would ever appear on the market, or believed that if it did, that the low price would bring in so little profit that Osborne would go broke. Perhaps this was sour grapes, I don't know.

"Pity it doesn't have the contents of an Esky." Contemplation of the Osborne 1.

The second new US machine was from LNW Research, a small company which up until now has been making mainly computer hobby kits. Their LNW80 is software compatible with the TRS-80, but offers higher speed, high resolution colour graphics and a double density disk controller – all in one box. My impression was that it will probably sell, but to a restricted market.

The third US machine was the Expander, a sort of super-expandable machine a little like the Exidy Sorcerer and its S-100 expansion unit squeezed into the same case. Fully RAM-based and designed to be used solely with disks, it

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is being made and marketed by a new Chicago-based company set up by a Swedish entrepreneur, Mats Ingemanson. The machine itself was actually designed by the same engineer who produced Osborne's machine (Lee Felsenstein), who explained to me that this one represented his "no compromise" approach; this is reflected in the price, as the basic machine alone sells for $2200. Although company president Mats Ingemanson was very confident about its future and Lee Felsenstein is a highly regarded designer, I still found myself strangely unconvinced.

Getting back to the NEC computer for a moment, it looked quite impressive. Styled a little like the Sorcerer, it comes with a very powerful 24K BASIC in ROM, high resolution full colour graphics and up to 96K of RAM. Although not cheap, it looks very professional and could become a strong contender in the business market.

One of the really intriguing new peripherals at the show was the Votrax Type-N-Talk, a new speech synthesiser attachment from the Votrax division of Federal Screw Works. Made to work with virtually any small computer or terminal (it uses the RS-232C interface), it is unlike most previous units. Instead of having a fixed repertoire of words or phrases in memory, the Votrax uses phoneme synthesis – so it can say virtually anything you like! This in itself is not new, but previous phoneme synthesis units cost a lot more than this one's under-$400 price tag. And whereas previous phoneme synthesisers needed to be programmed in special phonetic language, this one has an inbuilt microcomputer with an algorithm to let it work from normal ASCII text strings!

The Votrax people had a couple of advance samples working on their stand, and just for fun I typed in the message "HELLO, WELCOME TO DICK SMITH ELECTRONICS". It sounded quite impressive – and it must have been fairly clear, because the next thing I felt a hand on my shoulder and heard a familiar Australian voice saying "Hey, no free advertising!" It was Professor Ron Aitcheson of Macquarie University, visiting like myself, who had heard the message while passing in the crowd!

Among the peripherals and software items, I noticed an increased number for the Apple. Apparently this has been very strongly marketed in the US over the last year, and this has resulted in quite a few new support products from independent suppliers. One I especially noticed was a very powerful 8-colour high resolution graphics printer, using ink-jet technology. It sells for around $8000, so perhaps it will be a while before we see one in every Apple owner's home! Still, I imagine that this and the other Apple support products were of considerable interest to Australia's "Mr Apple", Computerland managing director Rudi Hoess, who was also over there for the show.

Needless to say, Tandy/Radio Shack had a fair-sized stand, and were demonstrating their new products. Along with the new Model III computer and the little colour computer, they had a new low cost data terminal called "Teletex" which looks like a half-brother of the colour computer. It features a built-in Bell system modem and RF Modulator, and sells for only $399.

Among computer-related products, I was most impressed by the new microprocessor–based Gulbransen "Equinox Musicomputer" organ, which featured touch-sensitive control tabs and an incredible range of inbuilt rhythms, automatic chording and arpeggio and programmable accompaniment. It even corrects any miskeying of the melody line! This was demonstrated by the chap on the stand playing a popular piece solely by striking the keyboard in various places with a loosely-rolled up magazine – the organ automatically selected the most appropriate note!

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Microcomputer News & Products

TRS-80 Model III makes an impressive debut

Tandy Electronics Corporation has introduced a new member of their computer family, the TRS-80 Model III. At the time of the release, Tandy also displayed an extensive range of business and educational software and gave details of the planned expansion of their support and marketing divisions.

The Model III is essentially the same computer as the Model I in a different package. In a departure from the separate keyboard and video enclosures of the Models I and II, the new computer is an integrated unit. Added hardware features and extensive software support make the Model III a very attractive offering.

A single cabinet measuring 31.7cm × 48cm × 52cm contains the 30cm video monitor, a 65-key keyboard and a 12-key numeric pad. Next to the video monitor is space for mounting 2 14cm (5¼in) disk drives. A rear connector is provided for a single cassette recorder, and a Centronics-compatible parallel printer interface is included, in addition to an expansion bus connector. The prominent red Reset switch on the keyboard is recessed as a protection against accidental use, and AC and video monitor controls are mounted at the side of the cabinet.

The computer is based on the Z80 microprocessor, running at a clock speed of 2.027MHz – a 30% speed improvement on the Model I. The monitor screen displays 16 lines of 64 characters each, and all of the graphics features of the Model I are available.

The Model III is available in several versions. The lowest cost system includes 4K of RAM and Level 1 Basic in ROM, and sells for $999. Tandy are also offering this version coupled with a cassette recorder and Quick Print II thermal printer for $1427.90 – said to be the ideal computer system for the beginner.

The 4K system can be expanded to run Model III Basic with 16k of RAM for an additional $479.00, or the Model III Basic system can be purchased at the outset for $1399. Model III Basic has all the features of the Model I, Level II language and more. Residing in 14K of ROM, the Basic includes upper and lower case characters and two speed cassette operation (500 baud for Model I compatibility and 1500 baud for faster tape loading). It also includes an expanded character set for graphics, keyboard-controlled screen printing, support routines for the in-built real-time clock and routines for using an optional RS232C serial interface.

Memory can be expanded to 48K on board, and dual floppy disk drives can be added at any time. Tandy's are selling 16K RAM expansion kits for $200. Two disk drives add $1598 to the price of the 16K system.

Top of the line is the Model III Desktop Business Computer. Built into the computer housing next to the video screen are two 14cm disk drives, providing 178K bytes of storage per disk. Two external drives can be added, giving a total disk storage capacity of around 670K bytes. Included with the system is TRSDOS, with the Model I Disk Operating System commands plus many added features. Also included in a built-in RS-232C Serial Communications Interface.

Model III TRSDOS includes statements to make use of the real-time clock and serial interface, and a special "Convert" routine which allows single density Model I disk files to be re-formatted for use with the double-density Model III disk system. The DOS also includes a special "Help" command which gives detailed information on the use of each of the features of TRSDOS.

Software support is one of the strong features of Tandy's marketing scheme.

Virtually all of the software for the Model I is compatible with the Model III, making a wide range of applications programs immediately available for the new machine. In addition Tandy accompanied the introduction of the Model III with the release of a new range of business and educational software.

Software now available for the Model III includes a version of Visicalc, file management and statistical analysis programs, and disk-based Mailing List, General Ledger, Inventory, and Accounting programs. For word processing Tandy have available the powerful Scripsit package, for either disk or cassette based systems. Scripsit works in upper and lower case with Model III Basic, or upper case only with Level I Basic.

In addition to business packages, there

Micronews
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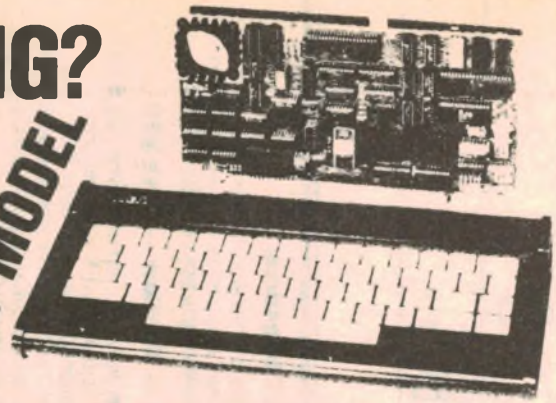

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The New "Super Instructor 80"

Build your own computer! The INSTRUCTOR 80 is an ideal starting point designed to save a bundle for the newcomer to microprocessors. This proven design is available in kit form or assembled and tested and includes FULL INSTRUCTIONS and our unique step-by-step PROGRAMMING COURSE and our full technical backup and warranty service. We won't let you fail!

Best of all the INSTRUCTOR 80 is part of the MICROWORLD family of compatible modules all designed to conform to the S100 bus. This ensures you can expand your computer to virtually any configuration you may require! Watch out for cheap "throw-away" non-expandable imitations, the INSTRUCTOR 80 is based on the proven DGZ80 (ETI Nov. 1979) and has a large SOFTWARE base AVAILABLE NOW. You can add the required memory and run MICROWORLD 12K LEVEL II BASIC, EDITOR/ASSEMBLER, play games such as CHESS, SPACE INVADERS, TARGET and many more . More than that DGZ80 is also a useful microprocessor controller and you can experiment with ROBOTICS, SPEECH SYNTHESIS and MACHINE CONTROL. When expanded to include disk drives, your DGZ80 based computer will become a full business system capable of running world class software such as CP/M 2.2, WORDSTAR, and a host of powerful financial/inventory control packages.

The INSTRUCTOR 80 package includes the DGZ80 single board CPU, MW640 VDU, RCA keyboard complete with case, 4-slot motherboard, all necessary sockets and cables and, of course, full construction manuals and PROGRAMMING COURSE. Add a cassette interface such as the USCII and more memory such as the AT16K and you have what we consider to be the most cost effective and versatile 16K home computer available in Australia today. To operate your INSTRUCTOR 80 you need only connect a simple 8V power supply and connect to a video modulator or a video monitor such as the NT50.

The INSTRUCTOR 80 sets new standards for price and performance in a kit computer. The central processor is the powerful Z80 microprocessor, backed by a wealth of software worldwide. Full S100 expandability is a big feature of the INSTRUCTROR 80. Because we use the S100 bus from the word "GO" there is no need to purchase any $500 type expansion interface. Load and save programs using a reliable cassette interface such as the USCII and you can even connect a printer to the powerful PIO port. The VDU generates the full ASCII character set (UPPER and LOWER case with descenders!) and 64 characters/line 16 lines to the screen. Under software control you can generate "chunky graphics" with 128 x 64 bit resolution. Optional S100 modules enable you to use such options as PROGRAMMABLE GRAPHICS (512 x 256 bit resolution), SPEECH SYNTHESISERS, additional memory to 64K including RAM and EPROM boards. You can add disk drives and convert your INSTRUCTOR 80 into a WORDPROCESSOR or SMALL BUSINESS COMPUTER.

INSTRUCTOR 80 is TOTALLY UPWARD COMPATIBLE. You can go on adding modules to build your computer to suit virtually any application. You learn as you build your own INSTRUCTOR 80 and then once you have mastered the world of the microcomputer it becomes a sound basis for future expansion. The INSTRUCTOR 80 is your LOGICAL INVESTMENT that will introduce you to the FASCINATING and REWARDING world of the MICROPROCESSOR.

INSTRUCTOR 80 in kit form complete with all manuals and programming course:

$399 or **$459** assembled and tested.

MICROWORLD S100 MODULES and ASSOCIATED EQUIPMENT

DGZ80 single board CPU kit	$199
MW640 64 char/16 line VDU	$159
AT16K 16K STATIC RAM (ass/tested)	$199
TCT16K Block locatable RAM kit	$219
TCTPCG Programmable graphics generator	$140
SBC2650 2650 CPU on the S100 bus (kit)	$209
SCVT100 Serial terminal (EA Oct. 80)	$195
DG750 I/O 2 serial, 24 parallel bits	$175
MWWRP Wirewrap card	$ 25
MW2516 EPROM card	$ 99
MWEXT Extender card	$ 30
MW1550 10 slot motherboard	$ 49.50
MW S100 CF Card frame kit	$ 49.50
MW S100 PS 8V @ 10A, 15-0-15 @ 2A	$ 75
MW S100 EC Desk top cabinet	$ 65
MW S100 FP Front Panel	$ 15
MW USCII Cassette interface	$ 30
NT50 12" VIDEO MONITOR	$139.50

SOFTWARE: (DGOS Format on cassette)

MICROWORLD LEVEL II BASIC with manual	$19.75
MICROWORLD Z80 EDITOR/ASSEMBER with manual	$19.75
GAMES PAK #1 TARGET/TREK	$14.75
GAMES PAK #2 MULTIPLE GAMES	$14.75
MW-640 CHESS (two versions with/without PCG)	$14.75
MW-INVAD MICROSPACE INVADERS the arcade game	$14.75
MW-UTILITY Useful test and display programs	$14.74

SOFTWARE: (EPROMS)

MICROWORLD LEVEL II 12K BASIC with manual	$65
DGOS Monitor program for DGZ80	$40

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All items expected to be available and prices correct at time of going to press. Please phone for confirmation of price and availability.

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AT 013

Microcomputer News & Products

are utilities programs and wide range of games and personal finance management programs. Also new in Australia is a range of educational programs designed for use in schools. Tandy is supporting an intensive development effort to produce effective microcomputer materials for use in the classroom – or "courseware" as they are calling the programs.

Currently Tandy's Computer Assisted Instruction Series includes programs for maths and alphabet practice, spelling and geometry, graphics programs for demonstrating linear equations and the use of graphs in physics, and TRS-80 Pilot Plus, a computer language that allows the user to create or adapt programs for classroom use. CAI programs are available for all levels, from primary to senior high school.

On the hardware side the use of computers in the classroom is made easier by the new Network II controller, which allows up to 16 TRS-80s to be connected to one central computer. The central computer, or "host" requires at least one disk drive, and can transfer programs to and from student stations at 500 baud. With the use of the Network controller a teacher can supervise the operation of each individual computer as required, while each student has full use of the peripheral computer.

With the introduction of the Model III Tandy Electronics also released details of their Plotter/Printer, an intelligent device that responds to Basic commands and can produce text or complex graphics plots up to 19cm wide and of any length. Characters can be printed in a 75-column line, and can be enlarged or rotated. The printer/plotter does not use a ribbon, but a replaceable pen, and actually draws images under program control. The single unit can thus be used as both a printer and a plotter.

Tandy Electronics currently account for over 40% of worldwide microcomputer sales, and their new marketing initiatives will very likely increase this figure. Certainly the Model III is a computer to watch closely, of interest to the hobbyist and business person alike. Tandy claims that, for the price, there's probably not another business system on the market that can match the Model III for power and economy.

Melbourne readers will have seen some of the first results of Tandy's aggressive new marketing strategy. On June 10, 1981, Tandy Electronics opened five major new stores in Melbourne, and simultaneously re-opened six stores which had been re-located and renovated. The result was a grand opening of 11 stores – in one day!

Games galore

Compshop Australia has released six new programs for the TRS-80 and System-80 computers. For Adventure fans there is Labyrinth, a graphic, three-dimensional trek through a maze populated by a minotaur and various traps and treasures. The program is written in machine language, so that the 3D perspective view of the playing area is updated instantaneously as the player moves.

Deathmaze 5000 is also a 3D adventure. The action takes place in a five storey building containing a host of strange objects and obstructions, and the object of the game is to escape the Deathmaze . . . alive!

Also from Compshop is Star Trek 3.5. This new and improved version of the classic game includes sound effects, fast execution of sensor scans, multiple move options, and more intelligent Klingon battle tactics for even greater challenge. Galactic Empire, also for the TRS-80 and System-80, is a space battlegame on a strategic level. As commander of the Galactic forces, the player must conquer and hold the inhabited worlds, deploy armies, raise taxes and manage his resources carefully as he builds an empire.

"Missile Attack" is a version of the popular arcade game which pits Anti-Ballistic Missiles against a barrage of enemy ICBMs coming down over your

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THIS MONTH'S SPECIAL

HAMS

The ultimate computer programme for Amateur Radio Communications is now available for the PET
Send and receive ASCII, BAUDOT at 45, 50, 75, 110 baud, and MORSE at 5 to 99 WPM. Transmit SSTV.
Written entirely in Machine Language, this fast and powerful program features a split screen with cursors and over 50 commands.

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Microcomputer News & Products

city. As the player's skill improves the level of difficulty of the game increases.

"The Curse of Crowley Manor" allows you to play detective in an engrossing mystery story. The scene is London in 1913, and there's been a murder at Crowley Manor. What starts out as a simple investigation turns into a trip into the occult as strange twists and turns develop in the plot. The news release puts it "This adventure is sure to keep you riveted to your computer screen waiting for the next axe to fall!"

All of the programs are available on cassette tape, and run in 16K of memory. Labyrinth and Deathmaze cost $15.95 each, the others $19.50 each. Compshop is at Suite 4, 75 Palmerston Crescent, South Melbourne, 3205.

Winchester plus Floppy Disc

Vector Graphic Inc recently introduced the Vector 3005, said to be the first desktop business system to incorporate the speed and capacity of Winchester disk storage. The system includes a 14cm, 5-megabyte Winchester, a 630K byte double-sided, quad density floppy disk, Vector 3 computer, display terminal and keyboard and an extensive range of Vector software.

Both the Winchester and the floppy disk are controlled by a single controller board. The Dualmode board automatically corrects up to 5 erroneous bits in every 256, eliminating errors due to disk contamination, aging and surface defects.

Software provided with the Vector 3005 includes CP/M 2.0, Scope editor, debugger, ZSM assembler and Microsoft Basic-80). Optionally available are Peachtree business and accounting software, and Vector's Memorite III word processor and ExecuPlan financial planning packages.

Vector products are distributed in Australia by Dicker Data Projects Pty Ltd, 31 Cawarra Rd, Caringbah, NSW, 2229.

New system has PASCAL, Colour Graphics

Pacific Communications Pty Ltd has released the new Ramtek 6214 Colourgraphic computer, featuring full PAL television compatibility. The 6214 has been designed specifically with television applications in mind, and the graphic output of the computer can be used as a standard input to a video cassette recorder.

The 6214 Colourgraphic computer is programmable in PASCAL or assembly language, and is capable of either stand-alone operation or linkage to a host computer. It consists of a Z80A processor operating at 4MHz with 80K of RAM, floppy-disk controller, single or double-density floppy-disk drive, display unit, and the UCSD PASCAL operating system. Video resolution is 640 × 480 picture elements, and a software look-up table allows display of up to 16 colours from a range of 64, or eight colours plus text.

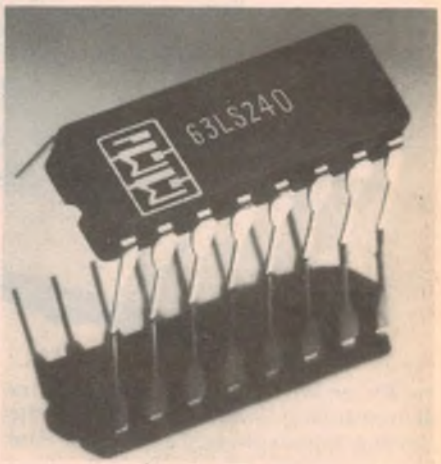
Optionally available is a high speed vector generator, which enables lines to be drawn on the video screen at a rate of 0.8μs per pixel. Also available is a graphics software package written in PASCAL, consisting of a set of graphic procedures and routines to simplify graphics programming.

At the same time Pacific Communications Pty Ltd released the new Ramtek 1000 line 62cm colour video monitor for use with graphics display systems. The GM 865C monitor expands Ramtek's previous GM850 series, and provides a large screen presentation for high resolution graphics.

Further information can be obtained from Pacific Communications Pty Ltd, 2/71 Palmerston Crescent, South Melbourne, Vic 3205.

Flea-power PROM

A range of low power consumption 1K and 2K programmable read-only memories (PROMs) is now available from Monolithic Memories Inc. The devices use titanium-tungsten fuses to reduce power consumption without reducing speed. Each chip draws only 70mA, and access time is 55ns for the 1K version and 60ns for the 2K version.



The combination of low power consumption and high speed make the new PROMs ideal for use in microprocessor and telecommunications applications which involve stand-alone equipment.

For further details contact Monolithic Memories, 505 Hamilton Ave Palo Alto, California, USA 94301.

Australian Software on show

Visitors to DATA '81 this year will have a chance to see and compare the latest in Australian produced software.

Australian-developed software has a high reputation both here and overseas, and many Australian companies are finding a growing export market. Along

Micronews continued p130 ►

System-80 and TRS-80 Users

SALE! **VERBATIM** DISKETTES x 10 + Plastic Filing Box (while stocks last) 30 for $99 + ST — **$39** + ST

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HARDWARE

KIT	DESCRIPTION	PRICE
S/09 6809 Computer w/128K Memory		$3450.00
/09 6809 Computer w/56K Memory		$1760.00
6540 Printer 132 characters		$2350.00
Anacom dot mat printer 150 CPS		$1495.00
S/00 S/09 W/O Process/Mem card		$730.00
DT-80 12" Terminal w/monitor		$985.00
8209 Terminal w/monitor		$1050.00
8212 12" Terminal w/monitor		$1175.80
DT-5 2 double track double density 1-9 MB		$1950.00
DMF2 Disk System w/2.5m Capacity		$2750.00
D5-2 double side/double density 720KB		$1395.00
CDS-1 Winchester Hard Disk System		$4835.00
MP-09A 6809 Process/Board (Assem)		$225.00
D5-2 double side/double density 720KB		$1395.00
3809 128K Memory Expansion for S/09		$2305.00
MP-LA Parallel Interface		$65.00
MP-L2 Dual Parallel Interface		$135.00
MP-N Calculator Interface		$99.50
MP-R Eprom Programmer		$119.50
MP-S Serial Interface		$65.50
MP-SA Serial Interface (Assembled)		$78.00
MP-S2 Dual Serial Interface		$135.00
MP-SX Serial Interface Expansion		$27.50
MP-T Interrupt Timer		$99.50
S-32 Universal Static Memory Card		$125.00
MB 6809 Mother Board		$148.50

SOFTWARE

ASM09 Optimizing Assembler (5" or 8")	$110.00
Flex 09 ver.2.8.1w/manual	$38.50
Inventory Program	$110.00
Mail List Program	$110.00
Word processing Editor & Text processor	$165.00
Word Processing Editor	$110.00
Text processor	$82.50
SP-09-2 Text Editing System	$55.00
SP-09-3 Mnemonic Assembler	$55.00
SP-09-4 Basic	$82.50
SP-09-5 Debug Package	$82.50
SP-09-6 Extended Basic	$110.00
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UniFLEX Multi-tasking BASIC	$150.00
SP-09-10 Sort/merge	$82.50
SP-09-11	$82.50
* UniFLEX:- Prices ex Sydney	$495.00

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D-5 Two double sided, double density, 5" disk drives with a total on line capacity of 720,000 bytes of data. Includes cabinet, power supply, connecting cable and controller. Controller will operate up to four drives. This is an ideal disk system for small stand alone word processing systems, or for businesses that do not work with large inventories.

14 x 6 x 10
— 20lbs. . . . $1395.00

DT-5 Double track density version of the D-5. The DT-5 uses two 96 track per inch drives to provide an on line capacity of 1,400,000 bytes. Includes cabinet, power supply, connecting cable and controller. Controller will operate up to four drives. This is a disk system with enough capacity to include small inventories of up to 1,000 items, plus the usual business package of general ledger payroll, etc.

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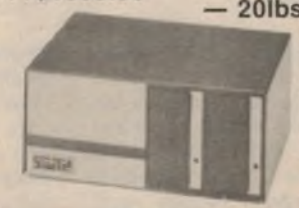

D-5 or DT-5

DMF-2 Double sided, double density, dual eight-inch disk system with an on line capacity of 2,400,000 bytes. Our "top of the line" disk system features a DMA type controller for fastest possible data transfers. This drive was designed for larger businesses and multi user installations. The DMF-2 will provide the fast operation necessary for systems running multiterminals under the UniFLEX operating system. Complete with a heavy duty 1/8-inch metal cabinet, power supply, connecting cable and controller. The controller will operate up to four drives.

17½ x 5 x 21½
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DMF2

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HARDWARE

32K Static Ram Board	$580.00
16K Static Ram Board Expandable to 32K	$368.00
6809 Plus CPU Card	$532.00
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with a huge range of hardware and other products, software will be a key element of DATA '81, Australia's biggest annual exhibition of computers.

The exhibition is to be held at Sydney's Centrepoint from August 25 to 27 and at the Wentworth Hotel in Melbourne from November 10 to 12. The exhibition is being organised by Graphic Directions Pty Ltd, 28-36 Foveaux Street, Surry Hills, NSW 2010.

Gandalf modems from Datamatic

Datamatic Pty Ltd now has available an extensive range of modems manufactured by Gandalf Data Inc. Versions for both private and public network use are available, and both synchronous and asynchronous models can be supplied. Synchronous transmission frames each byte sent with hand-shaking signals, allowing error-free transmission at higher speeds than asychronous operation.

The five asychronous models feature speeds from 0 to 19200 bps (bits per second). For private networks ranges are specified for each model, and vary from 14 to 20km at speeds up to 4800bps and 3 to 15km at speeds up to 19200bps. One model can operate over 322km at 4800bps. Five synchronous models are also available, with data transmission rates from 2400bps to 50000bps and ranges from 21km at 2400bps to 3km at 50000bps. One model, the SM9600, has an unlimited range at 9600bps.

Most models can be used either full or half duplex, and line requirements vary from two or four wire private cables to voice band public data lines. Interface options available include RS-232C, CCITT and 20mA current loop.

For further information contact Datamatic Pty Ltd, 60-64 Dickson Ave, Artarmon, NSW, 2064.

Micronews continued p134 ►

You could pay $10,000 for a word-processor! Ours will cost you just $4,000* and it's a computer as well.

You probably already know the benefits of installing a word-processor. And you know they cost around $10,000. They did until K&L's System 140. For around $4,000, System 140 will outperform many units costing far more. In addition, because it is a microcomputer and not just an intelligent typewriter, it has the flexibility to do your accounts, by simply adding the right software option.

Here are some of the System 140 word-processing features:

- Standard keyboard and 640 character display. 70 pages per diskette, 80 character/sec bi directional printer.
- So simple, even the boss can use it.
- Rapid text entry. Automatic wordwrap; insert document from another file; tabulator functions; glossary, for fast entry of frequently used phrases.
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MICRO-80 is a monthly magazine dedicated to users of SYSTEM 80 and TRS-80 microcomputers. Owned and produced entirely in Australia, each issue of MICRO-80 contains at least six programs, articles, useful hints and answers to readers' problems; all designed to help YOU get the most out of your SYSTEM 80 or TRS-80. Since MICRO-80's first issue in December 1979, we have published over 80 major pieces of software and 10 hardware projects. Most of the programs and articles are written by our readers to whom we pay publication fees thus enabling them to make their hobby pay. MICRO-80 readers can save money by buying Tandy products at 10% discount from an authorised dealer — for details see any issue of MICRO-80. Our sister business, MICRO-80 PRODUCTS, sells Australian designed and produced software and high quality, imported goods at low, sensible prices. We repeat, if you own a SYSTEM 80 or TRS-80,

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If you do not have enough time at the keyboard to type in the program listings which are published in MICRO-80 each month, then you need a cassette subscription. As well as MICRO-80 magazine, you receive a cassette each month containing all the programs listed in the magazine.

SPECIAL OFFER TO ALL NEW SUBSCRIBERS TO MICRO-80

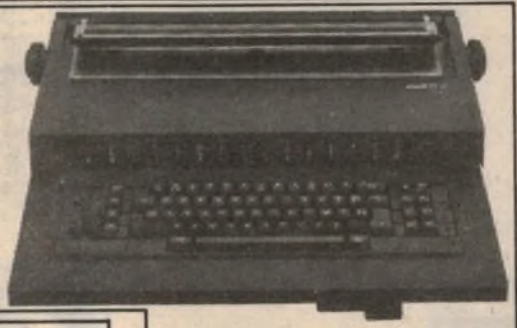
A FREE cassette containing 6 programs (3 Level I + 3 Level II), together with complete documentation, will be sent to every new subscriber to MICRO-80.

Suspicious of mail order? Then send $2.50 for a single copy of MICRO-80 and see for yourself that this is the magazine for you!

Daisy Wheel Typewriter/Printer

MICRO-80 has converted the new OLIVETTI ET-121 DAISY WHEEL typewriter to work with the TRS-80 and SYSTEM 80 or any other microcomputer with a Centronics parallel port (RS 232 serial interface available shortly). The ET-121 typewriter is renowned for its high quality, fast speed (17 c.p.s.), quietness and reliability. MICRO-80 is renowned for its knowledge of the TRS-80/SYSTEM 80 and its sensible pricing policy. Together, we have produced a dual-purpose machine:- an attractive, modern, correcting typewriter which doubles as a correspondence quality Daisy-wheel printer when used with your micro-computer.

How good is it? - This part of our advertisement was typeset using an ET-121 driven by a TRS-80. Write and ask for full details.



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MPI is the second biggest manufacturer of mini floppy disk drives in the world. They produce a family of high quality 5¼" drives with super-fast track-to-track access times (5ms!)

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Dual head drives use both sides of the disk and occupy two drive positions — it is like having two drives for little more than the price of one!

Prices quoted are for bare drives. Add $10 per drive for a cabinet and $30 per drive for a power supply.

DISKETTES FOR TRS-80

NASHUA 40 track single side . . . $4.50 ea
VERBATIM 40 track double side . $5.90 ea
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NEWDOS 80
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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

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.

SYSPAND 80 FOR THE SYSTEM 80 $119.00

SYSPAND 80 is a self-contained module which connects to the expansion port on your SYSTEM 80 and gives you a CENTRONICS parallel port to drive a printer PLUS the TRS-80 40 line bus. SYSPAND 80 allows you to connect all Tandy peripheral, including the expansion interface, disk drives, MICROTEK MT-32 memory expansion unit and the fabulous EXATRON STRINGY FLOPPY.

TRS-80 MEMORY EXPANSION UNIT
MT-32 ... $149.00

The MT-32 is manufactured by MICROTEK Inc., USA. It provides a CENTRONICS printer port and sockets for up to 32K of dynamic RAM. It comes complete, ready to plug into the expansion port of your Level II 16K machine. (Will also work with your SYSTEM 80 via SYSPAND 80).

MT-32A without RAM $149.00
MT-32B with 16K RAM $179.00
MT-32C with 32K RAM $209.00

16K MEMORY EXPANSION KIT
ONLY $30 incl. p&p

These are prime, branded, 200 ns (yes, 200 ns!) chips. You will pay much more elsewhere for slow, 350 ns chps. 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.

DISK DRIVE HEAD CLEANING DISKETTES
$29.00 plus $1.20 p &p

Disk drives are expensive and so are diskettes. As with any magnetic recording device, a disk drive works better and lasts longer if the head is cleaned regularly. In the past, the problem has been, how do you clean the head without pulling the mechanism apart and running the risk of damaging delicate parts. 3M's have come to our rescue with SCOTCH BRAND, non-abrasive, head cleaning diskettes which thoroughly clean the head in seconds. The cleaning action is less abrasive than an ordinary diskette and no residue is left behind.

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- ☐ 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

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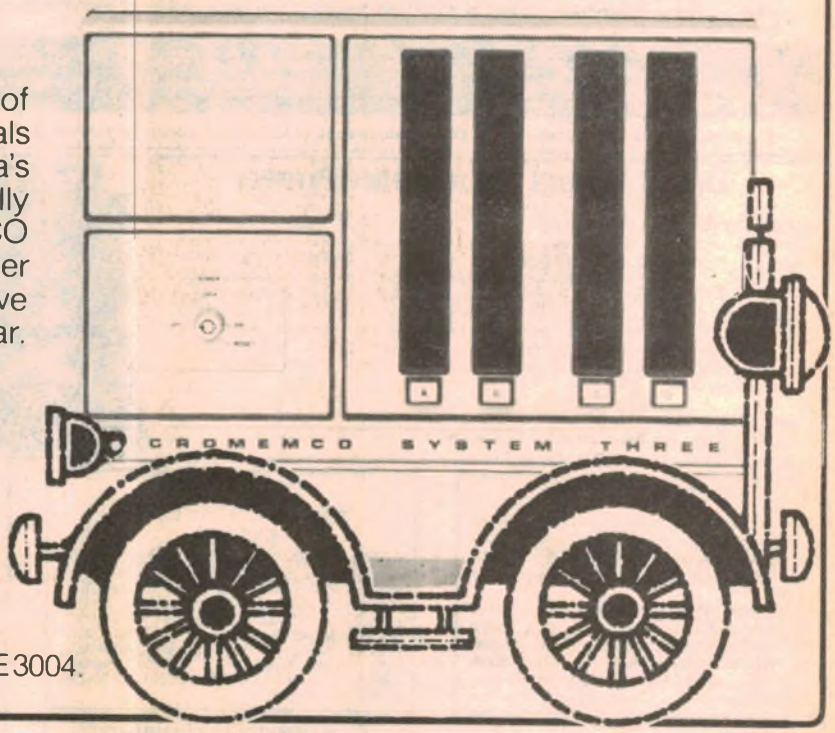

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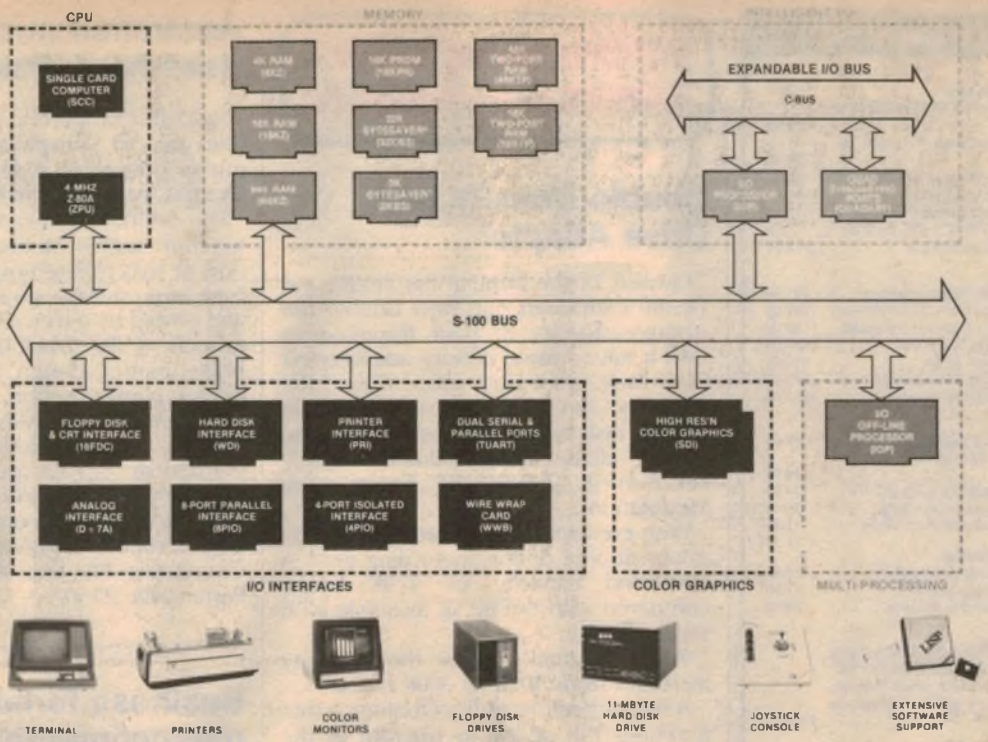

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Again, you can have beautiful high-resolution color graphics with our color graphics interface. You can select from over 4000 colors and have a picture with a resolution at least equal to quality broadcast-TV pictures.

You have an unprecedented selection of memory including our unusual 48K and 16K **two-port** RAMs which allow high-speed color graphics.

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(SII, C1P unless specified)

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- Superboard Smoky Cover, or Metal Box, or Fibreglass Case (Holds Cass. rec)
- R.F. Modulators, Power Supplies, Monitor TV's, 2114 Chips

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Microcomputer News & Products

Double Density Disk Drive Adapter

Owners of the popular System-80 and TRS-80 computers can now double the storage capacity of their floppy disks with a new double density adapter unit from Dick Smith Electronics. Called the "Doubler" the unit allows existing single density disk systems to read, write and format disks using double density recording (Modified Frequency Modulation).

With conventional 35-track minifloppy drives double density recording gives a formatted capacity of 175K bytes, compared with the 87.5K available with single density.

With 40 track drives the capacity increases from 100K to 200K bytes.

A further feature of the Doubler is that it retains the ability to operate in the single density mode, so that full compatibility with the user's existing software and data on single density disks is assured.

The unit is easily fitted into the expansion units of both the System-80 and the TRS-80, plugging into the existing controller socket. It comes with an instruction manual and a disk containing DBLDOS, a double-density DOS which is fully compatible with Tandy TRSDOS.

The Doubler is priced at $225, and will be available from Dick Smith Electronics.

TCC releases Panasonic computer system

A comprehensive computer system based on the Panasonic 740 computer has been released by The Computer Company (TCC) Pty Ltd. The Panasonic 740 is one of family of Panasonic computers, for which TCC is the sole Australian distributor.

TCC are making a special offer to introduce the Panasonic system. The desktop system includes floppy disk storage and a 120 character-per-second printer. Applications software including packages for order entry, invoicing, accounts and stock control are included in the offer.

Optionally available is the Panasonic word processing package, a full screen-based word processor.

The system is available from TCC for just under $10,000, including five hours of training at TCC's Sydney office in the use and operation of the system.

For further details contact The Computer Company, 4 Cliff St, Milsons Point, Sydney, 2061.

Australian micro uses hard disks

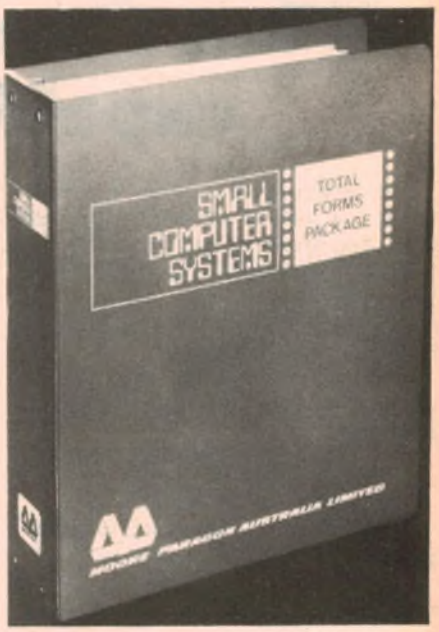
Sandell Computers Pty Ltd has just released an Australian manufactured microcomputer using the Shugart SA1000 series of Winchester fixed disks.

The SA1000 series of disk drives are random access storage devices using one or two non-removable 20cm disks. Each disk surface contains 256 tracks, and is read by a movable head. The two models of the SA1000 are the SA1002 single platter design and the SA1004 double platter version.

The SA1002 provides 5 megabytes of storage, while the SA1004 provides 10 megabytes. Up to four SA1000 drives may be connected in one system.

For further details on the Sandell hard disk computer system contact Sandell Computers Pty Ltd, 4/101 George St, Parramatta, 2150.

Business forms for microcomputers



Business operations using microcomputers now have a wide variety of fanfold business forms available to suit any major application. Moore Paragon, a leading Australian manufacturer, has developed a series of pre-printed designs for common business applications.

For those needing only a small quantity the forms are available off-the-shelf. A user can also select pre-designed forms and have them personalised during printing.

For further information contact Moore Paragon Australia Pty Ltd, The Boulevard, Richmond, Vic. 3121.

Micronews continued p136 ►

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***An ideal introduction to computer technology.**

***The world's lowest price computer.**

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Unique component parts

The MicroAce is not just another personal computer. Quite apart from its exceptionally low price, the MicroAce has two uniquely advanced components: the powerful BASIC interpreter, and the simple teach yourself BASIC manual.

The unique versatile BASIC interpreter offers remarkable programming advantages:

- UNIQUE 'ONE-TOUCH' KEY WORD ENTRY: the MicroAce 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. This prevents entry of long and complicated programs with faults only discovered when you try to run them.

- EXCELLENT STRING-HANDLING CAPABILITY—takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The MicroAce also has string input—to request a line of text when necessary. Strings do not need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.

Excellent value

For just $199.00 you get everything you need to build a personal computer at home . . . PCB, with IC sockets for all ICs; case; leads for direct connection to a cassette recorder and television (black and white or colour); everything!

Yet the MicroAce really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The MicroAce is programmed in BASIC, and you can use it to do quite literally anything, from playing chess to managing a business.

The MicroAce is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV . . . plug in a mains adaptor . . . and you're ready to go.

Fewer chips, compact design

The MicroAce owes its remarkable low price to its remarkable design: the whole system is packed on to 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 MicroAce 1K byte RAM (EXPANDABLE TO 2K ON BOARD) is roughly equivalent to 4K bytes in a conventional computer—typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

ACCESSORIES TO MAKE YOUR MICROACE EVEN MORE VERSATILE.

Video Modulator to use your MICROACE on TVs with VHF tuner
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9V 600mA Cat: M 9560 **$12.95**

Cassette recorder 'National' brand to load and save programs Cat: A 4095 **$79.95**

Expansion kit to 2K of RAM
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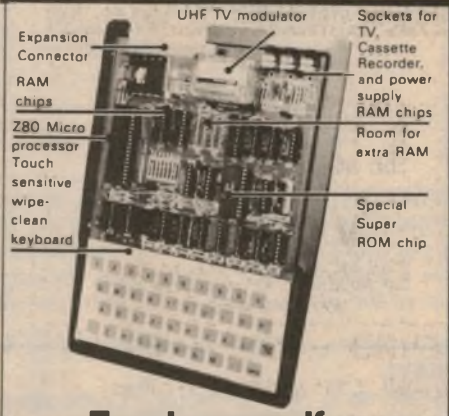
- P.C. Board with IC Sockets for all ICs.
- All components supplied
- New, wipe clean, touch sensitive keyboard.
- Stylish moulded case.
- Leads and Plugs (For cassette and TV connection.)
- Free BASIC programming book-course.
- Coaxial TV antenna connection switch.



Teach yourself

If the features of the BASIC interpreter mean little to you—don't worry. They're all explained in the specially written book *free* with every kit! The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming—from first principles to complex programs.

A hardware manual is also included with every kit.

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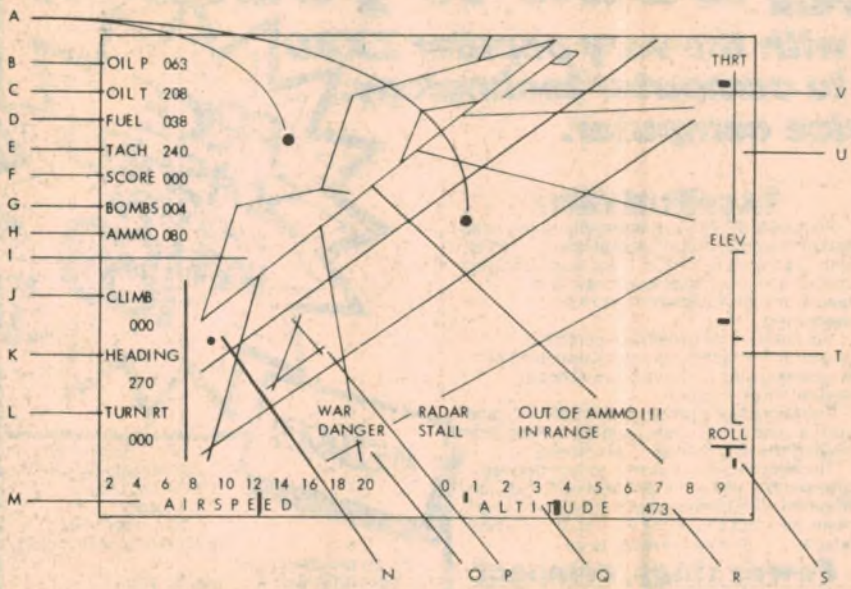
Microcomputer News & Products

How to fly the System-80



A Enemies on 3D screen
B Oil pressure (psi)
C Oil temperature (degrees F)
D Fuel (gallons)
E Tachometer (rpm)
F Score (1 per fighter, 1 per bomb hit)
G Bombs remaining
H Ammunition remaining
I 3D out-the-windshield display
J Climb rate (feet per minute)
K Compass heading (degrees true)
L Turn rate (degrees per minute)
M Airspeed (mph)
N Enemy fuel depot
O Status messages (6 in all)
P Enemy airbase (three runways)
Q Altimeter (feet)
R Micro-altimeter (feet) when below 700 feet only
S Roll rate indicator (rudder position)
T Elevator position indicator
U Throttle position indicator
V British airbase

SHOWN ABOVE is the screen display of the X3684 Flight Simulator program for the System-80. It provides a 3D display of the landscape you are "flying" over and read-outs of your plane's instruments, and can be used to demonstrate the theory of flight, or in a combat mode which allows the user to fight battles.
Cost of the program is $34.90, and it is available from all Dick Smith stores.

SAVE
$726 on a 16K Computer, "Commodore Pet".
Purchase your 16K computer for $999.00.

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Legal data base — computerised lawyers?

"Pacific Computer Weekly" for May 15 carried a story on a legal data base system proposed by the Computerised Legal Information Committee (CLIC) of Victoria. The Committee's proposal is currently under consideration by the Standing Committee of Attorneys-General, comprising the Attorney General's of all the States and the Federal Attorney-General.

Lexis, a US-designed legal data system already in use in the US and UK and planned for France has previously been the favoured system for adoption in Australia.

The Victorian committee is arguing for the acceptance of CLIRS (Computerised Legal Information Retrieval System), an independent system developed in Australia.

CLIRS would be one of a series of state units which would be linked with the existing Federal legal data base to create an integrated Australia-wide system. The objective would be to provide computerised legal information services to a wide range of users at the lowest possible cost.

Users would access the data base through remote terminals. Lexis uses terminals which are dedicated to the legal information service, while CLIRS can be accessed by terminals which also perform other functions. This is seen as a big advantage for CLIRS, because existing computers and word processors in libraries and offices could be used with the system.

A trustee authority with members from government, the legal profession and private enterprise would be formed to set up and maintain the legal data base.

Guidelines for new technology

The Victorian Government has introduced a set of comprehensive guide-lines for the introduction of new technology in the public sector. Victoria is the first State in Australia to introduce formal guidelines of this kind.

The guidelines suggest a 12-point basis for discussion before any new technology is introduced. The discussion points range from the objectives and impact of any proposed scheme to the effects and costs of any job redundancies.

Minister for Employment and Training, Mr Brian Dixon, said "The guidelines are designed to ensure early discussion between State authorities or the Public Service Board and the appropriate employment groups before any decision is taken to introduce new technology".

A committee comprising union, industry and public service representatives will be formed to discuss government proposals. ●

SOMEWHERE IN THE MICROCOMPUTER JUNGLE, THERE'S REAL HELP FOR THE SMALL BUSINESSMAN

It's a big jungle, a confusing jungle, with many extravagant claims being made, some that don't stand close examination.

Let's consider what we think a small businessman should look for in a computer.

- Will the system do ALL the tasks associated with small business?
- Does the computer offer a good price/performance ratio?
- Does the supplier or manufacturer provide good local software and technical support?
- Are the software packages written in Australia?
- Is the system versatile and easy to use?
- Can the system be easily and economically expanded?
- Will the system execute programs under any of the high level languages?

Obviously we wouldn't be asking these questions if we couldn't answer YES to all of them.

Many PMS-100's are already in use throughout Australia — working efficiently and profitably for small business.

Should you decide to call us, don't forget to ask about the DC-500 Hard Disk Drive subsystem that brings main frame storage to the micro user.

KEY SPECS — PMS-100

PROCESSOR — Z80A 4Mhz CLOCK
MEMORY — RAM — 64K BYTES. 200 NS PROM 4K BYTES
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SOFTWARE — D.O. SYSTEM: CP/M COMPATIBLE AS STD LANGUAGES: BASIC. ASSEMBLER. COBOL. PASCAL ETC. PACKAGES: ACCOUNTING. WORD PROCESSING & STOCK CONTROL

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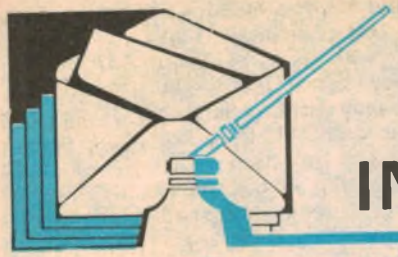

INFORMATION CENTRE

CYLON VOICE: I have recently built the Cylon Voice project described in January 1981, and have found it to be quite good but the background noise (VCO) is louder than the actual voice when you speak. What I would like to know is; is there supposed to be a background noise. It sounds like a flying saucer landing, and is variable through the sine and triangle switch and the two pots. Whatever I do, the VCO is always louder. Are there any simple mods that can overcome this problem. If there are could you please advice me of these. I have also varied the value of the capacitor between pins 5 & 6 of the chip, but to no avail. (E.C., Fairy Meadow, NSW).

● There are a number of possibilities as far as the noise source is concerned. The noise may be originating from the preamp circuit, or else from within the ring modulator circuit itself.

To test if the preamp is causing the problem, remove the coupling capacitor between it and the ring modulator section of the circuit. If the noise disappears, then chances are that the noise is coming from the preamp. This can be verified by connecting the output of the preamp to the input of your power amplifier. This should be done with a 0.1μF capacitor because of the DC offset at the output of the op-amp.

Now, listen to the speakers. If there is reasonably high noise level, then the problem is probably in the preamp. Speak into the microphone and check to see if the noise level is higher than the voice. If so, then the problem is probably a faulty 4.7μF capacitor in the amplifier biasing network.

If the preamp comes through the test OK then you will have to look at the ring modulator circuit. With the preamp still disconnected, hook the output of the modulator to the power amplifier.

If you cannot get a complete null, then set the pot for minimum output. One component that should be checked is the 1μF bypass capacitor connected between pin 10 and ground.

PLAYMASTER TWIN-TEN: Recently I constructed the Playmaster Twin-Ten amplifier (May-June 1979). Once I had constructed the unit I checked it over several times, I connected a portable cassette player and speakers to the unit and switched on. To my disappointment there was a terribly loud humming noise and the music was so distorted it was unrecognisable.

After checking I found that if I firmly held the 100μF capacitor, connected to earth, and also held the 1000μF capacitor in the power supply, at the same time shorting the 1000μF capacitor to the chassis via my arm, I could reduce the hum and distortion considerably. I replaced the capacitors and found no difference. Can you help me? (D.L., Emerald, Vic).

● It appears likely that the earth wiring of the input sockets or the wiring to the selector switch of the amplifier is incorrect. These should be thoroughly checked in comparison with the circuit and the wiring diagram. Note that the input wiring is connected to mains earth (ie, chassis) at one point only.

There is also a possibility that the input lead (active and shield) connections from the cassette deck is transposed.

PLAYMASTER 132 AMPLIFIER: I have a Playmaster 132 amplifier (modular form – no integral tuner) which is obviously getting a bit old and which I am thinking of "pensioning off" in favour of your new Mosfet amp. Could you please give me your valued and unbiased opinion on the following:

(1) Would the improvements in THD, frequency response and stability of the Mosfet amp be audibly appreciable rather than of mere academic significance?

(2) By taking the rather drastic step of physically isolating the power supply from the preamp and power amps I have managed to get my 132 to a stage where there is no hum and no audible background noise when using either tuner or tape inputs. However, I do have a transistor/resistor "hiss" on phono input which is audible above about half volume. The only MOSFET I have seen appeared to be much better in this regard. Is this inherently so, or can my amp be improved by changing transistor types in the phono preamp stage etc?

(3) Having forsaken your principles by including a "loudness" switch in the Mosfet amp, could you suggest suitable circuitry to achieve the same function in the 132. (H.W., Moggill, Q.)

● The Playmaster Mosfet stereo amplifier is likely to be audibly superior to any amplifier we have published before the Playmaster Twin Twentyfive or Forty/Forty. In particular, it is much quieter, especially with regard to the phono preamplifier. There is no way, short of redesign, that the Playmaster 132 can match the latest design.

The Playmaster 132 can use the same Loudness control as used in the Playmaster Mosfet Stereo Amplifier.

SLIDE CROSSFADERS: May I suggest that you consider another photographic project namely, the programmable control of two slide projectors incorporating the fade-in fade-out system controlled from a tape recorder. The name "DIAMATIC" is now being used for this type of control. It appears the better commercial types (at a fearful price) use inaudible signals off the tape to control the projectors. Cheaper versions use one track of stereo recorder to control the projector and the other for commentary or music.

As one who gives slide lectures on occasions I think, if you favour such a project, you should aim for the unit to be capable of the following: continuously variable fade-in and fade-out, both full on, and multiple changing of one projector.

The digital enlarger timer is an outstanding success – we have made up a number of these in our camera club. (L.N.R., Mt Keira, NSW).

● Considering the number of letters we have had there is clearly interest in such a project and we hope to publish a suitable circuit fairly soon.

AUTOCHIME: I recently constructed the Autochime originally described in "Electronics Australia" in the September 79 issue. I also became aware of the circuit modification shown on page 125 of the March 80 issue of "Electronics Australia".

However, even when constructed incorporating the modification described in the March 80 edition, I found that more than one pulse (actually a negative-going transition) was occurring at the Vdd line (ie pin 4 of the microprocessor). This seemed rather an unexpected behaviour for transistor Q2, however there were also additional pulses occurring at each of the outputs R0 to R7 of the microprocessor, as indicated in the March 80 edition.

I used a frequency counter to determine that these additional pulses occurred at the time the front door button was pressed, and that the single pulse occurred as required at the end of the tune be-

ing played. I suspected contact bounce on the pushbutton, and fitted a 2μF capacitor to the two pins on the printed circuit board to which the front door button was connected.

Doing this eliminated the extra pulses from both the Vdd line and all outputs R0 to R7 of the microprocessor, and the unit now steps one tune at a time. The 2μF capacitor was simply one I had on hand; other values (lower) should be suitable (not electrolytic or tantalum though). I hope you find this information useful as there may be others who have found problems with the Autochime, even when modified to use the Vdd line. I suspect others have had this problem as one "Electronics Australia" reader sent in a decoder to indicate which tune was being played, something which would appear unnecessary if tunes are played sequentially.

And finally, although this may be a characteristic of the microprocessor supplied (MP0027 dedicated version of TMS 1000), there were some features which differed from those described in the original article. These are:

(1) All tunes play longer if the button is kept pressed.

(2) The unit does not run through the complete set of 24 tunes if the front door button is continually pressed.

(3) The order the tunes were played were different in places, the order being 1, 4, 2, 3, 5, 6, 7, 8, 9, 12, 10, 11, 13, 14, 15, 16, 17, 20, 19, 18, 21, 22, 23, 24, these numbers being the tune numbers in September 79 issue of Electronics Australia. (D.H., Hazelmere, WA).

● In the original version, the tunes did play longer if the button was held down. The changed order of tunes would probably be due to a changed program in the internal ROM. Thank you for your comments. We are sure that other readers will find them helpful.

MULTIBAND SUPERHET File No. 2/SW/77: Could you please tell me who sells the 2N5458 transistor. Also, I have an IC that is labelled LN380 and not LM380. Is this a manufacturer's error? There also appears to be something wrong with the diagram of the superhet receiver in the November 1980 issue. I have checked the set over and over again and cannot find out what is wrong. Could the diodes be drawn back to front in the diagram? (R.W., Orange, NSW.)

● The 2N5458 transistor is available from Dick Smith Electronics and also from Radio Despatch Service. You can order these components from both suppliers by mail order. Your second problem regarding the identification of an IC appears to be no more than a marking error. As far as the Superhet is concerned, there are, to the best of our knowledge, no errors in the circuit.

ELECTRONIC ROULETTE WHEEL: Could you please advise me on the electronic roulette wheel project which appeared in the February 1976 issue? Having built the unit completely, I find that it works OK with one exception. There are always two LEDs lit when the unit stops. The only part that differs from your parts list is the BD135 transistor. I have used a BD139 because the other was unavailable. All the voltages measured at different points in the circuit are correct. (R. de M., Coffs Harbour, NSW.)

● The problem you are experiencing could be due to a number of factors, but the one that seems most likely is a faulty transistor. The two outputs of the 7473 flipflop drive the two bus switching transistors. We suggest that you check these outputs to see that they are in fact changing state alternately. If they are, then check the two transistors.

THAT COVER PHOTO: I would like to know how the photo on the front cover of the March issue of EA was achieved. It appears to me that two shots were taken, one with studio lighting and one without, then somehow made into one. Please would you throw some light on the matter for me? (W.G., Williamtown).

● In regard to the cover photo, two exposures were taken on the one film. To obtain the TV screen, a time exposure of several seconds with studio blacked out was required, while studio flash was used to obtain the surrounding equipment and of course, Ron de Jong. To avoid reflections during the second "flash" ex-

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posure, the TV screen was covered with black felt.

We have to employ this procedure every time we require a photograph of an oscilloscope, computer with video display or an instrument with a LED digital readout.

DIGITAL ENGINE ANALYSER: I have built the Digital Engine Analyser (October 1980) and have found the display to be unstable. I have corrected the fault with the 0.1μF capacitor in the oscillator but this has made no difference. The readout varies on the 4-cylinder RPM scale by 70rpm – ie between 1500 and 1430rpm – and 2° (44-46°) on the 4-cylinder dwell scale. It also affects the other ranges to a lesser extent.

Could you please tell me which component/s would cause this problem? (K.M. Broadmeadows, Vic).

● The variation in the tacho readings is most likely due to actual changes in engine speed. These do not always show up on a conventional tachometer because of the long time constants involved in these circuits, but it will in a digital tacho. To satisfy yourself that the digital tacho is in fact quite stable just connect up the tacho to the calibration circuit shown on page 51 of the original article.

If the tacho is, however, unstable when connected to the calibration circuit we would assume that multiplexing "hash" from the 74C926 IC and the displays is breaking through. This might be cured by earthing the board to the chassis. Apart from this we can only suggest that you individually examine the clock signal from IC3 and the PLL output from IC9 for any spurious pulses.

PLAYMASTER AM/FM TUNER: With reference to the Playmaster AM/FM tuner with digital readout and clock in EA December 1979, to build this I purchased a Dick Smith K-3494 Kit and hope you will be interested to hear that reception of overseas medium-wave stations by this tuner at my address is more than surprising.

Particularly between 1510kHz and 1640kHz there are many stations that have been received including Radios Moscow, Netherlands, Peking, All India, Geneva and others not yet identified due to lack of station reference in English. At first I thought it was shortwave heterodynes I was receiving but when an American announcer said that the station was "The Voice of America from Washington in the medium-wave band" I was then convinced otherwise. At present, for instance, Radio Netherlands, Hillversun, Holland is received daily on approx 1580kHz and the strongest signal, up to 7 on on the signal meter, is between 5 and 6pm.

It is my intention to build the RF Preselector (EA April 1979) and incorporate the three aerial systems (EA February 1973) in the hope of increased station separation. The ferrite rod aerial is pointing approx NNE on the tuner. (A.S. Kangaroo Point, Qld.)

● Thank you for your letter and favourable comments on the Playmaster AM/FM Tuner.

4-DIGIT LCD CLOCK: I am building the 4-Digit LCD Clock on page 48 April, 1980. Near the top of the third column it is mentioned that with a small modification to the PCB pattern, it can be made to get a 24-hour display.

Could you please tell me how it can be done? I want it to run on GMT (24-hour time). It may be possible to switch it to read local or GMT. I am not constructing the timer section. What is meant when they say "DUAL TIME" function? (H.H. Scarness, Q.)

● As advised in the "Letters to the Editor" page in the June 1980 issue, the clock modules now being supplied by Dick Smith Electronics will not work in the 24-hour mode.

A clock or watch with "dual time" function requires two separate clock counters which can be selected for display.

CASIOTONE M-10: Enclosed is a copy of my technical bulletin on how to greatly expand the capabilities of the Casiotone M-10 keyboard. Perhaps you would like to arrange the availability of this bulletin in your magazine. I am distributing the information on a non-profit basis because the modified M-10 is such a lovely instrument.

The M-10 which is distributed by Australis Instruments, and costs $189, is a portable, battery operated, digital, polyphonic keyboard musical instrument which has four voices and vibrato. When modified it has 25 voices, two octave-drop switches, hold, sustain, a milder vibrato and is tunable.

The cost of the modifications is about $15.00 and it takes about eight hours to do. If your readers send me $1.50 to cover printing and postage I will mail them a copy. If you want any more copies use your photo copier. Above all get hold of an M-10 and modify it, you won't believe that such big beautiful sounds are coming from such a small instrument. (Robin Whittle, 42 Yeneda Street, North Balwyn, Victoria 3014).

● Thank you for your letter and enclosed bulletin on the Casiotone M-10.

IGNITION PRIMARY CIRCUIT: I want to build a device shown in EA, April 1981 on page 80: "Simulation of Ignition Primary Circuit Pulses".

Please tell me of what value in mH or μH is L1? Can L1 be bought and how to ask for it? If I should make it myself, please tell me how it can be done? The Editor advised use of another transistor instead of 2N 1711. What number of transistor would be better to use? (G.M., Broadmeadows, Vic).

● While no value was stated for L1, the winding details were shown on the circuit. A suitable transistor, with a collector rating of 300V, is the MJE340.

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Notes & Errata

INFRARED LIGHT BEAM RELAY (April, 1981, 2/LR/7): There is an error in the overlay diagram of the transmitter involving the two CQY89A infrared transmitting diodes. The designations "A" and "K" are correct, but the "flat" shown on one side of each of the LED packages is reversed.

SOUND LEVEL METER (May, 1981 File No. 7/M/59): The CA3140 op amps used in our prototype were the 8 pin DIL "E" package versions not the "T" package as mentioned in the text and parts list. Either type is suitable.

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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
3300 ohm, 10W	25c
6800 ohm, 10W	25c
1500 ohm DUAL, 21W	50c
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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
1A, 10 for	$1

SPECIAL TRANSISTORS

AD 161-162	$2.50 pr
BSC 901A	$1.50 ea
BC 548	10 for $1
AD 149	$3 pr
OC9554	50c
BD202N	50c
BD135	50c
2NC055	$1

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
100MFD, 350V chassis mount	$1

- Telescopic aerials, $1.50
- 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

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.

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
½ 1 meg dual Concentric tapped at 100K	$1
2 meg ganged double pole switch	$1
1.5 meg dual ganged	50c
2 meg ganged log	$1
1 meg dual ganged	$1
½ meg dual ganged LIN	75c
25K 50K dual ganged Concentric double switch	$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K lin ganged pots	75c

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 $1.50
24V	10 for $1.00
Pilot light holders	$1.50

- 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

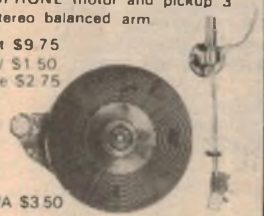
DIODES

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
Diodes BYX 55, 300	30c
BY 188	30c
DIODES BAV20 10 for $1	
Valve sockets 7 pin	10c
Valve sockets 9 pin	10c
OCTAL	10c
09478	5 for $1.00
BZX79	5 for $1.00

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

COLOUR 26" TV BOARD

TO SUIT PHILIPS, PYE, KRIESLER

$40

FRONT END COMPLETE PUSH BUTTON TUNER SECTION
TO SUIT PHILIPS, PYE, KRIESLER ETC, **$25**

PICK UP ARMS

Mono	$3.50
Inc Ceramic Cartridge & Stylus	
TRIMPOTS	
200 ohm	10c
5K	10c
100K	10c
47K	10c
10K	10c
470 ohm	10c

Miniature speaker and drive output transformers ..... $1 pr

Special mixed tag strips ..... 10 for $1

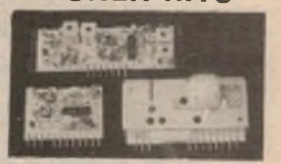
SPEAKER SYSTEMS

Inc one 6 x 4 speaker. 5W RMS $4.75 ea. P&P: NSW $1.80, Interstate $2.80, WA $4 (For singles or pairs.)

SPEAKER SPECIALS

5 inch in 3 5 8 or 15ohms $3.50
15 ohm 4" — 2 for $2
6x9 15 ohm $5 each
5x7 15 ohm $4 each
8x4 15 ohm $4 each
6x4 15 ohm $3 each

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 $22
P&P $1.00

TRANSISTORS

2N3055	$1.20	AC187	50
SE1002	4 for $1	2NC3055	50
BF459	50	2SB407	$1.00
B544 DE6	50	BC549	5 for $1.00
C106 F1	50	25C154B	50
TIP 110	50	OC968	5 for $1.00
608EK	4 for $1	608EK	5 for $1.00
BCS548	10 for $1	DS113AG	75
2SB186	50	BD236	50
2SA101	50	BD139	50
BD263	50	BD135	50
BSB405	50	25A240	75
2SB77	50	BF469	50
2SB303	50	BD235	50

VU & BALANCE METERS

STEREO VU **$3.00**

12Kn 100uA **$2.00**

TV TUNERS

$2.50 + P+P

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RCS Radio Pty Ltd,
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Bexley, NSW 2207.

Radio Despatch Service,
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Sydney, NSW 2000.

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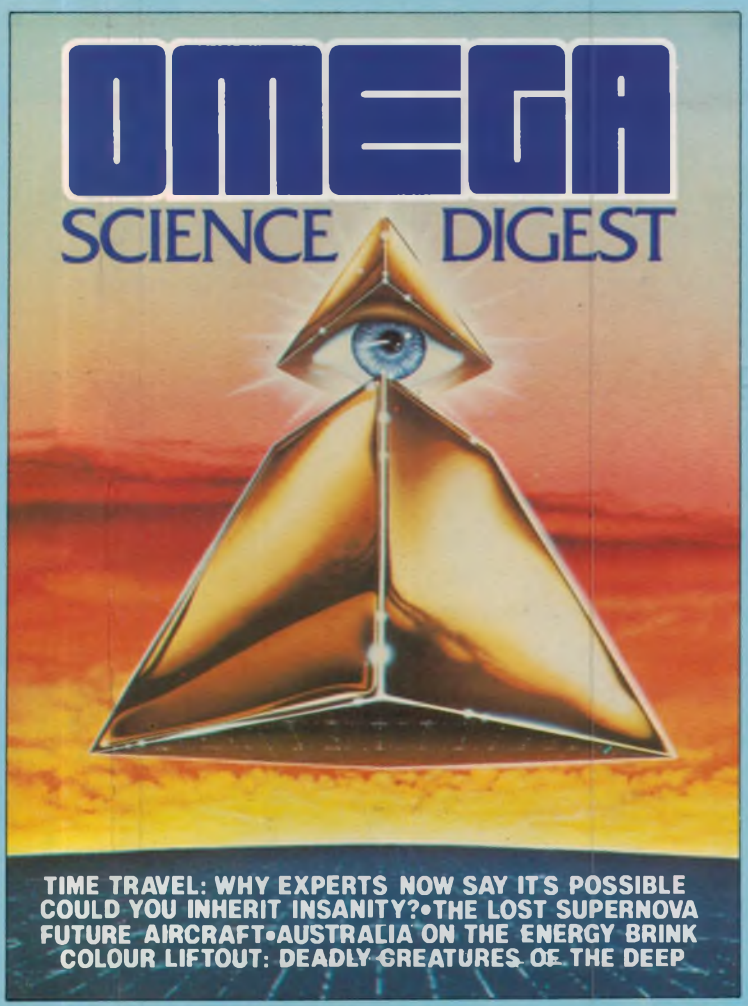

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UNTIL WE DEVELOPED THE STEREO GROOVE, HI-FI WAS PRETTY HO-HUM!

The world of hi-fi owes a lot to the original and continuing innovation of JVC. Few companies, if any, have done as much to help turn records and record-players into the virtual musical instruments they are today . . . or to lead the way in developing so many *firsts* in the more recent concepts of sound amplifiers, cassette decks and computer-designed speaker systems. Hi-fi, as we know it today, had its beginnings in 1956, with JVC's development of the 45°/45° groove for stereo records. The fact that this system still remains as the world standard is, in itself, outstanding testimony to the technology of JVC. The development revolutionised not only the record-*making* industry, in which we've been involved since 1930; it also paved the way for enormous advancement in the design and engineering of record-playing equipment. Now, hi-fi has expanded to

R-S77. Super-A FM/AM Stereo receiver

embrace a wealth of highly-sophisticated electronic equipment; and it's not surprising that JVC has continued to play a leading role in so much of its development.

HR-3660 EA. VHS Colour Video Cassette recorder

THAT WASN'T OUR ONLY FIRST, EITHER.

We also pioneered Japan's television industry, introducing their first TV receiver just over 40 years ago. A more recent innovation is VHS, the home video recording system now gaining world-wide acceptance as *the* system for such equipment. In the course of staying ahead, we've introduced a number of world *firsts* of radical importance: the Quartz Lock turntable is one of them.

THE QUARTZ LOCK TURNTABLE. MANY TIMES MORE ACCURATE.

It stands to reason that if your equipment is at the top end of the range, then your turntable must be capable of comparable performance. Only Quartz Lock ensures this, tying the speed of the turntable to the unvarying pulse of the atom, and providing a level of accuracy far in excess of conventional turntables.

MORE MILESTONES IN HI-FI.

To match the superb quality of Quartz Lock, we produced the S.E.A. graphic equalizer system. Then we refined it to such a degree it even compensates for the effect your furniture has on sound when it leaves the speakers! To expand the capabilities of tape, we designed ANRS and

SEA-80. Stereo Graphic Equalizer

Super ANRS — automatic noise reduction systems which not only reduce distortion and 'hiss' but actually extend the dynamic range of the tape. Similarly, with speakers: at JVC we employ computers in their design to help provide the ultimate in sound reproduction.

AND NOW, SUPER-A.

In its own way, as significant a hi-fi development as the stereo groove. Imagine an amplifier which combines the *best* features of the two recognised amplifier classes (A and B) . . . an amp which combines the *efficiency* of one with the *low distortion* of the other. Some engineers said it couldn't be done: but not those at JVC. Enter the Super-A amplifier . . . the *latest* JVC *first!*

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HAGEMEYER

JVC
the right choice

THE FUTURE.

It's already with us. For instance, we were so far ahead in the new metal tape technology that our cassette decks were metal-compatible before the tapes were generally available. And now there's the JVC Electro-Dynamic Servo Tonearm, damping tonearm resonance by means of a purely electronic system and two 'thinking' linear motors. Who was it who dubbed JVC, 'the innovators'?

1861