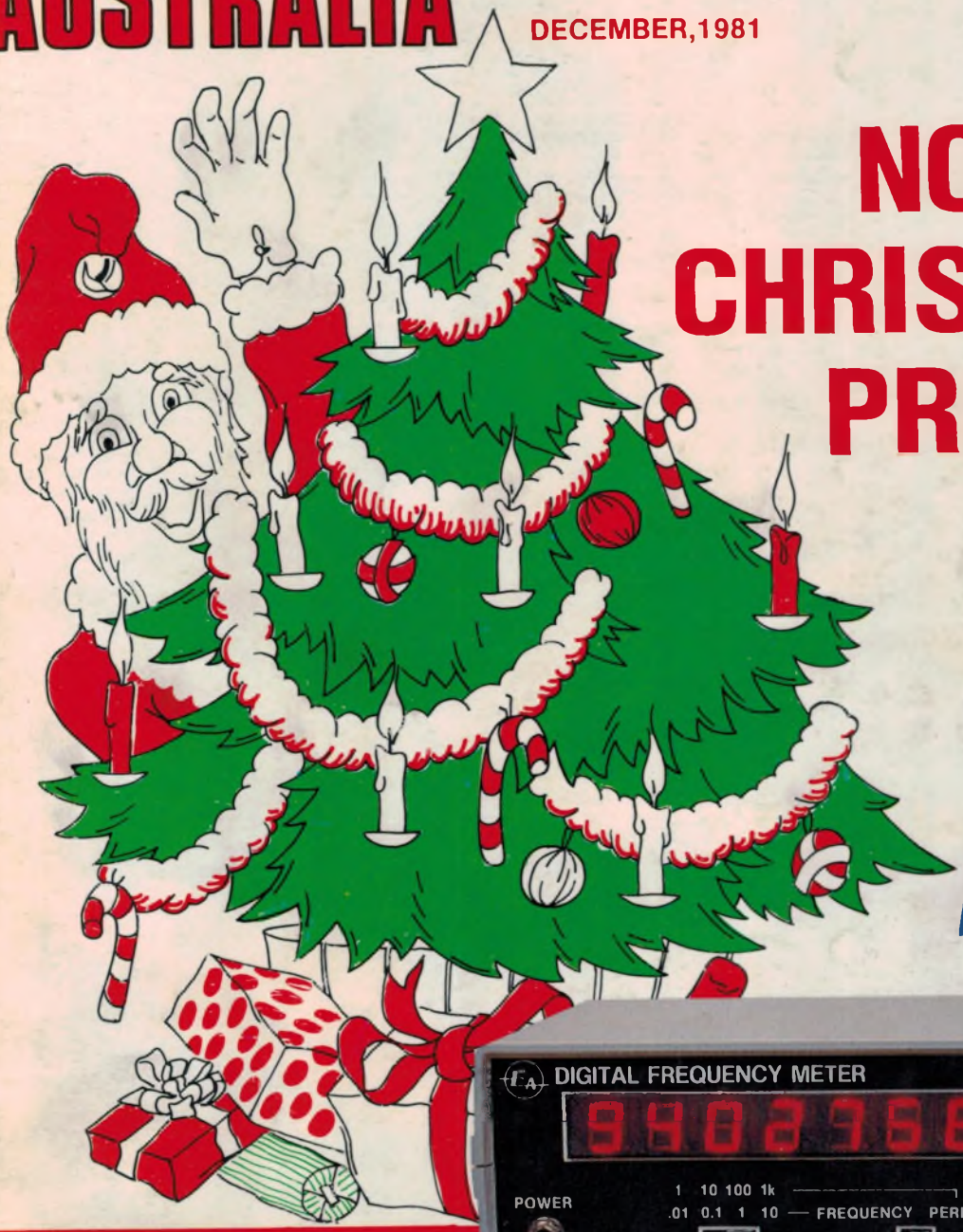
ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

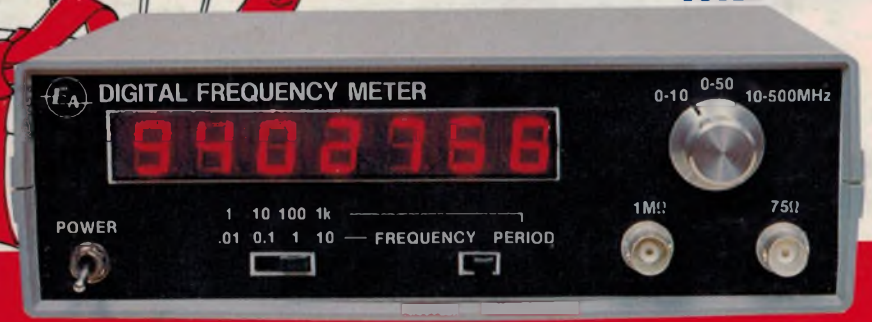
DECEMBER,1981

AUST $1.80* NZ $2.00



NOVELTY CHRISTMAS PROJECT

BUILD THIS 500MHz DIGITAL FREQUENCY METER



- AUSTRALIA: THE CASE FOR HIGH TECHNOLOGY
- LED BAR GRAPH DISPLAY
- HIFI REVIEW: MARANTZ STEREO RECEIVER

Enter the state of higher fidelity with the new Walkman 2 stereo player, the world's smallest Hi-Fi. It's a sensational way to listen to music on cassettes and raise your awareness of sound. Walkman is so light it practically feels weightless. So small it's hardly bigger than the plastic case that cassettes come in. And so personal, with headphones that weigh next to nothing, that HiFi has never been more intimate.
The new Sony Walkman. It can make your experience of sound infinitely wondrous.

The World's Smallest HiFi
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Walkman is a registered trade name of Sony

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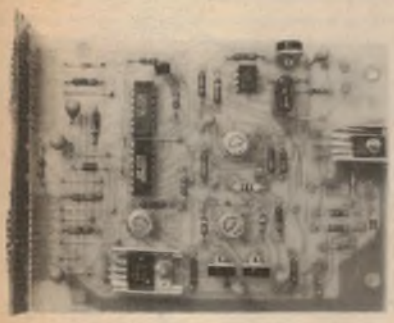
ELECTRONICS AUSTRALIA

Volume 43, No. 12
December, 1981

AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE



Add electronic metering to your hifi system with this new LED bar graph display. It displays both peak and average signal levels. Details p56.

Want a 500MHz digital frequency meter that's easy to build? This design features period measurement, switchable gating and a bright 7-digit display. Construction begins p44.

COMING NEXT MONTH! – Find out what's coming by turning to p86.

On the cover

We've captured the Christmas spirit this month, with a special project to celebrate. On p53 you'll find the cover artwork reproduced full-size and a novel LED flasher circuit so that you can produce your own unique Christmas decoration. (You can even make Santa's eyes flash on and off.) Inset shows our new 500MHz digital frequency meter (see above).

FEATURES

HIFI, VIDEO AND REVIEWS

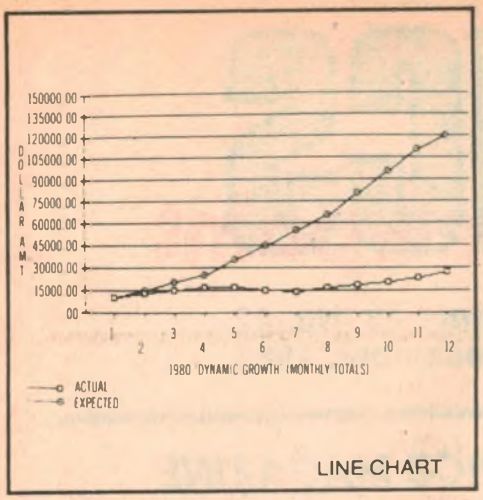
PROJECTS AND CIRCUITS

MICROCOMPUTERS

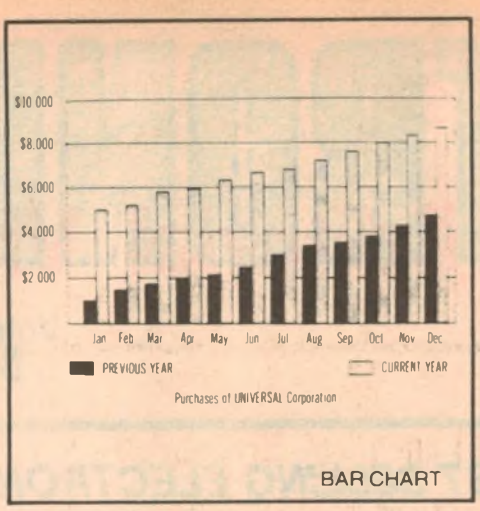
AMATEUR RADIO, CB SCENE, DX

COLUMNS

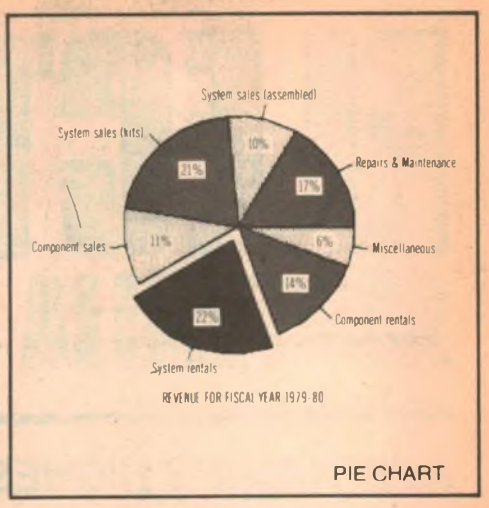
DEPARTMENTS



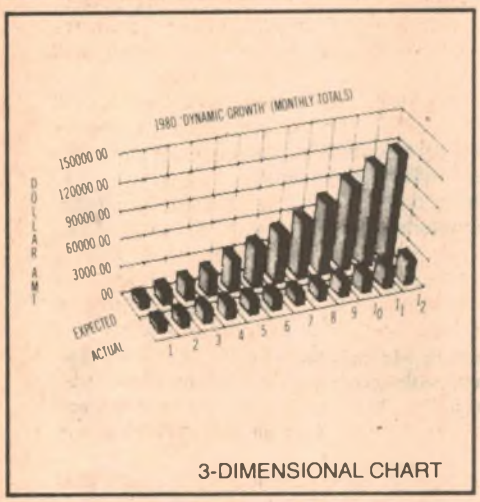
LINE CHART



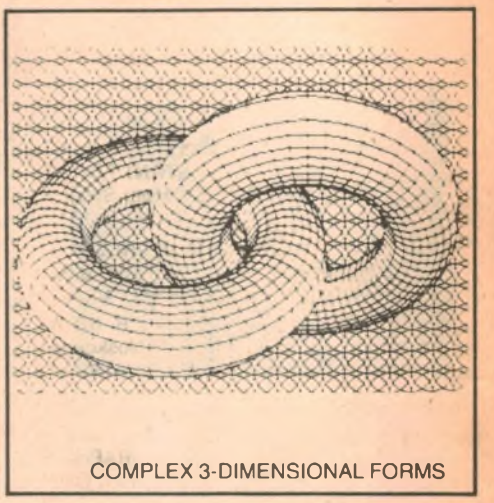
BAR CHART



PIE CHART



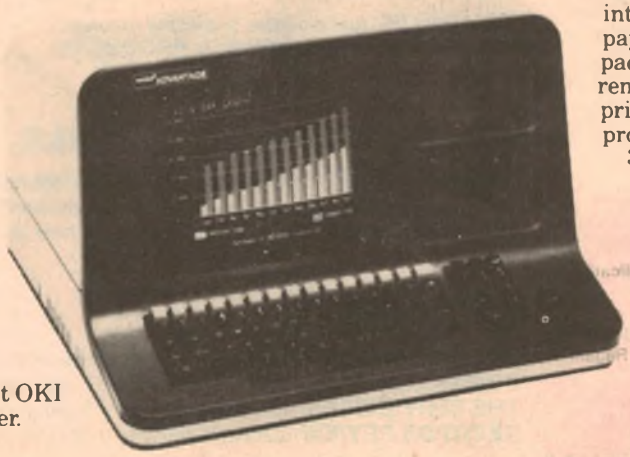
3-DIMENSIONAL CHART



COMPLEX 3-DIMENSIONAL FORMS

A business with all this at its fingertips must have an ®Advantage.

With the North Star Advantage, A.D.E. can now offer to the computer industry a significant small business computer breakthrough. For the first time there is available a high performance, fully integrated desktop computer capable of producing bar charts, pie charts, plotted graphics and three-dimensional visuals.
The Advantage's features include two integrated double-sides, double-density floppy disk drives, an 87 key Selectric® style keyboard which includes 15 programmable function keys, a 12-inch green graphics display, business graphics software and self-diagnostic capabilities. The A.D.E Advantage package is completed with the excellent OKI Microline 82A Serial Dot Matrix Printer.



The small business computer user will be able to integrate graphics into everyday business without paying a premium. The Advantage package is available for a remarkable $5,595. At that sort of price, and with the ability to produce everything from a 3-dimensional visual to a pie chart, the Advantage will give businessmen a chance to grab a bigger slice of the profit pie. Talk to your A.D.E. Representative now.

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Editorial Viewpoint

Hifi: Let's enjoy what we have!

It is often said that there is nothing like a good challenge to stir people into action. Truism or not, it would certainly seem to be the case with that part of the hifi industry which is concerned with conventional phono decks and records, cassettes and cassette players.

Over the years, there has been much complaint about the quality of sound available from commercial recordings, leading to a tacit assumption, not always justified, that there were no good recordings; simply that some were (or are) less objectionable than others!

This, in itself, has provided a challenge to record, cassette and hardware manufacturers. But, more recently, they have also had to face the prospect of video style technology and the possibility that it would sweep aside the entire analog approach, with its built-in problems of noise, distortion, dynamic range and frequency response. And while the audio industry had a stake in the future, it certainly had no desire to see current technology swept aside too summarily.

So it is not surprising to see the emergence of audiophile discs of one kind and another, using purist mic. techniques, dbx and other forms of encoding, direct cut, digital mastering, half-speed transfer, special vinyls and so on. Alongside them are compact cassettes using top grade tape and technology and all but matching the discs.

The improved software has been supported by hardware developments, such that there are any number of phono decks, phono cartridges and cassette players in homes and hifi shops which, a few years ago, would have been a price/performance sensation.

There is still plenty of run-of-the-mill software and hardware around, of course, but that will always be the case, irrespective of the technology. The point I am trying to make is that the present generation of audiophile equipment has underscored the considerable resilience of the established domestic analog system and turned critical emphasis back to the two ends of the chain – the recording situation and the listening environment.

So, while we watch with interest the emergence of all-digital technology, we do so without any great impatience, and no urgent need to consign what we have to the junk heap. As I've remarked elsewhere, present-day audiophile recordings and playback equipment have the capacity to provide excellent sound with all the dynamics that one can use in the normal home.

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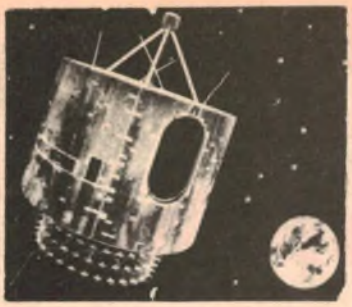


News Highlights

Confidential letter throws new light on Telecom's videotex proposal

The row over the Government's scrapping of Telecom's proposed national videotex service took another twist recently with the Opposition's release of a confidential letter to the Government from acting Telecom chairman, Mr T. E. May.

by Deborah Snow
Australian Financial Review

The letter, written in January this year to Communications Minister Mr Ian Sinclair, is a detailed analysis of the issues behind the Telecom proposal. It strongly advocates that Telecom be allowed to introduce the British-developed Prestel system to start up a national videotex service.

Mr May told Mr Sinclair that rival videotex systems – such as the Telidon system favoured by Myer Emporium – were "all at a similar stage of development to that of the UK Prestel system in 1975". He stressed that the business community in Australia wanted to move rapidly into videotex and that the delays involved in gearing up for any system other than Prestel would mean delayed profit and service opportunities.

"Prestel terminals will always be less expensive than Telidon terminals, and for the next few years are likely to be between one-half and one-third the price."

In deference to the Government's wish for maximum private enterprise involvement in the service, Mr May said that Telecom had decided to:

- Bar itself from the role of umbrella information provider, restricting itself to providing service-type information;
- Leave the responsibility for supply of screens (on which data from a central computer is called up) to private firms;
- Stay out of the terminal maintenance market;
- Encourage private in-house viewdata systems which would be compatible with Prestel;
- Buy enhanced Prestel software, developed in Germany, which would allow access through Prestel to private third-party computer data-bases.

"Adoption of these policies means that over 80% of employment and earnings from the videotex industry will be outside Telecom", Mr May wrote. He said information providers stood to earn around $5 million in the first full year, with set suppliers pulling in around $3 million.

Viewdata systems store information in a central computer which can be accessed over the telephone lines.

Telecom's participation in videotex was essential if the role of information provider was to be split from that of providing the means for disseminating information.

"It would not be acceptable to other publishers if one of their rivals owned and organised the service. With a projected forecast of 100-200 major publishing organisations on videotex in the first year, it is difficult to see how an acceptable consortium could be organised."

Mr May also argued that Telecom's proposed videotex service could be supplied nationally at a uniform price. It was doubtful, he said if private organisations would be willing to implement the cross-subsidisation from metropolitan to country areas that this would require.

LEDs get the blues

Sanyo Japan has reported the successful development of a light emitting diode (LED) that emits blue light. Previous attempts to manufacture a blue LED have been thwarted by the need for large crystals of silicon carbide, which are very difficult to produce.

Sanyo overcame this problem by growing crystals in layers, building up to the desired size. In the form of a diode, the resulting crystal emits clear blue light when supplied with a voltage of 3.5V at 20mA.

Red and green LEDs are, of course, already available. The addition of the blue LED may make a solid-state flat screen colour TV feasible, but Sanyo has so far only hinted at such a possibility.

Got a yen to convert?

Want to convert yen to lira? Australian travellers will appreciate the new "TravelChek" Auto Currency Converter, which uses a microcomputer chip to perform instant conversions from one currency to another.

All the user has to do is to key in a particular exchange rate, whether it is Australian dollars to French francs, Italian lira or Japanese yen or the other way around. The calculator will do conversions between any two currencies, and the exchange rate will be held in memory until a new rate is programmed, even if the calculator is turned off.

"TravelChek" is about the size of an ordinary credit card, and can be used as a conventional arithmetic calculator as well as for currency conversions.

"Paper-thin" battery

Matsushita Battery Industrial Co. Ltd, a subsidiary of Matsushita Electric, recently announced that it has developed a sheet type lithium battery with a high energy density but which is only 1.3mm thick.

The new thin battery uses lithium in its negative electrode and carbon monofluoride as the positive electrode. Nominal voltage is 3V, twice that of ordinary dry cells. Energy density is said to be as much as ten times higher than normal manganese batteries.

Three sizes of the battery are being manufactured – 20mm x 70mm, 43mm x 70mm and 75mm x 94mm. All are 1.3mm thick.

Solar energy: University signs export agreement for new process

An agreement was recently signed by the University of Sydney to permit a Japanese engineering company to produce solar energy collectors using a new "selective surface" process developed by the University. Announcing the agreement, Professor Harry Messel, Head of the School of Physics, and Director of the Science Foundation for Physics, said the Tokyo-based Nitto Kohki Co. Ltd was already well advanced on the construction of a "batch coater" – a machine which will be able to coat at least 1000 glass tubes a day with the selective surface.

"They are building a second generation coater, closely following a design suggested by Dr Geoff Harding, who developed the prototype which has been operating here for the past three years", said Professor Messel. "In the meantime we have sent them more than 500 coated tubes for assembly into finished collectors. They expect to go on the market next year, initially selling collectors for solar domestic hot water systems and solar-powered air conditioners".

Basis of the new collectors is the University's selective surface, which consists of two thin films applied on top of each other using an electrical charge in a low pressure gas. A copper film is first deposited in pure argon, then a graded metal-carbon film is deposited in argon mixed with hydrocarbon gas. The resulting coating is highly absorbent in the visible region of the electromagnetic spectrum and radiates very little energy in the infrared, so the absorbed energy is retained as heat. Nitto will pay a royalty on sales of the new collectors.

Demonstrating the effectiveness of the new coating, Dr David McKenzie (left) Professor Geoff Harding and Professor Dick Collins.

Are light bulbs what they used to be?

A lot of people are commenting on the apparently shorter life of light bulbs lately. The assumption is, of course, that "they just don't make them like they used to".

This may not be so, in fact! One major cause of premature failure may be mains voltage which rises above the 240V standard, a situation which is occuring more and more often.

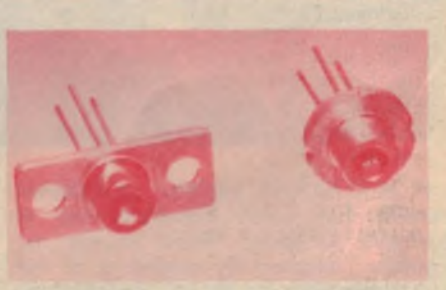
In an interview with Pacific Computer Weekly, Mr Colin Chambers, a power-supply consultant for the computer industry, spoke of the effects of power line fluctuations on data processing equipment. He said that over the past four years, the average voltage in the Sydney area had climbed to 248V, and that peak readings of 250V had been recorded. On the Queensland central coast the power grid sometimes showed readings as high as 258V.

Laser diode to reduce video disc costs

Hitachi Ltd has produced a laser diode which emits light in the visible portion of the spectrum and is suitable for use in optical disc players.

Current optical video disk players use a bulky and expensive helium-neon gas laser tube to read the disk surface, and power supply and mounting arrangements for this laser add considerably to the complexity of the players. The availability of a short wavelength (780 nanometers) semiconductor laser would allow the size of the pick-up head in laser disk players to be reduced, and as well as improving the signal-to-noise ratio of the pick-up.

In the past, short wavelength laser diodes have been unreliable, but Hitachi engineers claim to have overcome this problem with an improved chip structure and fabrication process. The HL7801



diode has an expected service life of at least 100,000 hours (at room temperature). Maximum power output is 5mW, and the diodes incorporate a monitor photodiode for coupling to an automatic power control circuit for ease of use in video disk applications.

Hitachi is currently supplying the diode in sample quantities for evaluation by equipment manufacturers. Cost of samples is Y40,000 (about $A154), but this can be expected to come down as mass production gets under way.

Caught on camera at 68km/h. Time and location are also shown.

Police radar has camera too!

A preview of the "Multanova 5F Police Radar" system was held recently by Zellweger Uster Pty Ltd, the Australian subsidiary of the Swiss manufacturer. The system is currently in use in some 40 countries, and Zellweger Uster claim it is "infallible", even in dense urban traffic.

Main feature of the system is its ability to take a photograph of the "clocked" vehicle, together with its speed, location and the time of day.

Operating frequency is in the X band (around 10cm wavelength) and beamwidth is 6° – much the same as competing systems. However, according to Managing Director Mr Fred Backer, Multanova is more accurate because the beam is angled at 22° to the traffic flow, with measurements being made when the offending vehicle is only 30 to 40 metres away.

Vehicle radar detectors may not be much protection against the Multanova radar system, as the detectors pick up the new radar at about the same time the speed reading is being taken.

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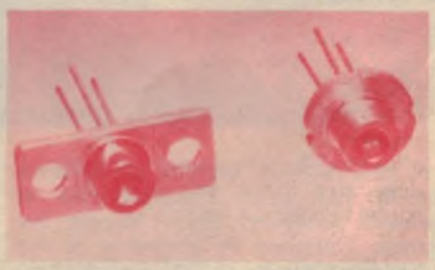

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NEWS HIGHLIGHTS

Surveillance system for Sydney's airport

A new $18000 security surveillance system has been commissioned at Sydney's Kingsford Smith Airport for Qantas. Designed by engineers at the Electronics Division of GEC Australia Ltd, the system will be used to monitor all activities around aircraft using the airport's international terminal.

Three Newvicon National cameras are sited on the roof of the main International Terminal building and another two on the roof of the passenger departure lounges. One of the bank of three cameras is capable of panning and tilting with Auto Iris zoom lenses. Both cameras above the departure lounges can also be panned and tilted.

The cameras are linked to five National monitors installed in the security control area. Qantas ground controllers use the cameras to maintain visual contact with arriving and departing aircraft as well as for monitoring the security of stationary aircraft.

Installation of the security cameras was the second major contract for GEC Electronics from Qantas. GEC engineers earlier installed the internal security system which monitors airport ticketing counters at the Terminal.

CSIRO to fight fires with aircraft

Bushfire fighters may have a new weapon in their armoury for fighting fires during Australia's long, hot summers as a result of a three year study begun recently by the CSIRO.

This summer the CSIRO will begin an evaluation of the use of aircraft for fire fighting – a new project announced recently by the Minister for Science and Technology, Mr David Thomson.

Code-named Project Aquarius, the evaluation will be carried out over three summers at a cost of $3 million. It will begin this month with calibration of airborne instruments over fires in the Australian Capital Territory. An infrared scanner has been installed in the CSIRO's Fokker F27 aircraft, which will become a flying observation post for the project. A mobile ground laboratory is also being fitted out for testing ground-based instruments.

In the summer of 1982/83 it is planned to study twenty high intensity fires in Western Australia. What is needed is a clear picture of the way bushfires behave in relation to weather conditions and the amount of fuel available.

The following summer – 1983/84 – plans call for testing fire suppression runs with airborne tankers. The results of the various suppression methods will be compared with the fire behaviour models and with ground based fire fighting methods.

Mr Thomson said that the results of the project should contribute to the evaluation of the effectiveness of bombing fires of varying intensities with both water and fire retardant chemicals, the effectiveness of conventional fire fighting techniques under similar conditions and the costs and benefits of bushfire control.

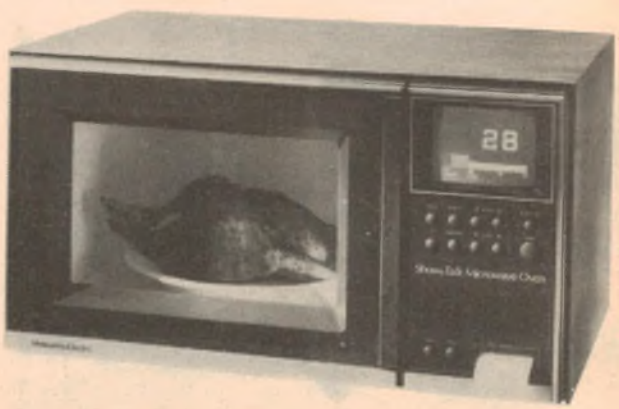
Chicago Electronics Show: the oven says "dinner's ready"

An oven which tells you when the dinner is cooked and a video display for selecting new hairstyles are just two of the new ideas from Japanese firm Matsushita.

At the Chicago Electronics Show earlier this year Matsushita had an exhibition entitled "Matsushita Technology Today", with more than 200 items on display. One new product is a microwave oven which is controlled by voice and makes announcements with an electronic speech synthesiser. Built in to the oven is a 15cm colour TV screen for displaying menus and cooking instructions.

Also on display was a new hearing aid which sends sound waves direct to the inner ear, bypassing damaged or impaired eardrums. The bone conduction hearing aid is completely contained in the frame of a pair of glasses holding the pick-up microphone, amplifier, battery and vibrator mechanism which is in contact with the bone behind the ear.

Matsushita also displayed a "Stylesetter" television set, which is already installed in many Japanese beauty parlours. It takes a video picture of the customer, freezes the image on a TV monitor and then superimposes various hair styles, glasses and other cosmetic changes over the still image.



"Show and Talk" microwave oven displays menus and instructions on a 15cm colour video monitor, prints a list of ingredients, responds to verbal instructions and announces dinner!

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Gold Coast Amateur's Paradise 32 2644
Townsville: Robco Equipment 72 2633

Victoria
Melbourne Eastern Communications 288 3107
Moe: Codlin Communications 27 4516
Hamilton: Hamilton Electronics 72 3333
Ballarat: Wecam 39 2808

South Australia
Adelaide: Compucom 43 7981
I.C.S. 47 3688
Mt. Gambier Set Services 25 2228

Western Australia
Perth: Willis Electronics 21 7609
Netronics 46 3232
Kalgoorlie: Hocks TV 21 1906

Tasmania
Launceston: Gelston 44 3882
Advanced Electronics 31 7075
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Burnie: VK Electronics 31 1708

VICOM

Model M100

The 10 channel, no-crystal scanner!

FEATURES:
- No crystals required
- 10 Channels
- 6 Bands
- All frequency search
- Priority
- 10 programmable R.A.M. Channels
- Search Hold to stay with important frequencies
- Search and scan delay
- Manual, Search or Scan Control
- Custom frequency-synthesized circuitry
- AC supply and DC cord supplied
- Detachable, swivel telescope antenna supplied
- Attractive, durable case
- Top-mounted speaker
- Regency quality and reliability

$399

Model H604

The hand-held scanner gives you the action wherever you go.

FEATURES:
- 6 Channels - so you'll hear all the action
- 4 Bands - LoVHF, HiVHF, UHF, UHF-T
- Advanced circuitry - combines small size with great performance
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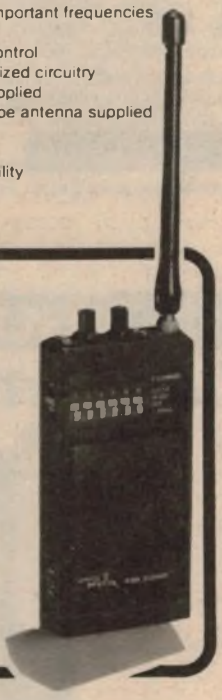

$169

price does not include crystals

Model M400

Hear all the action on 30 channels covering over 15,000 frequencies.

FEATURES:
- No crystals required
- 30 Channels
- 6 Bands
- All frequency search
- Priority
- Digital readout quartz clock
- 30 programmable Channels
- Search Hold to stay with important frequencies
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- Manual Search or Scan Control
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- Top-mounted speaker
- Regency quality and reliability

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As featured in Electronics Australia Projects June and July 1981.

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The Official Line

— from the Department of Communications

Australian outback TV system nears completion

The Remote Area Television project (RATV) is now well past the halfway stage. Once it is completed the service is expected to benefit between 50,000 and 100,000 outback Australians who at present cannot receive television in their homes or who have only marginal reception. The project may well be unique in its application of an international satellite for domestic purposes.

A departmental study made in 1980 revealed that of an estimated Australian population of almost 15 million, 300,000 were denied both television and a reliable radio service. RATV will make a dent in this figure although in many cases it will not mean new viewers as such but an improvement in the reliability of the service they already receive or the quality of the picture.

The department estimates that at present around 98% of the Australian population are able to view National (ABC) television while about 95% have access to commercial television. AUSSAT (the name given to the proposed national communications satellite system, scheduled to come into operation in 1985) will give all Australians access to television services, and also provide a better radio service in remote regions of the country. Improved reception should be possible for those people who at present have unreliable, poor quality reception.

Under RATV it is intended to bring ABC television to 77 remote communities by the end of 1982. The program began with the opening of the Surat translator station north-west of Toowoomba on July 28 1980 and by September 30 1981 47 stations were in operation. With only 30 still to be installed RATV is well on target. In 1977 the government approved expenditure of $8.8 million on the program, but since then the estimate of cost has declined slightly to $8.2 million.

Three separate means are being used to provide programs to the RATV stations:

- By relay via the Intelsat IV Pacific satellite (52 stations). Stations in Western Australia transmit programs originating in the Perth ABC studios while stations elsewhere transmit programs originating from the ABC's Sydney studios.
- From terrestrial microwave links (15 stations). These programs originate in the state in which the station is located although in the case of the Northern Territory programs originate either in Darwin or Townsville in Queensland.
- By receiving programs off-air from an existing nearby station (nine stations).

Originally 76 stations were on the RATV list, but Muttaburrah in central Queensland was added later although the type of service for it has yet to be decided.

In all except two cases – Dimbulah, inland from Cairns, and Eneabba on the west coast of Western Australia, which are in the UHF band – communities are served by low-powered television transmitting stations operating in the VHF band. At the satellite-fed stations a receive-only earth station provides the program for the transmitters.

Use of Intelsat IV did present engineering problems because although spare capacity was available on the satellite, it was not designed to operate with small earth stations. A study by several government departments and agencies produced a system using receiving antennas small enough to meet the need to keep costs to a reasonable level. To achieve this it was essential to use non-tracking antennas, which limits their maximum size and gain. By reduction of the orbital drift of Intelsat IV to 0.1 degree on both axes, antennas no more than 10 metres in diameter could be used.

A simple but flexible design was developed for the VHF transmitting antennas. This permitted up to four individual radiating elements to be mounted on the tower and oriented to optimise coverage of the communities serviced.

Engineers had to overcome high carrier noise levels and while the picture quality is not that of the usual broadcast standard, it is acceptable to most viewers.

Stations in the RATV network cost an average of $125,000, a figure which includes $30,000 for the satellite receiving facilities.

Each station has a range of between ten and fifteen kilometres, while the size of the communities they serve ranges from 100 in Birdsville (Qld) to 3000 in Exmouth (WA). The average population is 750.

Often Earth stations in the program are sited up to 500km from Telecom's nearest maintenance staff so an automatic alarm system for detecting and reporting equipment failures has been installed. When failures occur the equipment dials a preassigned telephone number. Assessment of the stations can be done at any time through remote interrogation of the alarm unit by telephone.

Possible difficulties with maintenance of air-conditioning from so far distant led to a decision not to install air-conditioning in the Earth stations. Instead the engineers have designed a thermally "transparent" shelter which maintains the internal temperature within a few degrees of the ambient or surrounding temperature. In areas of extreme temperature "peak-lopping" airconditioners have been installed in a few stations.

The remote area television program may be unique in that it is believed to be the first application of an international satellite working with a series of small earth stations located in remote communities. Other countries, notably Canada, use domestic satellites to distribute programs to transmission sites remote from the programs' originating points.

Introduction of Australia's national communications satellite system in 1985 will not mean that RATV will become obsolete. Receiving equipment on the Earth stations will be replaced so that programs can be received from AUSSAT. Use of AUSSAT will mean improved picture quality and reliability for the RATV sites, and offer new opportunities for direct-to-the-home satellite broadcasting.

R. B. Lansdown, Secretary
Department of Communications

The Department expresses its appreciation to "Engineers Australia" for permission to use extracts from an article concerning RATV which appeared in the issue for July 24 1981.

New staff at Anderson Digital Equipment

Anderson Digital Equipment recently announced the appointment of two new product managers to support the company's expansion of product lines and sales. Graeme Beggs has been appointed Products Manager for Systems and Graphics, while Alan Pine is the new Products Manager for Printers and Terminals.

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We need managers for the new stores we're opening right around Australia - and overseas. What better way to prepare for this than by training in a current Dick Smith Store. If you're between 18 and 30, have a hobby background in electronics and retail experience, give us a call. We'll probably place you in a store close to home (we have 25 stores - in most states).

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SERVICE TECHNICIANS:

Our North Ryde (NSW) service centre needs technical experts in all categories: audio, RF digital . . . the opportunities for promotion are very, very good for the right people (our current National Service Manager started 'on the bench' just a few years ago!) You'll be working in air-conditioned premises, with the latest in service aids. The pace is hectic - so we want people who don't need continual supervision.

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18Hz-200MHz RANGE

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	3 pin panel socket	P-1626	$4.20	$3.40
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ONLY $49.50
Q-1380

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CHECKS TRANSISTORS & MEASURES CAPACITANCE TOO!

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AND ONLY $74.50

TRANSISTOR CHECKER/MULTIMETER

This multimeter is similar to the Q-1140 above right, but there are a few differences: If you don't need to measure capacitors (for instance you might have an AC Bridge), you can save heaps. Otherwise, everything else is pretty much the same. A bargain at this price!

ONLY $59.00 Q-1136

PROTECT YOUR METER

This handy meter carry case keeps your leads & instructions tidy, also gives you room to store notes, circuits etc.

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WAS $17.50 2 YEARS AGO!!

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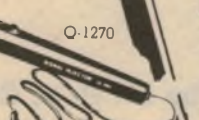
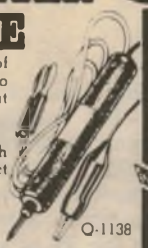


Q-1270

ONLY $6.75

MULTIMETER RF PROBE

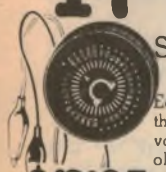
Extend the useful range of your multimeter way up into the RF region with this neat probe. Freq. response is 150kHz to 30MHz (ref. 500 kHz). Comes equipped with 4mm banana plugs for direct multimeter connection.



Q-1138

$17.95

RESISTANCE SUBSTITUTION WHEEL



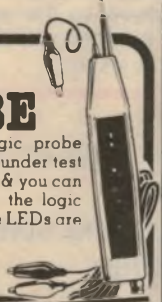
Easy to read value selection that enables you to select values from 5 ohms to 1M ohm in 36 steps using most common divisions. Complete with leads & clips.

Q-1410

$7.95

LOGIC PROBE

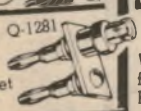
This outstsanding logic probe hooks onto the circuit under test for its power (5V DC), & you can tell at a glance what the logic level is by which of the LEDs are glowing.



$28.80 Q-1272

CRO-BNC ADAPTOR $9.90 Q-1281

Converts the 'banana' socket terminals to a BNC type.

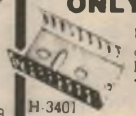


Value heatsinks

This TO-3 heatsink gives the greatest possible heat dissipation in the smallest possible space. Thermal rating of approx 5°C/W. 50mm square by 25mm high. **10 OR MORE $1.20ea.**

ONLY $1.35ea.

H-3400



H-3401

Universal hole pattern allows the mounting of almost all 'power' semiconductors. Has ribbed walls for max. efficiency. **10 OR MORE 90¢ea.**

ONLY $1.00ea.

H-3470

Flag mounting type with fins top & bottom. Available drilled or undrilled to accept two power transistors of most types. **10 OR MORE $3.20 EA.**

ONLY $3.75ea.

H-3422

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GREAT LED DEAL!

Z-4000

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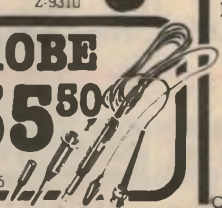
Z-9310

100MHz x1/x10 CRO PROBE

This incredibly versatile probe set, will suit virtually any CRO & give you all the features of a probe set you would pay $$$$ more for. Here's what you get: Basic probe with inbuilt x1/x10 switch, 1.5M of cable, complete with co-ax type BNC connector & wandering earth lead with aligator clip.



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Q-1245

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Q-1280

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LISMORE, NSW: Decro Electric, Magellan Street & Bruxner Hwy. Phone 214 137

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ORANGE NSW: M&W Electronics, 173 Summer Street. Phone 626 491

PENRITH, NSW: Acorn Electronics, Shop 12 541 High St (Phone not yet connected)

PT MACQUARIE NSW: Hall of Electronics, 113 Horton Street. Phone (not yet connected).

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A way out of the quarry

High technology

If Australia is not to become merely a quarry for the rest of the world we must develop our own high technology industries. A short-lived boom based on carefree exploitation of our mineral resources could leave most of us worse off than before. Manufacturing and advanced technology point the way to a future as an independent and prosperous nation. What sort of country do you want to live in?

by DR C. K. COOGAN
Chairman, Australian Scientific Industry Assoc.

Australia has reached a cross-roads in its progress. Are we to become a country which plays down manufacturing and derives its income mainly from rich resources in coal, minerals, agriculture and fisheries? Or are we to progress towards a more balanced economy with a healthy and diverse manufacturing industry?

We have recently seen the profits of mining firms dip alarmingly, and the leaders of the resources "boom" industries have been vocal in telling us how vulnerable the industry is. We are at the mercy of world markets in these commodities, and mineral prices tend to rise and fall together.

Even with good markets, the resources industries are capital intensive, employing relatively few people per $1 million invested. Unemployment continues to rise and must be dealt with in the long term, if only to avoid a huge social and political problem.

But the resources industry not only employs relatively few people per $1 million invested. Because the industry is capital intensive, much of the capital needed must come from overseas. Already, a large proportion of Australia's natural resources is in foreign hands, and that proportion is increasing.

So why not diversify and ensure that we supplement our resources potential with manufacturing? Of course, we already have a broadly based manufacturing industry but it has been very sluggish. In the past decade or so it has grown at less than 3% per annum, which seems commendable until one looks at the growth rates for exports from the OECD countries.

When compared with the OECD countries, we come out poorly for manufacturing industry as a whole. The Jackson Committee study of nine OECD countries in the decade to '72-3 found that of West Germany, Sweden, USA, UK, Italy, Norway, Japan, Canada and Australia, we came out worse than any excepting the UK (and we all now see its problems).

An Industries Assistance Commission study of the period 1971-77 showed that our manufacturing industry grew at a slower rate than our Gross Domestic Product, whereas for OECD countries, manufacturing industry grew at about the same rate as the GDP. And incidentally, the growth rate of our GDP in that period was nothing to write home about!

Labour productivity was also the lowest in Australia. (Productivity is of course complicated, as it is partly a product of worker and management efficiencies and partly of investment per worker). The Jackson Report showed that only one country, the USA, had a slower productivity growth, but the USA started with a handsome lead. In absolute terms, we attained levels of 25-50% of the USA output of "value added" per worker.

Table 1 shows the volume change in exports '72-77 for OECD countries. Australia's 2.7% per annum looks sick against all but Turkey's – 2.7% (itself the sick man of Europe), Sweden's 1.6% (starting from a high base) and Finland's 2.7%. Even New Zealand, with massive problems from the EEC's virtual rejection of its agricultural products, achieved 3% per annum.

Meanwhile, back in Australia, from 1968 to 1978 manufacturing industry slipped from 25% of the employed manpower to 19%, and its share of GDP from 28% to 22%. At the same time, manufacturing output grew at less than 3%, compared with the 5% or so in the 50's and 60's.

These various indices show that we have been slipping back rather than going forward. Our growth has been less than we ought to expect.

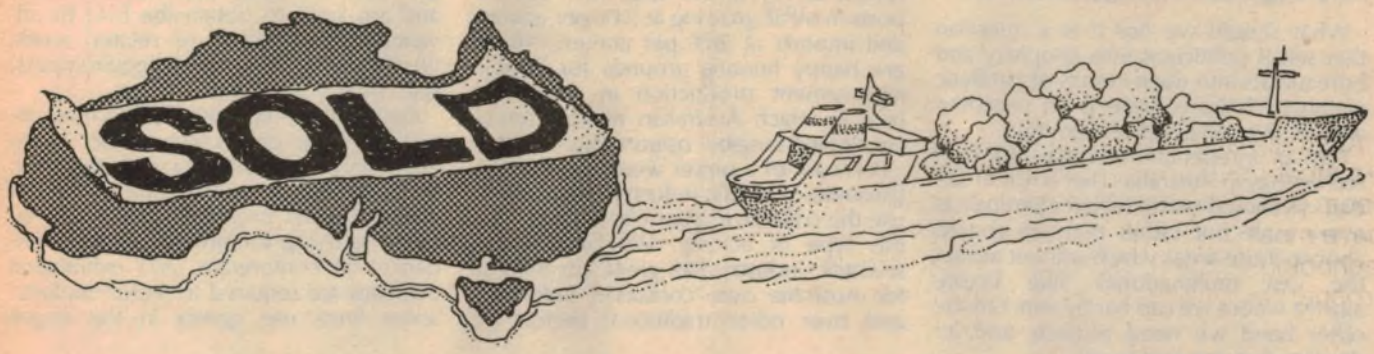
Just to put a little sour icing on this already bitter cake, our R & D effort (less than 1% of GDP) is deplorably small and would be equal to the square root of a legendary number were it not for the Government sector.

> To trade with the Glugs came the Ogs to Gosh,
> And they said in seductive tones,
> "We'll sell you pianers and pickles and spanners
> For seventeen shiploads of stones:
> Smooth 'uns or nobbly 'uns,
> Firm 'uns or wobbly 'uns,
> All that we ask is stones."
>
> *C. J. DENIS, "The Glugs of Gosh", 1917.*

When John Menadue, formerly Australian Ambassador to Japan, returned to Australia a couple of years ago he said that whereas Australia 50 years ago was a rich country surrounded by poor Asian countries, he would prophesy that we would soon become a poor country surrounded by rich Asian neighbours, unless we took stock and changed our style of industry.

What then are the difficulties of Australian manufacturing industry? Our biggest are most apparent. The "tyranny

and Australia



of distance" leads the field in terms of freight costs, time lags, information lags and marketing and servicing difficulties.

The second is the penalties of scale which we are usually forced to carry, as we do not have a large enough domestic market to support manufacturing at the most economic scale and in some cases (eg, the heavy chemicals industry) to support manufacturing at all. Thus we either have to forgo some manufactures, or think in terms of venturing to manufacture on world market scales (which may also be denied us due to freight charges or closed markets), which is more risky.

Many other traditional factors add to our disadvantages in manufacturing for export, the most significant again being capital for new enterprises or for revitalising old industries.

However, a new and potentially disastrous factor has come on to the scene in recent years. Much of our industry is so far behind technologically that it is in no position to take up new technology.

In the USA at the turn of this century there were companies making buggy whips. When they saw the new-fangled cars on the road they assured themselves that "this craze would pass". What did pass were the buggy whip companies! Unfortunately, Australia is rather richly endowed with buggy whip companies.

A bit sweeping? Several years ago Sir Ian McClennan, former head of BHP, resigned from the Chairmanship of the Defence Industry Capability Committee and made a public statement to the effect that Australia had never been in a worse position in regard to its ability to manufacture defence equipment. Sir Lawrence Hartnett, father of the Holden car and in charge of the manufacture of Defence ordnance in the '39-'45 war, later said we were now in a worse position than in 1939 – then we built our own planes, ships and tanks. About the same time it was announced that we would buy "Leopard" tanks from West Germany and that "offset" contracts to manufacture parts in Australia would be arranged. It was later announced that no contracts had been let as no Australian firms were capable of manufacturing any of the parts. Other members of the Defence Industry Capability Committee added their voices to support this dismal picture. For example, John Hooke, Chairman of AWA, told of the sorry state of the Australian electronics industry (about 39,000 employees in 1970/71 and down to 21,000 in 1980).

Report after report comes in bearing this type of news, but with buggy whip complacency our governmental leaders allow this to wash over them. After all, will the effects be felt in their Parliamentary term? They are too involved in internal wrangles and legal point-scoring that contribute little to our future needs.

Why? Well, one obvious reason is the miniscule knowledge or interest in science and technology in our parliaments (Peter Howson tried to form an all-party science committee in Canberra some years ago, and found only himself and Lord Casey as starters) – most members are trained as lawyers, accountants, graziers, teachers or union officials.

Can anything be done? Let me assure you that there is a lot we can do and that there are many signs of hope.

First we should look at the facts, squarely. The IAC and other groups have tried to do so, but their perspectives have been limited, either by their briefs, or by the lack of visionary and understandable input from high technology industry.

We are a moderately well educated community with perhaps a peak at the top end of academic and scientific achievement. We are remote from suppliers and market. We pay our labour force a moderate wage (but we are not high in the OECD tables for wages/hour). However, our worker productivity in industries that can reasonably be compared is fairly good. We have always been an inventive race, posibly due to our apprenticeship with fencing wire, the sine qua non of Australian ingenuity. Our inventions are used around the world (more later).

Volume Change in Exports '72-'77 in average % pa

Australia	2.7
Austria	6.0
Belgium	4.8
Canada	3.6
Denmark	3.5
Finland	2.7
France	6.3
West Germany	6.8
Greece	11.3
Ireland	8.9
Italy	6.3
Japan	9.8
Luxemberg	4.8
New Zealand	3.0
Netherlands	5.3
Norway	4.9
Spain	10.4
Sweden	1.6
Switzerland	5.1
Turkey	−2.7
UK	6.6
USA	6.4

TABLE 1

Against that, we have a yahoo image overseas to struggle against – even in China they are amazed to find that we have anything beyond wool, wheat (with weevils) and wombats. America views us as a military base and an energy and minerals source, a place where one might invest money but not go for a holiday – the figures prove it. Beyond that we are a country of limited capital resources, certainly not enough to pro-

gress as fast as we want to, and therefore we are forced to sell some of the farm to develop faster, and thereby mortgage our future.

The High-technology Answer

What should we do? It is a question that sends politicians into apoplexy and bureaucrats into deep comas of paralytic caution! I believe there is an excellent answer in specialised technology!

I am an unrepentant enthusiast for high technology in Australia. That is not to say that we should tackle high technology at every scale but rather that we should choose those areas which will not attract the vast multinationals like Exxon, against whom we can hardly win. On the other hand we need projects and industries that are non-trivial.

Choosing just a few examples in this area will illustrate what I mean: scientific instruments and professional equipment, biomedical instrumentation and apparatus, small scale computer gear, and computer software production. We already have an excellent track record in all these areas and all of them offer a peek into an exciting future.

In recent times Sandra Prerost, working for the CSIRO Planning and Evaluation Unit, has examined the economics of the measuring, professional and scientific equipment (MPSE) sector of Australian industry with very interesting results. Prerost's results show that over a significant period since about 1974, while Australian manufacturing industry as a whole has been declining, the MPSE sector has gone against the trend. Fig.1 shows the performance of both in terms of changes in employment.

Of course, we have seen similar things happening in other countries.

Should you fail to be impressed by Fig.1, then I invite you on a guided tour over Fig.2. This emphasises the difference between the growth rate of scientific industry and "traditional" manufacturing industry.

The 1981 "US Industrial Outlook" expects the total market in the instrument industry, measured at about $24 billion in 1980, to grow at an average rate of 14.3% in 1981 and to settle to an average rate of 8.3% per annum for 1981-85. Locally, whereas our production in 1969-70 was $27.1 million and the local market $89.4 million, by 1979-80 production had increased to $165.8 million and the market to $305.4 million. Most notably, exports increased from $5.4 million to $56.0 million in the same period – a ten fold increase!

Yet, for all that, high-technology imports, of which MPSE is a part, have now overtaken motor vehicles to occupy second place on our import accounts – only exceeded by petroleum products. Part of the story is no doubt our avid consumption of computers, and as top of the world league in this regard, the ratio of imports to exports for computer items is a whopping 13.6!

As the leading firm of economic consultants, W.D. Scott soberly remarks in a recent survey of the field, with our exports in MPSE growing at 24% per annum and imports at 20% per annum, "there are happy hunting grounds for import replacement production in a growth field in which Australian manufacturers are finding tangible opportunity".

For want of a better word, we in ASIA (Australia Scientific Industry Association) use the collective "scientific industry" for this type of activity. We believe the scientific industry has great advantages for Australia over consumer industries and over other traditional sectors of manufacturing industry.

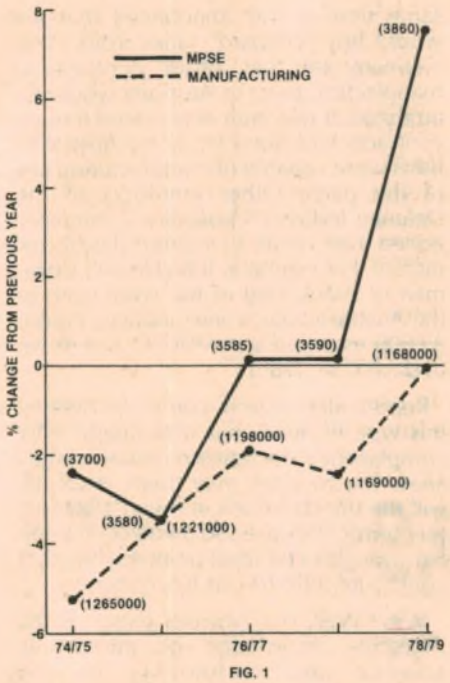


FIG. 1

What does the scientific industry have going for it in Australian terms?

● Not Capital Intensive. In general, scientific industry starts from small beginnings. It is not the type that requires a $100 million investment, like a micro chip factory (as valid as that is for Australia).

● Not Freight Intensive. The value/freight ratio is inevitably very high, so that in general air freight can be used routinely, which cuts the freight lag in delivery times.

● Not Cheap Labour Intensive: Most instruments and scientific industry products are not competing against items made or assembled in cheap labour countries. The products are ideas-intensive and sell on how well they perform their functions. As they are often critical "enablers" in other types of industry, price does not cut them out of the market if they perform well.

● Not Market Restrictive: Generally speaking, the world market is open to the manufacturer of scientific instruments. The users of such products are well educated and well informed, and are keen to obtain the best to advance their research or related work. Quality heads the list of requirements, not country of origin.

Against these advantages, there are inevitably some disadvantages too. These are mainly the disadvantages of distance.

● Marketing at a Distance: This has always caused problems, which the industry is trying to solve. Personal attendances at conferences and exhibitions overseas are required to foster markets. Some firms use agents in the target markets; others market from Australia.

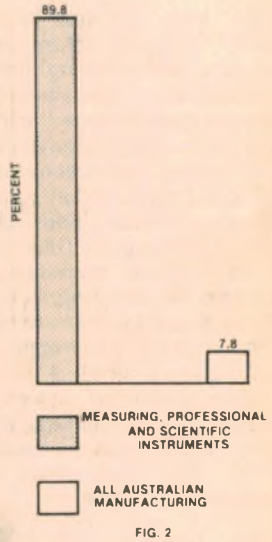


FIG. 2

Fig. 2 indicates growth rate of MPSE industries compared to other manufacturing.

● Servicing at a Distance: This too has been a chestnut for the industry. Often, it is cheaper to airfreight an item back than to send a man. Many firms concentrate on providing comprehensive user manuals. Some train agents abroad to do the job. However, it is a considerable disadvantage until the market grows to the extent of supporting a serviceman in the field in the market country.

● Information Gathering at a Distance: This is our ancient difficulty which applies to both technical matters and commercial matters. Modern information technology is rapidly diminishing the effects of our remoteness from the scientific centres of Europe and North America. Really this, and miscellaneous other disadvantages, are beginning to enter the "can't complain" category.

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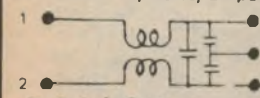

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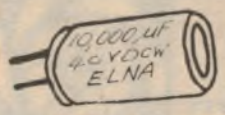

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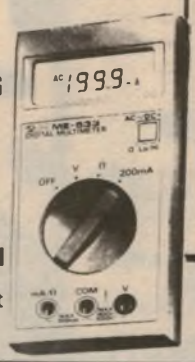

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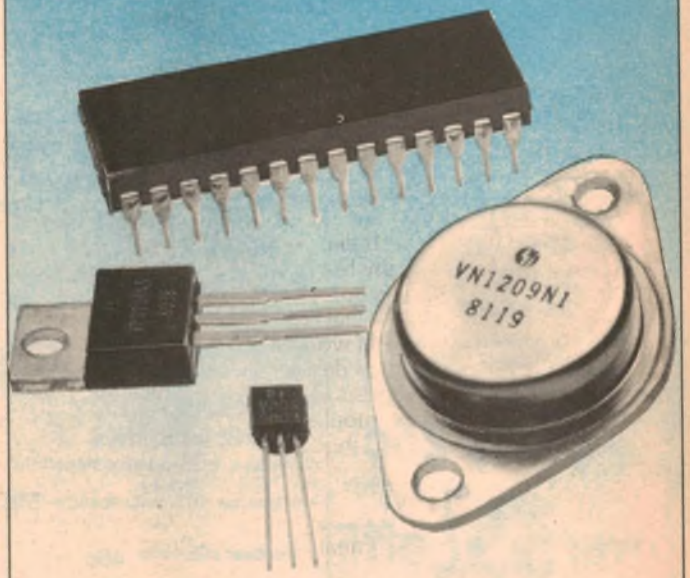

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At left is a view of part of the 9000 square metre facilities of Varian Techtron in Mulgrave, Victoria. The company designs and manufactures scientific instruments which are sold in 120 countries. Above is the Spectrum 11 minicomputer, also manufactured in Victoria by D. D. Webster Electronics. Software includes, among others, programs for farm and orchard management.

Let's look at some successful examples to illustrate our opportunities. We have always been an inventive country, a fact unknown to many Australians. Over the years Australians have invented a myriad of things ranging from the stump-jump plough, to ready-mixed concrete, rotary mowers, the sugar cane harvester, and atomic absorption spectroscopy, to name but a few.

Scientific instruments offer great opportunities. Already we have exploited some categories of these. Atomic absorption spectrometry is perhaps the best known. Invented in Australia in the 50's by Sir Alan Walsh in CSIRO, it is responsible for about half the chemical analyses in the world today. Not only did it give rise to the well known firm of Varian Techtron, which manufactures AA equipment and spectrophotometers in Melbourne, but also to a second generation of spectrometic gear eg. R & D Instruments' plasma excitation equipment, demountable high intensity metal emission sources and multiline emission spectra analysers; Scientific Glass Engineering's high intensity demountable hollow cathode lamps and temperature gradient emission sources for volatile elements; and GBC Scientific Equipment's new AA spectrophotometer.

Another area of excellence is in gas and liquid chromatography. The Flame Ionisation Detector was invented by Dewar and McWilliam in ICI ANZ in Melbourne in 1958 and revolutionised gas chromatography by increasing detector sensitivity by orders of magnitude. Maybe we did not benefit by exploiting that locally as much as we might have done, but nowadays SGE supplies a large fraction of the world's gas and liquid chromatography industry with the critical component, the columns, made on an OEM basis in Melbourne. ETP's (Electron Tube Products) Sydney-made backscattered electron detectors are widely used around the world and Geoex's Sirotem ground conductivity prospecting system (made in Adelaide) is used to search for minerals around the world. Examples could go on ad nauseum. The pipeline is also full of exciting new items, which have not yet emerged in the market.

And he gave it for his opinion, that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together.

JOHNATHAN SWIFT 1667-1745, "Gulliver's Travels": Voyage to Brobdingnag.

In the field of biomedical instrumentation and equipment a similar story can be told. Telectronics' heart pacers have a record second to none for life and reliability in an area where a cut corner or a faulty component costs a life. Alongside them, AWA has developed the high reliability microelectronics, which form the heart of the heart-pacer.

Ausonics' ultrasonic scanners used to scan anything from babies to cancer, is opening up a new field for Australia. Artificial ears and eyes, robotic limb substitutes with touch sense feedback, and computer-based treatments are all at one stage of development or another in Australia. Specialised surgical instruments, like Professor Gerard Crock's ingenious ophthalmic instruments, or Microfine's minute nylon monifilament prethreaded 2mm nerve microsurgery needles are shipped to all parts of the world. The potential is virtually untapped in the biomedical field notwithstanding our current activity in this field.

The computing equipment story is more difficult. There is little chance of making a significant impact on the market in mainframe computers. What we can do is to build the specialised equipment for peripherals and for minicomputers. D. D. Webster Electronics does just this. They have sold more than 250 Spectrum minicomputers which many associate with its farm control applications (earlier advertising showed 3 piglets flopping over the console), but it also is widely used as a "mark-sense" card reading computer using Monash University's excellent MONECS system to teach students in schools and universities to program.

Now MONECS is being considered for adoption in other countries. At least half a dozen other firms have similar excellent track records.

A leading micro-electronics expert returning recently after years abroad in the USA says he was astonished on returning to find how cost effective routine Australian programming was. This illustrates our software industry potential. As this is essentially a customised industry, multinationals have little advantage over our smaller scale industry, and in any case the sector does not offer attractions for large capital investment.

Microprocessor software is a variant of this theme and offers great scope for Australian firms with the expertise and ingenuity to tap this market world-wide.

Tariffs, Subsidies or Preference?

Maybe I have overly belaboured the fact that this type of industry suits Australia. What should Australia do to push scientific industry to the extent of our potential?

Immediately hoary old arguments – such as protection versus free trade; aid versus survival of the fittest; subsidy or R & D assistance; and Government loans or private enterprise funding – raise their heads.

● Tariffs are provided to protect new Australian industry against established imports; then the new Australian enterprise is given a chance to gain a foothold in the local market by the price advantage it should enjoy if at all efficient. But individual buyers of the equipment must pay the tariff (effectively) and this never produces sunshine and happiness. At best tariffs provide a good start for an Australian industry, at worst they create a lazy situation of inefficient industry which will need still higher tariffs to help it survive. Perhaps the ideal tariff situation is one which gives adequate protection at the start and is phased out over a number of years.

● Subsidies are not unknown in Australian industry, as for example throughout the rural industry. These are sums of money paid by the Government to the producers on the basis of production volume and, unlike tariffs, their burden is borne by the community as a whole. To me this seems more sensible. If Australia believes that the scientific industry is worth encouraging then the cost of this, as the benefits, should fall on the community in general.

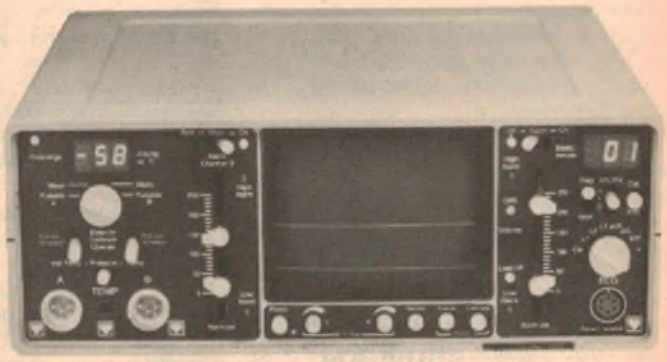
Like tariffs, subsidies can be counter productive if they produce complacent industry. Perhaps a phase-out scheme could be most appropriate in this area too. Unlike tariffs, subsidies can apply to individual firms. Tariffs protect all components of the industry making a sheltered product equally, but subsidies can have "age" or "means" test applied.

● Stability of assistance is essential. We have seen over the years on-again off-again assistance to industry which could hardly be bettered as an inhibitor to the commencement of new industry; particularly in the scientific industry. What is needed is an assurance of some continuity of policy programs. An illustration of the effect sudden changes can have on the scientific industry is seen in the sudden change in the tariff on imported word processors which occurred several months ago, from 21% to 6% after some months only at 21%. A number of firms started activities in local word processor production in these months and their thoughts on this change are not fit to print! To assist matters, Government preference for Australian-made items was removed on the same day!

● R & D grants for industry are needed now as they have never been before! The level of R & D in Australian industry has declined dramatically over the past five or six years to a most unacceptable level. In Australia about 70% of all R & D is done by Government agencies and the rest by industry or private bodies. In the OECD it is just the reverse. This is not because Australia has a massive Government activity but because the portion undertaken by private industry is small. In opening the South Australian Technology Park, recently, Hon David Thompson, Minister for Science and Technology, made a spirited appeal to industry to undertake a greater proportion of R & D to ensure Australia's future.

The most easily discernible reason for lack of research here is that ownership of many of the larger components of our manufacturing industry is in foreign hands. Overseas ownership means overseas research. Even if a token R & D effort is sustained in Australia, too often the cream – promising Australian ideas – is whipped off for real development at the overseas base.

● The world is not standing still, in a gentlemanly fashion, to wait for us to catch up! The lesson of history is that in technological matters the rich get richer. The advanced countries spend more on research, a greater proportion of total income, than the less developed coun-



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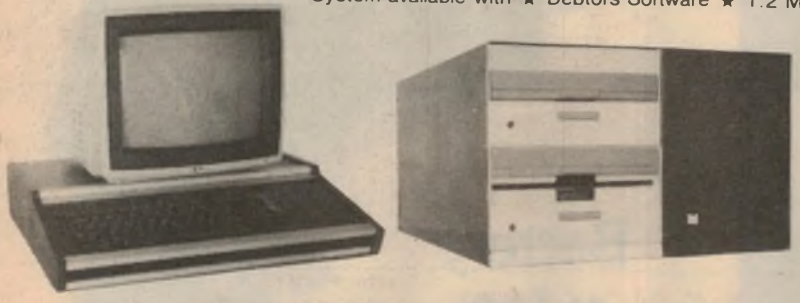

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tries, and move even further forward. The richest country in the world, the USA, spends prodigious amounts on science – the knowledge industry – and knowledge creates power. Not only has the US community got into the idea of expecting benefits from R & D, and thus being willing to contribute venture capital, but the Government provides subsidies for developing inventions on a scale unmatched in Australia.

Sometimes these grants are called NASA or military R & D grants, other times development contracts, research contracts, research grants or other names, but they all add up to support for high technology industry which enables it to invent, grow and export. If you like, these represent export subsidies or incentives against which our products must compete. At the end of the year, when the auditors are at work it does not matter what money coming in is called so long as it helps produce black figures below that bottom line!

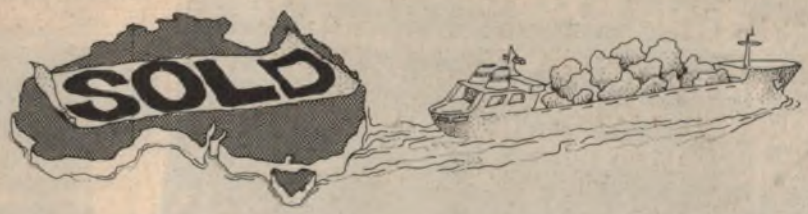
● Dispersion of Aids for Industry: On paper, our quiver of aids to industry appears much better than it is in practice. But we have the happy knack of scattering these over many departments and geographically to the four winds. I have yet to meet a small firm which even knows all that is available to it, such as perhaps eligibility for a NERDDC (National Energy Research, Development and Demonstration Council) grant for an energy related project or a ROSTA (Road Safety Traffic Authority) grant for road traffic related items. I constantly meet firms who say, after attempting the hassle, that they can't afford the time to research all that might be offering, and that it is just not worth the effort to gain government assistance.

An R & D Grant is taxed as if it were normal income, so half goes back to the Government, and only inefficient firms making a loss avoid the tax siphon-off and gain full benefits of the aid!

Personally, I believe them to be wrong and believe they and Australia are the poorer for that attitude, but the lesson is that we must make it very much easier to gain assistance. Two possible remedies are available:

● One-shot liaison men: These would be people who know what is available to firms, and who will then turn this into action. For example, in our rural industry about 2000 men roam the country turning research and testing into improved practices in the rural industry as a whole. In manufacturing industry, we would be lucky to muster 100 people of vaguely their description.

● One-shot Technology Centres: This strategem is based on gathering into one place all the service and aids which industry might want to form a highly visible, conveniently usable "supermarket". The Victorian Government is currently investigating this type of scheme.



As this issue went to press we received news that the Australian government has decided to exclude high technology products from the previously announced abolition of preference for Australian goods in government purchasing.

Minister for Administrative Services, Mr Kevin Newman, said that although the general preference policy would be discontinued, the Government would follow a new policy designed to encourage high technology industry. His Department would be advising relevant industry groups about details of the new policy.

The end of the preference policy was announced in August by the Prime Minister, along with his decision to request the Industries Assistance Commission to report within six months on a general reduction in protection levels.

Following intensive lobbying by high technology industry groups in support of the "Buy Australian" policy, a modified scheme has been introduced. Preference for Australian goods would continue to apply in the strategic defence industries, and would be assessed on a case-by-case basis on high technology orders worth more than $100,000.

According to Mr Newman, an Australian preference policy would not be "cost-effective" for tenders of less than $100,000.

Total abolition of preference policies for local high technology products would result in an estimated $100 million worth of lost orders for Australian industries, out of a total Government import bill of almost $5 billion annually.

Each of the organisations participating in the Centre will do its own "thing", but the mere presence of all in one place will acquaint firms with what is possible and will enhance the usage of all.

This concept is quite different from a Technology Park which collects high-technology into one place (with the best known example sprawling Silicon Valley), but the two are not incompatible. Both deserve support.

Overall our resources in human know-how and inventiveness are woefully underused. We must maximize their use.

Sandra Prevost found that in the MPSE (scientific industry) sector, the effective assistance is of the order 5%, which is less than one third of the average for manufacturing industry as a whole. It goes without saying that this is also considerably below the levels of assistance to the various agricultural industries. Critics of increased expenditure say we can't afford it. I make no case for manufacturing industry as a whole (I just don't know) but it seems elementary to foster the MPSE or scientific industry at a time when it seems likely to take off – with help.

Tarifs, Protection, Preference, Export Incentives, or What?

ASIA has recently made submissions on behalf of the scientific industry to the Industries Assistance Commission on the benefits of existing export incentives, and on areas in which these incentives might be improved.

We have been invited to go back to the Commission with our version of what we believe would be the best type of support for the scientific industry, not necessarily following the pattern of present aids – an invitation we were delighted to accept.

Our suggestions will include:

- Untaxable R & D grants;
- Use of Government purchasing to launch new products, by guaranteed first production runs (on the basis of Government purchase if not otherwise sold);
- Tax deductibility for profits ploughed back into expansion;
- More imaginative use of Defence money to sponsor local development of needed products.
- Development of import replacement industries via tapering subsidies rather than tariffs;
- Stabilisation of available grants;
- Government guarantee to facilitate availability of venture and expansion capital;
- Provision of science and technology information services of various types;
- "Dedicated" Trade Commissioners, specialising in high-technology products.

If our manufacturing industry is going to survive into the 21st century, then we will need to support to the utmost those industries in this sectors which offer hopes of a bright future. Hopefully, someone out there is listening?

If you would like to find out more about ASIA or contribute to its ability to project the needs and opportunities of high-technology industry in Australia, please write to: The Secretary, ASIA, PO Box 225, Dickson, ACT 2602.

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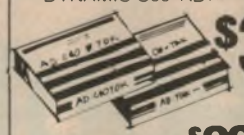

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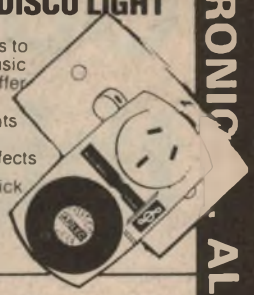

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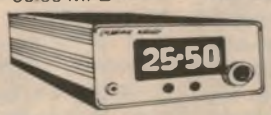

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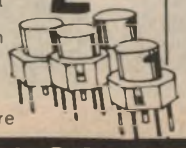

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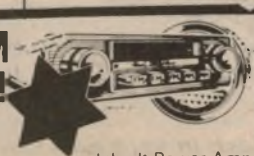

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Computers will think like people

Artificial intelligence — engineering or psychology?

Using the principles of artificial intelligence, computers will process information in the same way humans think. The goal of artificial intelligence research in the US, Britain and Japan is to produce machines with "commonsense" — making computers think like people rather than the other way around.

by PETER MARSH

The soap factory is in turmoil. Instead of turning out its products in nice, regular blocks, the machinery is disgorging what look like pieces of Weetbix which fall apart as soon as anyone touches them. The man who designed the plant has since left for another company; and the computer controlled equipment is so fiendishly complex that to trace the fault might take days. Meanwhile, the multimillion dollar factory has ground to a standstill and head office is on the telephone demanding to know what is happening . . .

It is this kind of nightmare which scientists at Unilever's research laboratories at Port Sunlight, Merseyside, are working to avoid. They aim to design computers that contain the knowledge of human experts and which other, less brilliant, people can consult to find out answers to complicated problems. Such a computer, or "expert system", could sit in every Unilever soap factory. It would contain the knowledge of the person who designed the plant. In an emergency, or simply to find out a little more about how his machinery works, the plant's manager would sit before a terminal and ask questions of the computer via a keyboard. Answers flashed onto a display screen would give him the insight he would otherwise lack.

Unilever is one of several large corporations in Britain researching into expert systems. The others include BP, Shell, ICI, GEC, Sperry Univac and ICL. The companies think that, ultimately, expert systems could provide a way of conserving, or spreading out, a precious resource – human skills.

Specialist engineers, for example, can be in no more than one place at a time. If a geologist who works for an oil company is based in Texas, it is annoying – not to say expensive – for his employer to fly him out to the Middle East every time the firm finds a new field. A portable expert system which encapsulates the engineer's knowledge would bring huge advantages. An identical system could be positioned everywhere drilling takes place.

At present, eminent engineers and scientists record their thoughts for posterity on paper. In the future, they may wish to be remembered in another way – by leaving behind expert systems. The practice could spread to other professions, particularly those given to conceit. Politicians, for instance, could leave their wisdom in computers, confident that disciples would be able not only to follow their arguments but be able to ask questions of them as well.

Artificial intelligence

The development of expert systems is just one branch of the discipline of artificial intelligence, or AI. Although academics started AI research in the 1950s, soon after the electronic computer first appeared, it is only in the past few years that the subject has become respectable in industry. In the US, IBM, Schlumberger (which is working on an expert system for oil prospecting), Xerox, Texas Instruments, and Bolt Beranek and Newman have large research efforts in AI. And the US can boast the first AI system in widespread use. Engineers who work for DEC are questioning a system called RI. The machine's answers help them to fit complicated sequences of electronic components into computers. In theory, the systems can contain the knowledge of anyone, from car mechanics to doctors, whose skills are useful to others. Some of the best known expert systems are for medical applications (Box A).

Although most AI research is in the US, Japan is taking the subject seriously. The Ministry of International Trade and Industry is discussing a $300 million plan to devise a new generation of computers which would use the principles of artificial intelligence. The computer would process information in a manner approaching that of humans. A "knowledge system" containing general information about how the world works, and on human thought processes, would act as a buffer between the user and the data processing part of the computer.

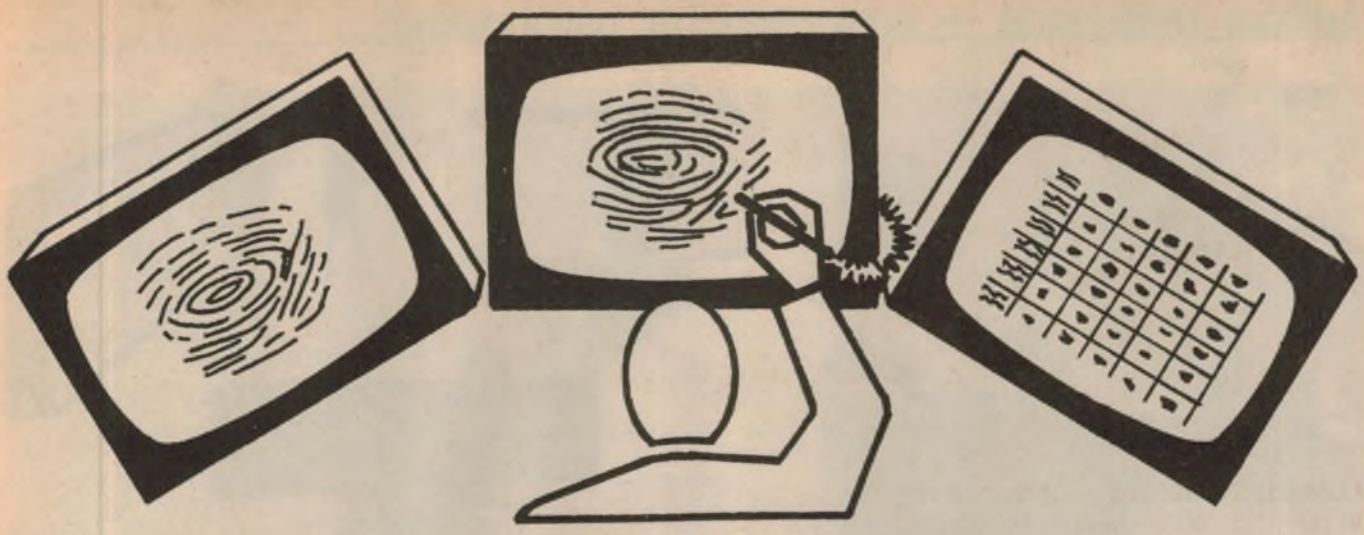
What is AI? The nearest thing to a definition is this: if a computer does something that, in a person, is said to require intelligence, then the computer is

Expert systems —

Jack Myers and Harry Pople constitute two-thirds of an unusual team, whose third member is a computer. Between them, they are helping doctors to diagnose illnesses from masses of often confusing symptoms reported by a patient.

The trio is located at what is called the decision systems laboratory at the University of Pittsburgh. The laboratory, a hybrid of the medical and business schools, is working on expert systems — computers which are filled with programs representing the reasoning processes of human experts and which others can consult. Myers is a doctor — a "domain specialist", in the jargon of artificial intelligence. Pople is a computer researcher whose job is to write software that let Myers put his knowledge into a computer, and which allow others access to the expertise afterwards.

Myers and Pople have produced



Fingerprint retrieval illustrates common feature of all AI systems – ability to sort information according to known rules.

displaying artificial intelligence. The definition is clearly unsatisfactory, but that is not the fault of computer researchers: rather, everyone else is to blame for not making clear what is special about humans' intellectual capabilities.

Opinions on this subject are constantly changing. Most people would agree that driving a car, diagnosing a disease or understanding speech require intelligence. The computers in routine use can do none of these things (though some of those in AI laboratories can). But what about playing chess? A few years ago there was no doubt – it requires intelligence. But now that chess programs can beat humans, people are not so sure. We do not easily surrender to machines what is thought of as a unique human attribute – it puts us under threat.

Besides expert systems, AI work falls into several other areas; perception problems (for instance in "seeing" robots), automatic programming, natural language processing, intelligent retrieval from data bases, and the proving (and compilation) of theorems from a mass of experimental data. All are jobs which, people generally agree, require intelligence.

AI researchers themselves fall into two camps. The first breaks down a difficult problem into stages which can be tackled with the help of computers, plus any other bits of engineering gadgetry which are to hand. The techniques employed are not necessarily relevant to the way people solve problems using just their brains. The second type of researcher studies the way people operate, and attempts to put into computers human reasoning processes. With these, so the researcher hopes, computers will manage difficult jobs and just as impor-

computers that share their knowledge

several related expert systems — the best known is called Internist. The original system contained information about some 500 different diseases and Myers is working on adding data about a further 150.

Every disease is linked to an average of 60 or so symptoms that are relevant to the ailment. There is a lot of cross-indexing between the symptoms for different diseases. Thus every observation indicating ill-health leads to a list of perhaps 20 possible causes, ranked in order of likelihood.

According to Pople, the system does not necessarily pinpoint the causes of a person's ill-health, but rather focuses a doctor's attention on certain symptoms. Rather than solve problems outright, Pople says, the system should help doctors to organise their thoughts, so that they can (perhaps) reach the right conclusion by themselves.

The doctor using the system (in AI parlance, the "client") communicates with the computer by a keyboard. Most "interviews" take 30 to 45 minutes. The system might ask the doctor, via words displayed on a screen, to list his patient's symptoms. It then indicates a likely set of diseases, and asks new questions that are relevant to each ailment. For instance, if it looks as though the patient has a kidney disorder, the computer might ask whether the patient has had jaundice. The final "answer" might be a list of as many as a dozen possible causes of the disorder.

Pople wants to improve his system in several ways. At present the user cannot issue directives to the system, to tell it to focus on one particular line of thought for instance. The instructions come in one direction only — from the machine. Pople therefore wants to let people instruct the machine. This would make communicating with the system more like talking to a person on equal terms. Secondly, the equipment cannot reveal to the doctor the detailed physiological arguments with which it formulates its answers. Rather, the user has to take these arguments on trust. A new version of the apparatus should be able to say how it has arrived at conclusions.

Pople says that programs like Internist are relevant to lots of other problems of diagnosis; finding out what has gone wrong with complicated equipment for instance. Such an expert system, for diagnosing faults in oil platforms, has been devised for BP by Edinburgh University. One of the leaders in expert systems is Stanford University, which has produced (among others) Dendral for producing chemical structures from spectral data and Mycin, which diagnoses diseases.

Conventional computers are not noted for their accessibility or ease of use.

tant, will function more like people, thus gaining their confidence.

The first approach is that of the enginner; the second has its roots in psychology. At its most extreme, the second technique aims to instil into a computer all the rules of logic, powers of deduction and general knowledge that belong to a person. In other words, the computer would have common sense. Such a computer would be so easy to use that people could talk to it. Chatting to machines to tell them what to do, or to inquire after their health, would be an everyday activity. Astounding though it may seem, the Japanese government aims to produce such machines by the 1990s.

The difference between the two approaches is best illustrated in research into robot vision. Engineers all over the world want to make robots "see"; the machines could then, for example, pick things up – even if the objects are not always presented in the same place. With the "engineering" technique, researchers store in a robot's memory coded images of the parts that it is to locate. When a TV camera spots objects that correspond to these images, the robot instantly recognises them.

Ordinary robots are blind

Although the process works well enough for parts that the machine has been instructed to look for, the robot will be blind to all the other things in the world about which it has been told no information. This cuts down greatly on the robot's usefulness.

The more promising approach, according to Michael Brady of the Massachusetts Institute of Technology (MIT), is to find out how people see and then program a robot in a way that reflects this. The robot would build up an understanding of objects in front of it by looking for juxtaposition of edges, lines, colours and so on. In theory, the machine could then recognise anything.

Although most attempts to make "seeing" robots use the engineering technique, Brady claims that the psychology-based route will pay off in the long run.

Stephen Slade of Yale University also feels it is better to make computers think like people – rather than the other way around. "Computers can do some things which people are very poor at – working out payroll figures for instance. But humans do other jobs much better, for instance solving a crossword puzzle, holding a conversation, walking a dog. To make computers do the second kind of task, it's fundamentally necessary to look at how people operate. After all, we know that people can do these jobs; we can't say the same of computers."

Researchers at Yale University have produced remarkable computer programs called SAM and FRUMP which translate text into different languages and precis long newspaper reports into a few short paragraphs. Another program called BORIS can be fed a short story and then answer questions about it, showing that it can "understand" what the story is all about.

The Yale computers have to know, intuitively, that "Jack is in bed with a cold" means something different from "Jack is in bed with Dorothy". And the programs in the machines must have the gumption to realise that when, for instance, someone says he plans to order a drink at a pub, he gets the drink from a barman or women and not from a drinking companion. In all these cases, the computers get their general information about the

Voice recognition systems – general purpose computers controlled by the human voice – will change many or our ideas on how computers are used.

Language lessons for a computer

Box B

To make computers "understand" a simple sentence, according to researchers at Yale University, the first step is to strip the sentence of its dependency on rules of language and rephrase it in terms of basic concepts. Consider, for instance, "John went to New York". This sentence can be rephrased, in terms of concepts, as:

Author: John
Action: ptrans (short for physical transfer).
Object: John
Direction (to): New York
Direction (from):?

The Yale researchers call this set of "event slots" a "conceptual representation".

More complex sentences will have more complicated representations; but all will share in common the idea of filling up slots in an event frame. The sentence above could, for instance, be made more complex by specifying that John travelled in a car. In this case, the conceptual representation would have an "instrument" slot, which would be filled with the word "car".

In the Yale work, a computer first translates sentences to their language free conceptual representations. In a second step, the machine acts on the representation, for instance to translate it to another language or to produce a precis.

Difficulties arise with more than one sentence. Other parts of the computer program have to connect the sentences in the text in a causal chain and also fill in things that are left unsaid in the original. When people talk or write, they leave out lots of words and sentences that they assume others already know about. Consider these three sentences:

John went into a restaurant.
He ordered a hamburger.
He paid the bill and left.

No one says anything about John eating the hamburger, but because of the final sentence it can be safely assumed that this is what he does. Further, the text does not bother to describe what happens inside a restaurant — the process of walking through a door, choosing a table, using a knife and fork, tipping and so on. To make a computer comprehend all these things, it must be given a "script" of what to expect inside restaurants. In other words, it must be given general knowledge.

For a program called Sam, the Yale researchers produced scripts of about six different situations. Their computer then "knew" about events such as entering restaurants, trips on the underground, car accidents and so on. It could understand (that is, precis or translate) sentences that cover these topics. However it was too slow — it took about 20 minutes to digest a simple paragraph.

An advance on Sam is a program called Frump, which works much faster. With the same basic rules, it can "understand" long news stories, shortening them into a few paragraphs. The program can cope with a story as long as it concentrates on one of 70 or so general topics; thus it can deal with reports about earthquakes and oil spills but not with editorials or feature style material. For each topic, the program has an event frame that it tries to fill up. For instance, if it discovers the story is about earthquakes, it will try to fill in slots about the location of the disaster, how much damage it caused and when it happen. When all (or a large proportion of) the slots in the event frame are full, the computer has understood the story, and is ready to shorten it.

world through what are called "knowledge scripts" which provide background data to specific situations (Box B).

Often, this means giving the computer information about the perverse way in which humans run this lives. "Most people assume that computers are coldly logical and that if you give them illogical questions, they blow up in a puff of smoke," says Michael Dyer, another Yale researcher. "But what people don't realise is that you can make computers illogical as well." Taking this idea still further, Professor Donald Michie of Edinburgh University has postulated that advanced computers may have to be given some kind of religion, and mechanisms for lying.

Some AI systems contain relatively little knowledge but work very fast; in others (expert systems, for instance) the opposite is true. Most chess-playing programs contain very little knowledge about chess strategies. The strength of these programs is their ability to work out very quickly, up to six or so moves ahead, all the possible combinations of moves in the game. The very best human players can look ahead for perhaps only two moves. But though chess-playing computers can conquer a good many humans, they are essentially stupid. They lack the canniness to challenge the game's masters.

Hans Berliner, a researcher at Carnegie-Mellon University in Pittsburgh, hopes to produce a program that can go one better than today's knowledge-deficient chess computers. Berliner's program will continually play games of backgammon with itself. "It will record its own behaviour; when it notes something that is not in line with something it knows already, the program will formulate a hypothesis and test it. In the process, it will learn, and gradually improve."

What are the prospects for artificial intelligence? People generally answer this in one of four ways. The cynics' view is that artificial intelligence has yet to prove that it can do anything useful — and it probably never will.

A second group, which includes Donald Michie, points out that developments in computers are virtually forcing people to become interested in artifical intelligence. Michie says that computers are rapidly taking near-total responsibility for some of the world's most complicated networks of machinery — nuclear power stations for instance. Unless we teach computers to behave more like humans — so that we can follow what they are doing — the machines could make unnoticed errors and bring disasters that people can do nothing about.

Not unnaturally, many AI researchers go to great lengths to point to the advantages of computers that use artificial intelligence. According to the Japan Information Processing Development Centre, increasing computers' intelligence will "make them better partners for people and easier for people to get on with".

Roger Schank of Yale University says that what he calls personalised information vendors could be among the most useful products from AI work. They would be computers that are linked up to information providers — wire services or the electronic equivalents of newspapers — which are "trained" to select only those items of news in which their owners are interested. He argues that people nowadays plough through whole newspapers when they want to read about only a few specific subjects — for instance who won last night's football match or the latest news from Iran.

Lastly, there are the prophets of doom. Many AI researchers think that their creations *could* have some nasty effect. Professor Marvin Minsky of MIT, one of the grand old men of artificial intelligence, has written bleakly of computers that go wrong.

"The first AI system of large capability will have many layers of poorly understood control structure and obscurely encoded knowledge. There are serious problems about such a

Continued on p129

FORUM

Conducted by Neville Williams

COPYRIGHT — and the contents of this magazine

The recent publicity about copyright has added a new dimension to our office mail. It takes the form of letters from school principals and subject masters inquiring about their right to use ideas, designs and articles from the pages of "Electronics Australia". What follows may help reduce the burden of correspondence — both ways!

"Background music or not, I tell you it's copyright!" (From "TV Times", UK.)

I must emphasise that this is not intended as a general dissertation on copyright. We had our say on that subject in the June issue and, by and large, not much has been resolved since then. Public debate has become somewhat tidier but there is fairly general agreement that hard and fast rules will only emerge from court decisions, as distinct from words in the statute books.

Since our company, as a publisher, will be subject to such decisions, it is not possible, at this point in time, to say: these will be our rules and these will be the charges where copying has to be paid for. All we can do is to state the position as it has been, and as it applies at present.

While most of the letters to hand have been prompted by public discussion of copyright, they have not been confined to the photocopying of articles. Questions have extended to the use of ideas or circuits for profit, the use of our PC board patterns, the right to sell packaged kits for EA projects, and the sale of projects in fully built-up form.

Let's put the record straight on some of these matters, before dealing with the vexed question of photocopying actual articles from the printed page.

While the publishers of Electronics Australia claim copyright on the form, text, pictures and diagrams, as published in the magazine, they (or we) do not normally seek to inhibit use of the information itself.

We assume that readers, hobbyists and professionals alike, will incorporate some of the ideas into their own thinking, their own experiments and their own projects. There is no restriction on so doing, as far as we are concerned.

We also assume that some commercially involved readers will want to sell components or complete kits for Electronics Australia projects, or even to market fully built-up units. And here we can answer one of the questions which is commonly put to us:

NO ROYALTIES

We do not seek to impose or collect royalties on designs evolved in our own lab – even though many of them have been highly successful in the marketplace.

If you want to market a kit for an Electronics Australia project, or a project in built-up form, you do not have to seek our permission, and you do not become liable for any royalty or other payments, as far as we are concerned. The same applies if you want to market, under your own brand name, something adapted from an Electronics Australia design.

In saying this, however, we have to add three important qualifications:

- If you market a kit or a built-up unit which is represented as an Electronics Australia project, it MUST conform to our published description. A significant departure from the published description could lay the vendor open to a charge of "passing off" or misrepresentation under consumer affairs legislation.
- To overcome the above difficulty where a kit or built-up version has been re-styled or amended for commercial reasons, we normally advise advertisers to use the phrase "Based on" the particular EA project. However, we must stress that we do not necessarily endorse such amended designs and that, in any case, they fall outside the ambit of our information service.
- As noted in each issue, published circuits may embody patents. This is normally of little consequence to a person building a single unit but anyone producing a significant number of units for resale should consider possible patent involvements.

PCB PATTERNS OKAY

To facilitate the production and sale of components, kits and built-up units, we normally publish printed circuit board patterns. In addition, we have an annual subscription service by which board manufacturers throughout Australia and New Zealand can obtain patterns in transparent form.

We take the view that most modern projects depend on the availability of a PC board and our past and present policy has been to make the patterns available to readers, manufacturers and vendors alike, free of copyright or royalty obligation.

That answers another of the questions frequently put to us.

Consistent with the above, we have no objection to schools, school groups, clubs, etc, using our designs for class and club projects, and manufacturing their own PC boards, to suit, from our board patterns.

It is evident from our mail that EA projects are being used widely in educational situations but that those responsible are now seeking to double-check on their position.

THE PROBLEM AREA

This brings us to the vexed question of photocopying the relevant text, pictures and diagrams from the pages of Electronics Australia – in addition to the PC board pattern.

The following are snippets from typical letters from educational institutions. We are not seeking to criticise the writers, because they are trying to do the right thing; indeed, we have omitted any identification, to save embarrassment.

"I find, as do all members of our staff, that your magazine is invaluable in our teaching program. I refer specifically to your projects. The staff are extremely concerned as to the implications of copyright, particularly in the use of circuit diagrams and PC board artwork related to projects in your publication."

"In the area of mathematics and computerisation, there is a need to refer to current information that cannot be provided from textbooks. Therefore, as a non-profit organisation, working in the area of education, we request permission to copy works from your publication for student class use."

"We are seeking copyright release for your article on 'Basic Readout Devices' first published in Electronics Australia in January 1977 and later reprinted in An Introduction to Digital Electronics. Your article is recommended reading and we would be most grateful if you would release this item to us."

In responding to letters like this, we are in precisely the same position as any other magazine publisher: we rely on newsagency sales for our very existence. If those sales were to fall below a certain level, for any reason at all, we would simply go out of business. There would be no EA, no theory articles, no projects.

Uncontrolled photocopying, in breach of copyright, poses a very real threat to the viability of any publication. The higher the proportion of reference or educational material carried, the greater the threat. Some copying will go on, anyhow, but to legitimise it and encourage it for any reason at all would be to hasten the process of bleeding to death – never mind by whose hand!

Regretfully, therefore, we have had to refuse those who have sought open-

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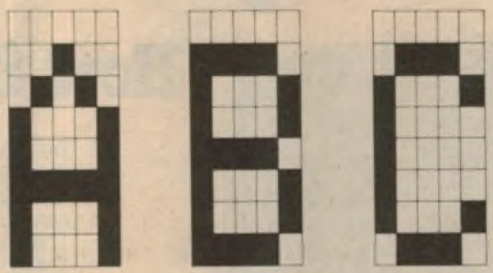

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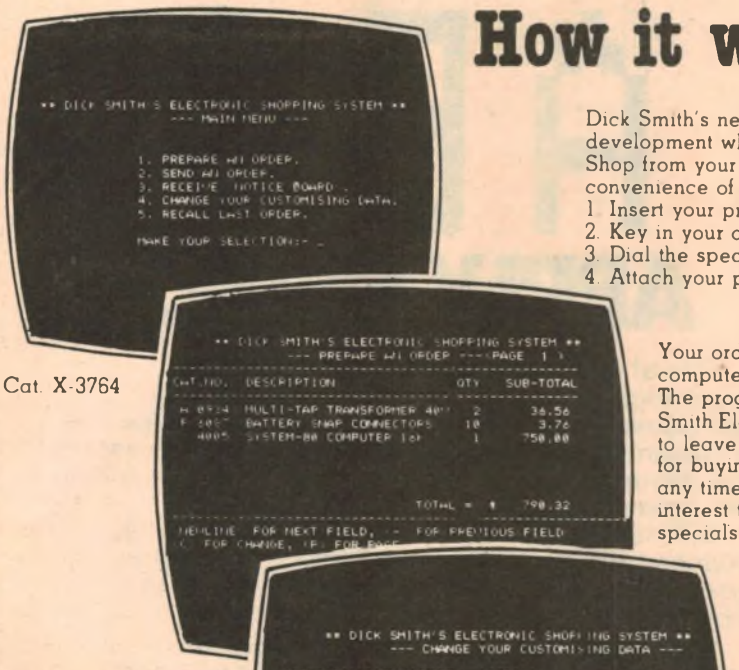

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Readers are free to study, utilise or profit by our ideas, circuits and project designs but we must protect the one thing we have to sell – the printed page. Above all, we are unwilling to condone photocopying of articles from issues or handbooks which are currently or readily available (in terms of the Act) "within a reasonable time at an ordinary commercial price".

The various EA handbooks are frequently advertised in our columns while mention is made, each month, in the Reader Service panel, of back issues and copies of past projects.

Where there are difficulties or special circumstances in relation to individual articles, we may well be prepared to make exceptions but, by and large, we anticipate that we will be guided by the slowly emerging system: what may or may not be photocopied, the records that may need to be kept, and the charges that may ultimately be imposed.

We would make one other point:

In line with various other electronics publications, we currently allow advertisers to include with each kit one copy of the relevant article from Electronics Australia. We make the condition, however, that it must not be the subject of an itemised charge. Moreover, such copies must not be sold or distributed separately, without our express permission.

While it is our present intention to leave the arrangement stand, the emerging pattern of copyright practice may ultimately bring it into question. But, once again, that is a matter for the future.

And on another subject . . .

Last month, I questioned what I felt to be highly debatable statements about digital recording. One that really grabbed me was to the effect that:

"If you take a low sustained organ tone, and slowly increase and decrease its level, so that you are asking the machine to decide what finite level to give it, it sounds like a motorboat!"

I had my say at the time and then largely forgot about it until a few days ago, when checking through records for review in this issue.

Amongst those which I turned over was a digital recording of Carlo Curley playing an Allen digital organ in the Alexandra Palace. I had had the album for several months but had put it aside because it was not readily available in Australia. However, a couple of days previously, Alan Little of PC Stereo in Queensland had mentioned, over the phone, that he was now carrying Chalfont recordings, including this particular one. So I put it on the turntable and began to listen to it seriously.

In case you are not aware of it, the source signals for Allen computer organs are sounds picked up by microphone from selected pipes in selected acoustic instruments. The sample waveshapes are passed through an analog to digital converter and stored in a computer-style memory bank. When the organ is played, the required tones are clocked out at the rate necessary to provide the appropriate pitch(es) and otherwise processed while still in digital form.

In due course, the signals are passed through a digital to analog converter and then fed to conventional amplifiers and loudspeakers.

In the case of this particular record, the organ sound in the Alexandra Palace was intercepted by microphones and fed to a Soundstream digital master recorder, being then converted back to analog for the disc cutting lathe.

In short, I was listening to sound that had been through, not one, but two complete digital chains in tandem, one of them involving a great deal of manipulation, switching and processing.

And the result? Magnificent!

Forget the words "electronic". This was big concert organ sound, per se, alternatively massive and delicate, and unpunctuated by any of the hisses and clunks that are heard from the monsters of the romantic period, when the microphones are straining to hear the small pipes.

But that's by the way.

Time and again, during the recital, the music stops at a climatic chord and one has the substantial reverberation period of the Alexandra Palace to hear the reverberant sound (bass and all) sink smoothly down towards the natural ambient.

I listened in vain for the infamous "motorboat" effect. On the contrary, what I heard was a completely smooth subsidence into a completely natural ambience.

And when the small pipes broke into the silence, they did so with a sweet and natural quality that belied any thought of quantising distortion and noise, at least in that environment.

Would one still pass the same judgement in a dead-quiet situation? I don't know. But who, in their right mind, would want to install, or play, or listen to, or record a concert organ in an anechoic chamber?

Sufficient to say that for this particular – and real – musical event, digital did a fine job!

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598A	2.80	80IF12	2.80	81SP1	3.00
81DC2	2.80	81SW1	3.50	80FB12	3.00
477	4.00	328	2.80	80RM12	3.00
80SA10	7.00	80AD12	3.00	ETI1500	9.00
ETI1500	9.00	ETI572	3.50	80RAM12	5.50
80MV11	2.80	80LS12	3.20	ETI476	4.00
ETI476	4.00	247	2.80	80TRS11	2.80
255	2.80	80DC10	4.80	80AW10	3.00
80LBRI2	2.80	80BM10	2.80	80ST10B	2.80
80TC12	2.80	80TM8B	2.80	EA80TM8A	5.00
80ST10A	4.50	327	2.80	ETI147	3.00
568	2.80	ETI457	3.00	ETI326	2.80
ETI475	4.00	80B7	2.50	80DM9	4.50
80LPG9	3.50	250	2.50	564	10.50
80TR9	3.50	80LL7	2.80	80M07	3.00
ET1324	3.50	80LL7	2.80	80M07	3.00
80PC7	3.00	80CH7	4.80	565	3.50
563	2.80	467	4.00	149	2.80
80PP7B	2.50	80PP7A	5.00	80RF5	2.80
80G6	4.80	578	2.50	636	16.00
80D6	3.00	78AF2	3.00	ET588820	10.00
80PA6	12.00	77CB12	2.60	78EK3	3.30
80BB3	2.80	ET135	3.00	781A2	2.60
454	3.00	80HHS6	2.80	ET716	4.00
80AW4	4.00	325	2.50	ET245	2.50
80C14	2.80	80PC4	3.00	78S3	2.60
466	6.00	562	3.30	77PH12	2.60
80AU3	3.00	453	2.80	80PG6	5.00
264	2.50	566A	2.50	80HLA5	2.50
322	2.80	80GPS3	2.80	80TV8	3.30
80S1	2.50	496	5.00	566B	3.00
ET560	2.80	496G	6.50	80F3	2.80
ET151	2.50	80CM3A	3.20	ET152	2.80
79DI0	2.80	561	2.80	726	8.00
79TI11	2.80	80GA3B	3.20	80CM3B	2.80
ET262	2.50	79SB10	2.80	455	3.00
ET150	2.80	ET452	4.50	80GA3A	5.00
79PG9	3.00	80SA3	4.50	ET474	2.80
ET573	2.80	79EB12	2.80	ET321	3.50
790M9	3.00	ET270	2.80	79FE11	2.80
79RR8	4.20	ET261	2.50	79PC12	2.50
79BT9	2.60	ETI46	2.50	ET263	2.50
79AC9	3.50	79MD9	2.80	ET260	2.50
ET576	4.20	ET577	2.80	79PS11	2.50
ET730	3.50	79PS10	2.80	ET606	3.00
ET252	3.00	79SF10	2.50	ET473	3.50
79WF8	3.20	79TT7	2.60	79RI8	2.80
79PS6	2.80	79SF9	2.60	79AI9abc	4.20
ET451	2.50	ET574	2.80	79W9	2.80
6800	8.50	ET814	2.80	ET731	3.00

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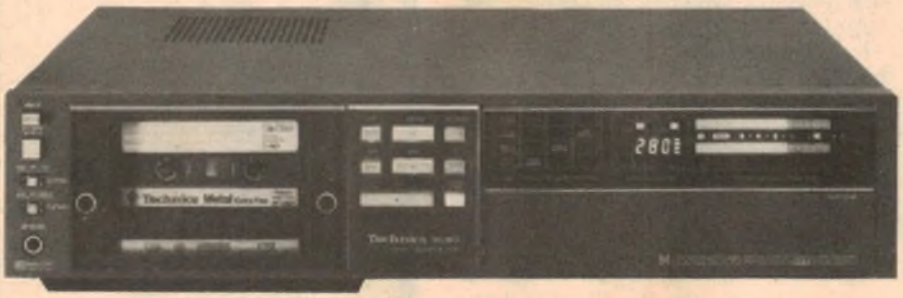
GERMANY: different brands but more of the same!

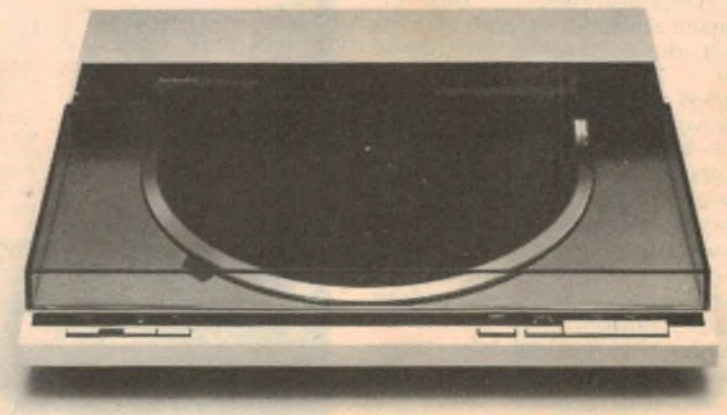
While we hear a great deal about equipment and marketing trends in USA, Japan and, to a lesser extent Britain, information from continental Europe is relatively sparse. We are indebted to Robert and James Cunningham (R. H. Cunningham Pty Ltd) for these glimpses of the German scene, picked up from the recent International Audio and Video Fair, held in Berlin.

by NEVILLE WILLIAMS

As in other developed countries, the domestic television receiver in Germany is gradually moving towards the role of a household video terminal. A greater range of information is becoming available and the expansion process is still going on.

Over-the-air videotext, similar to that being radiated provisionally by a number of Australian TV stations, has been broadcast for some time in the Federal Republic of Germany. Most recent estimates suggest that there are about 80,000 decoders in the hands of private consumers. Manufacturers are supplying some new models fitted for teletext, as well as conversion kits for selected older models.





A range of Technics models, announced some time ago for Australian release, was on display in Berlin. Included were the ST-S4, ST-S6 and ST-S8 slim-line tuners, the RS-M270X cassette deck reviewed last month, the multi-featured RS-M280 cassette deck, pictured above, and the SL-QL1 "super-flat" tangential turntable, also pictured.

The potentially interactive viewdata system, involving the use of phone lines or cable, is also undergoing intensive trials by the German Post Office. Known as "bildschirmtext", there are some 7000 subscribers in Berlin and Dusseldorf and the present target date for the official service to begin is mid '83.

In addition to normal over-the-air TV, teletext, viewdata and home video, German receiver design is gradually being expanded to include provision for subscription services, and the possible use of receivers as video terminals for home computers, video games, etc. Attention is being given to providing direct access to video circuits, sync circuits, and red/green/blue controls.

Fortunately, while the screen is becoming more informative, the technology is also becoming more compact. For example, as teletext and viewdata gravitates towards firm technical standards, semiconductor manufacturers are beginning to zero in on highly integrated chips which should make decoders possible in large numbers at commercially attractive prices.

AUTOMATION

Automation in manufacture and testing is also becoming an imperative rather than an option, with a strong preference emerging for single-board assembly. The differing requirements of individual receiver models has all but erased the one-time dream of being able to base long-term production and maintenance on a selection of individual standard modules.

An interesting side-issue of the modern technology is a very substantial reduction in the power requirements of modern domestic TV receivers. In 1971, the average power consumption of a 66cm (26in) receiver was just under 300 watts. It has now been reduced to well under 100 watts — representing not only a significant saving in power but also a notable reduction in the heat stress on components.

The German Post Office has also taken a strong hand in the design of the receivers by virtue of new standards

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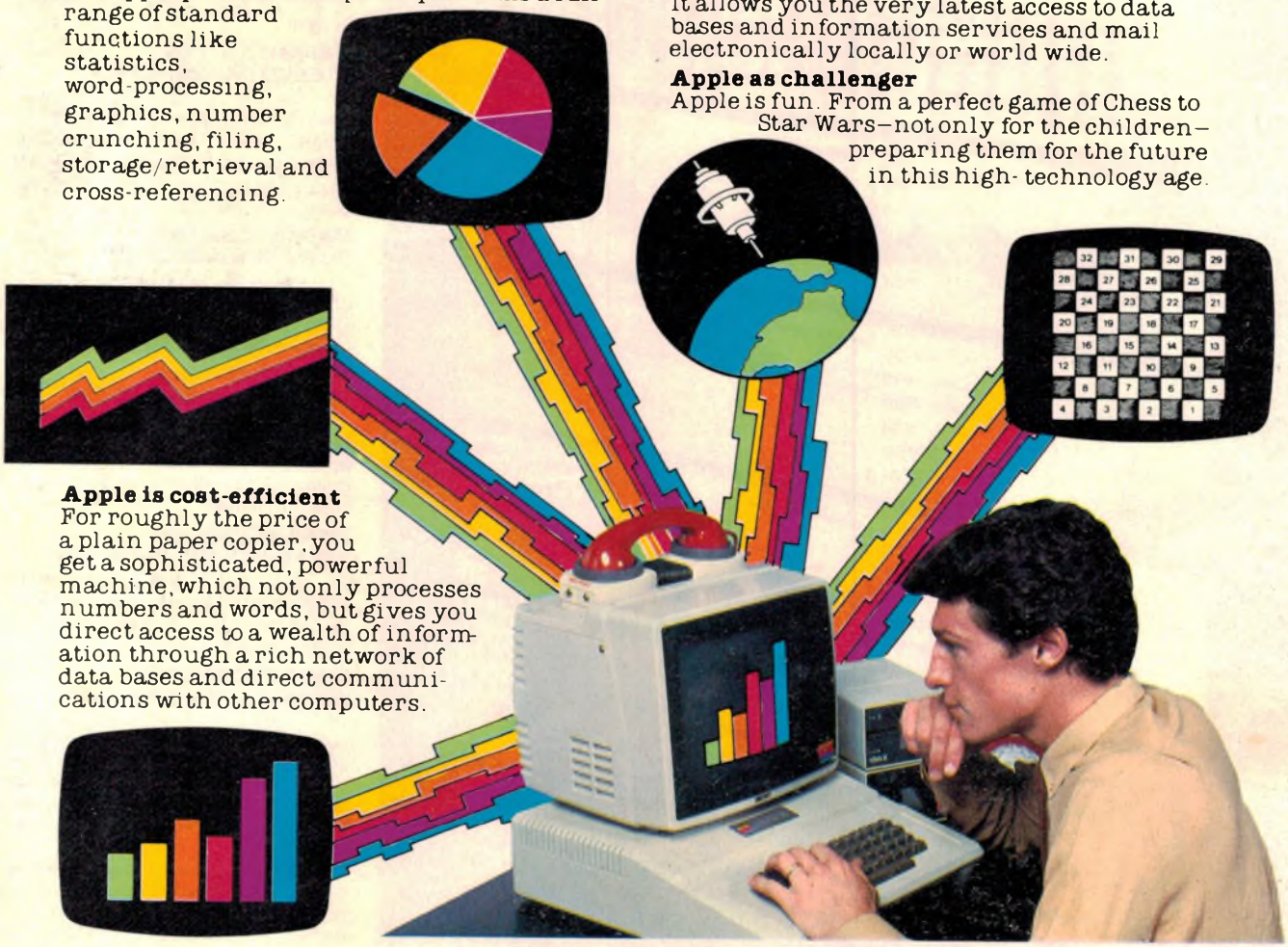

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which came into effect on July 1, this year. In particular, the new standards are intended to minimise radiation of potential interference from TV receivers, as well as making them less prone to interference from other sources.

Last but not least, the Institut fur Rundfunktechnic, in association with the TV industry has come up with a promising system for radiating two separate TV sound signals which they claim offers "a decisive advantage compared with the matrix method used in Japan".

For the home market, they see it as offering the opportunity for German viewers to watch English-language movies, either with the original soundtrack or with dubbed German dialogue. In other circumstances, it could equally be used for stereo sound, where available, providing the consumer industry with a whole new area of activity: multichannel audio TV, adaptors for existing receivers, interconnection equipment with hifi-stereo equipment, and so on.

VIDEO SYSTEMS

In addition, an export market could emerge involving countries like Belgium and Switzerland, which have a multilingual population of their own. Certainly, quite a few of the receivers listed in the Audio and Video Fair Manual offer two-channel sound.

Turning to video cassette recorders, displays at the Fair were dominated by just three systems, VHS, Beta and Video 2000. The older systems had virtually disappeared. They are still being serviced and there is some software available but few, if any, pre-recorded cassettes are on offer.

At present, VHS is the dominant system, with manufacturers vying with each other to provide the most user features for the least money. Consumers face quite a confusing situation in trying to decide what features they don't need and therefore don't need to pay for!

There is also very heavy competition in the area of portable VHS recorders and camera combinations. Editing facilities are being offered which are presumably an extension of the automatic edit and audio dub features already available on some Australian VCRs. These allow the user to over-record a failed or dreary scene with a map or signpost, or other relevant shot, without producing a noise break or loss of sync.

On the soundtrack, voice or music may be superimposed on the existing recording.

According to the official Fair handbook, Beta system VCRs have been at a disadvantage because of supply problems and also some difficulty in achieving an acceptable freeze-frame image. This last problem

A new aid for the visually handicapped

Developed in New Zealand and announced in Australia a few weeks ago, Viewscan is a new portable electronic reading aid that should be invaluable to many who have a severe visual handicap.

From time immemorial, people with limited or failing sight have relied on optical magnifying glasses for reading, but there are many for whom such an aid is not adequate.

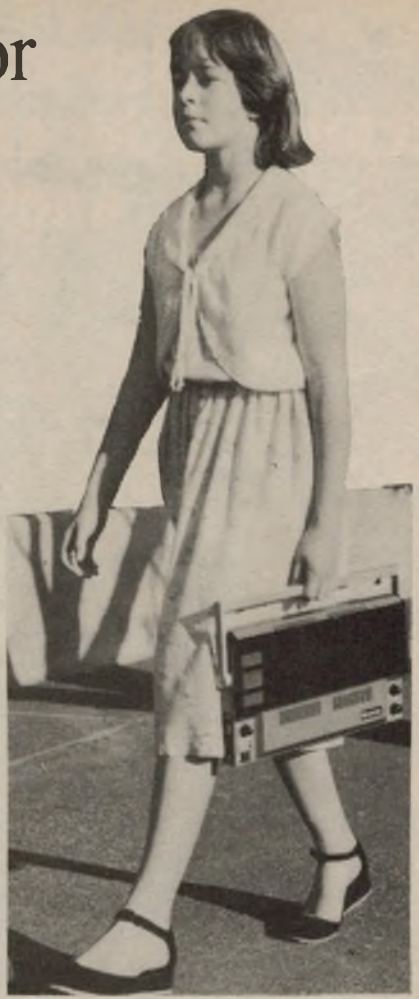
The more fortunate have been able to gain assistance from electronic magnifiers in the form of a specially designed camera and monitor set-up. The camera responds to the image of the letters and words and generates video information which is then displayed, considerably magnified, on a TV type viewing screen.

But most such equipment is heavy and bulky and is therefore found mainly in institutions. It is not accessible to people who want casually to read a letter or a newspaper elsewhere.

Although the letters are scanned by a line of light, as the read head is moved, enough information is stored in the memory bank to keep the screen filled with characters. Proficiency in reading comes with practice but a couple of hours is usually sufficient for the user to come to terms with the unit.

The new "Viewscan" solves that problem. It is light in weight (less than 5kg), incorporates its own power supply, and can be taken and used anywhere with the ease of a portable radio. It requires no special skills to operate and is well suited for use by children, students, office workers and older people.

In use, it is set up on the table at the most desirable viewing distance and a small reading head with rollers on its underside is moved back and forth



At first glance, the Viewscan could be mistaken for an ordinary portable transistor radio. According to Wormalds, there are no official figures available for those who have a serious visual handicap, without being legally registered as blind.

across the type. The resulting signal is conveyed to the instrument proper by way of a cable and the letters and words appear on the screen, enlarged by 64 times, depending on user requirements.

Inside the matchbox-size reading head, fibre optics are used to create a thin slit of light vertically across the line of type. As the reading head is moved from left to right, each letter is scanned, in turn. Information about the light and dark areas is fed, again by fibre optics, to a solid-state sensor.

The resulting signal is processed and stored in a computer-like memory and then used to produce a bright orange/red display on a neon type matrix recently developed by NEC in Japan. The associated electronics, however, was largely the brainchild of Dr Russell Smith of Wormald, in Christchurch, NZ.

(For details: Wormald International Sensory Aids, 22a Hunter St, Parramatta, NSW 2150. Phone 02 633 4126).

Sansui follows up the widely acclaimed Super Feedforward System with yet another breakthrough.

The Super Feedforward System is a remarkably effective amplifier circuit developed by Sansui and first introduced last year in the widely acclaimed AU-D11 and AU-D9.

Combining a standard negative feedback loop with an error-correction feedforward circuit, it successfully reduces to the very threshold of measurability all types of distortion—including all traces of switching, crossover and TIM.

So how is Sansui improving on this? Easy. We're introducing *two* new competitively-priced Super Feedforward amplifiers, models AU-D33 and AU-D22, along with a matching tuner, model TU-S33. This technological breakthrough means that now anyone can put together a stereo system built around a versatile, high-performance Super Feedforward amplifier.

We invite you to compare the distortion figures of either amp against any others on the market. And when you do, remember that Super Feedforward reduces or eliminates *all* types of distortion, not just harmonic or switching or TIM.

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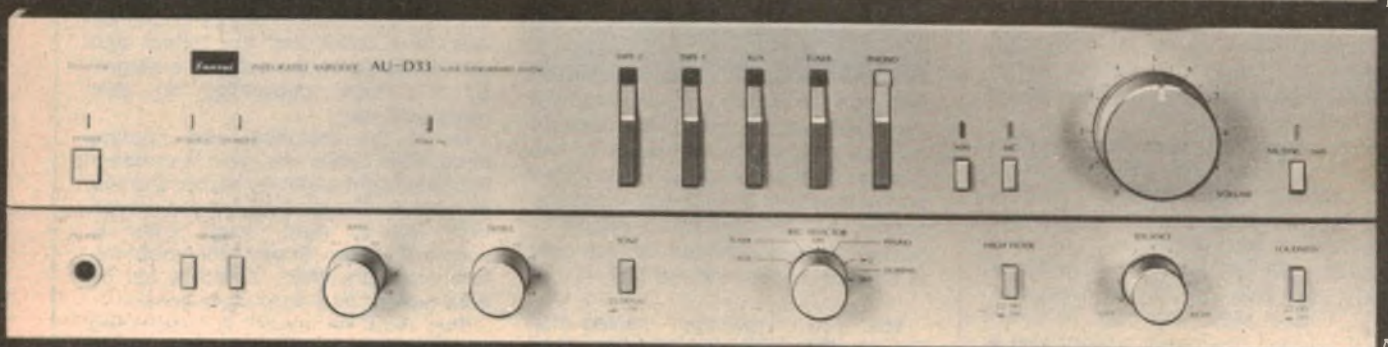

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It looks like a camera but . . .

The Sony Corporation has come up with a development which poses yet another massive threat to the traditional photographic industry — this time aimed at the 35mm slide and print market. It records snapshots on a magnetic disc and displays them on the family TV receiver.

You carry with you what is ostensibly an ordinary single-lens reflex camera, with the usual run of facilities: a range of shutter speeds, exposure metering, information display in the viewfinder, self-timer, indoor/outdoor light filter, automatic frame advance, and so on.

You've already exercised a choice in bayonet style lens, or you may be carrying an alternative lens from the range available: 25mm F2, 50mm F1.4, 4-times zoom (16mm — 64mm) at F1.4. All very ordinary stuff.

But that's external. Inside the new Sony "Mavica" camera, things are different — very different!

Instead of sensitised film, the image is focused on to a solid-state sensor with a matrix of approximately 280,000 elements — 570 horizontal by 490 vertical. After exposure, the stored electronic image is scanned and processed in the manner of a television image, then recorded on a small motor-driven disc within the body of the camera. It is recorded in the form of an FM signal, reminiscent of video cassette technology.

The magnetic disc pack, for which Sony have coined the term "Mavipac", measures 60mm x 54mm x 3mm and weighs a mere 8 grams, being highly suitable for mailing. It can accommodate 50 exposures and can be inserted, withdrawn or re-inserted in the camera at any time, without endangering the "exposed" track segments. Each Mavipac will hold up to 50 exposures and the system has provision for a frame counter and means to prevent accidential erase. However, this can be over-ridden to permit discs to be re-used as many times as desired.

In television terms, the Mavipac can provide a colour image with a resolution of 350 lines, which is well ahead of the 250-line resolution characterising the present generation of video cameras and VCRs.

In normal use, the Mavica camera is used in conjunction with a viewer — styled rather like a small video disc player with remote control. Most obviously, it can be hooked up to a domestic TV receiver or monitor and the individual shots displayed in the manner of slides. But this is only the beginning.

Recordings can be transferred from the Mavica viewer to a normal VCR for assembly into a complete slide show. Sony also envisage that the camera could, in fact, be coupled directly to a VCR in the same way as a normal video camera, so that it feeds a sequence of stills directly to the video cassette.

Yet another potential application is to feed the electrical signals out at an audio rate, so that they can be handled over a telephone line. This would provide the potential for phoning colour pictures to any subscriber who has access to complementary equipment. Alternatively, similar equipment could be used to exchange pictures by means of any ordinary cassette recorders and players.

What about high-speed photography? The Mavica system holds considerable promise in this area. Sony are talking about exposure times as short as 1/2000sec, with some help from the electronics. The camera can also take rapid sequence shots at any speed up to the field rate of the system — 50 or 60 per second. This promises the option of a sequence of stop-action pictures or a virtual moving image of 1 second duration.

And hard copy? Sony are working on that one, too.

Their plans provide for a Mavipac copier and a Mavipac colour printer which will provide colour prints in your hand.

When will all this happen? A footnote to the press notice from Sony Australia says: "We would appreciate you mentioning that the release date is approximately 18 months away."

Different brands but more of the same — cont.

is now being overcome with four-head machines and more attention is being paid to the provision of competitive facilities, and combinations of those facilities likely to have maximum market appeal.

The provision of a Beta recorder with auto cassette change facilities has also captured a lot of attention. Using four cassettes, up to 14 hours of continuous recording is available, broken only by the three 20-second change cycles.

The Video 2000 VCR, pioneered by Philips and using a 2 x 4-hour flip-over cassette, is making a strong impact on the European market and looks like taking up a position somewhere between VHS and Beta. Although portable versions are not expected for another year or more, the domestic version has much to offer.

A notable feature is that the azimuth of the video heads can be varied while in motion, allowing them to read the helical scan tracks under all speed conditions. This makes possible images free of noise bars for all modes including frame-by-frame.

Two separate (not just stereo) sound tracks are possible with this format and one manufacturer has come up with an instant read-out of tape remaining, valid from the moment that a cassette is plugged in. It is accurate to within about one minute either way, which is a lot closer than guesswork!

On the subject of video cassettes in general, mention is made in the Official Fair Manual that Agfa-Gevaert AG are being kept progressively more busy copying photo enthusiasts' films and slides on to video tape — an activity that involves a variety of film formats and speeds, with and without soundtracks, on to any of the major VCR formats. The current throughput is equivalent to about 1600 viewing hours per month.

Presumably, there is strong consumer support for having the transfer done professionally, rather than at a do-it-yourself level.

Not surprisingly, some attention at the Fair was being directed towards the CVC or compact video cassette formats, notably those in which the VCR function is housed within the body

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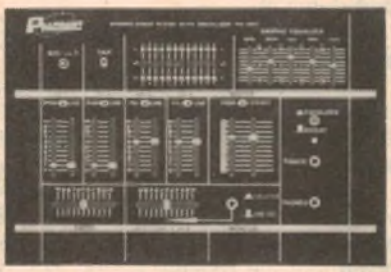

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Mr Hiroshi Kawai, newly appointed Managing Director of Sharp Corp Aust Pty Ltd. Mr Hiroshi is a veteran of the Japanese and American electronics boom, dating back to the '60s and, more recently, had headed Sharp's world-wide export division, based in Japan.

of the camera. But the advice and the mood was not to wait around for a new standard to emerge: While VHS and Beta format portables are bulky by comparison, they are here, they are highly developed and they will do the whole job — portable video recording, home recording, and the playback of rented software.

Other formats are still somewhere down the track.

In the area of audio-hifi, the thinking and the trends in the Berlin Fair were not markedly different from what is evident in Australia.

Thus, while Berliners are geographically much closer to Philips — the home of the new digital audio disc (DAD) — and to Telefunken with their mini-disc, there seems no great urgency to respond commercially. The mood is that there is a lot of life left in the analog disc, with the system's improving technology, and similarly in the latest cassettes and cassette technology.

Both can extend the potential of domestic amplifiers, loudspeaker systems and listening conditions, so there is no great urgency in seeking means to extend them further by means of newer, super-quality discs.

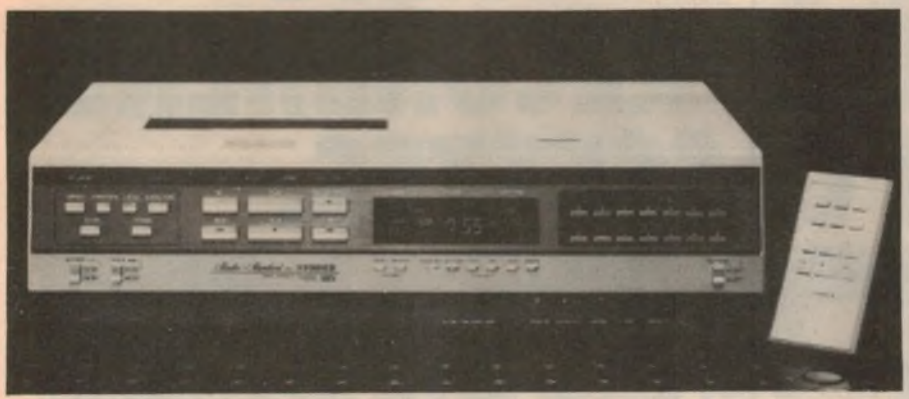
(The Philips compact disc has already been well covered in the Australian technical press. It has a diameter of 115mm and carries its signal in the form of pits which are read from underneath by a laser, much as for the optical video disc. The Telefunken mini discs come in two diameters — 75mm and 135mm — and use a vertically modulated groove with a pressure sensitive piezo-electric transducer.)

A somewhat parallel do-we-need-

PIONEER: New "Champagne Gold" hifi components

Silver — black — gold — silver — black . . . so the fashion changes, from time to time and from brand to brand, in a constant effort to look new and different. This time around, Pioneer have opted for "champagne gold" as the appropriate colour for an expanded range of audio components. Conforming to the general styling, as pictured above, the range includes (from top) seven different phono decks, two AM/FM tuners, six cassette decks, five stereo integrated amplifiers and a graphic equaliser. In addition to the distinctive gold colour, all units feature what Pioneer describes as "Pictographic display", a kind of illuminated panel flow-chart which is intended to indicate "the path which the music is following" through the system.

FISHER (by Sanyo)



When Sanyo Japan acquired the Fisher Corporation in 1977, it decided to maintain the brand and promote it as a second marketing outlet for Sanyo-made products. The first Sanyo-sourced Fisher products will be released on to the Australian market in 1982. They will include three up-market portable tape recorders priced at $399 upwards, and a range of hifi systems starting at around $1500. But perhaps the most interesting development is that the Fisher range will include VHS format video cassette recorders produced in the new factory of Sanyo Tokyo. Beta format VCRs will continue to be marketed under Sanyo's own brand name. For further information: Mr Mike Hart, Australian Sales Manager, Sanyo Aust Pty Ltd, 225 Miller St, North Sydney 2020. Tel (02) 436 1122.

them situation obtains in regard to the new domestic-style digital tape recorders, which were on show. Their specifications far exceed the requirements of the music sources currently available to the amateur.

But, in terms of actual hifi equipment, the coverage of companies and products is the largest single segment of the Fair Manual. About half the company and brand names listed are either unknown or little known in this country. Among them are a few Japanese brands but most are European based.

And, of course, in the lower price area, there was the expected array of clock radios, mono and stereo portables, plus cable-ware, accessories and other gadgetry. But one can see all those in the local shopping centre!

In brief . . .

DIAL-A-RECORD: If some Washington (USA) entrepreneurs can get their act together, it will not be necessary for their clients to visit a record store to obtain their copy of the latest hit release. They will be able to access a digitally sourced master copy in a Los Angeles sound studio, via their normal TV cable link and Westar IV distribution satellite, due to be launched next month. To be able to do this, the customer must have become a subscriber to the service for a base fee of between about $7 and $10 US. This would cover the rental of a decoder which would connect between the cable and his domestic audio cassette recorder — hopefully a high quality unit. To obtain any available recording, the customer would connect up his recorder, dial a given telephone number and the music would be fed to him at (maybe) half the cost of the store-bought album. The Digital Music Company is trying to recruit 5000 customers in five test market areas but the whole proposition rests on the co-operation of major music suppliers and about $20m of investment capital!

SONY CORPORATION is continuing to work on its HDVS (High Definition Video System) confident that it will find increasing application in the future. Basically it uses 1125 scanning lines with 60 fields per second, and involves a video bandwidth of about 30MHz. Sony have developed a high definition camera, video recorder, time-base corrector, fine-pitch Trinitron monitors and a 250cm, high definition TV projector. Sony's objective is to match the definition of 35mm film, thereby offering video as an alternative technique for many applications where film is currently mandatory.

AUDIO ENGINEERS PTY LTD are marketing two new Shure cartridges for use with linear tracking turntables. Type numbered V15LT and M97LT, they are suitable for phono decks such as the Technics SL-10, Revox, etc. The cartridges feature laminated pole-piece structure and telescopic shank design. Adaptors are available for use with tone arms having conventional 12.7mm mounts. Another interesting new release is the MV30HE, an integral high-performance cartridge/shell combination, intended for use with SME series III and IIIs tonearms.

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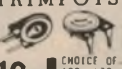

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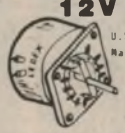

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TDK 8639

Marantz SR 8100DC Stereo Receiver

Capable of high output powers, this Marantz SR 8100DC Receiver has a microprocessor-controlled synthesizer FM tuner which includes three different methods of tuning. These are preset tuning of 16 stations (eight AM and eight FM), automatic tuning and manual tuning. It features a multi-function 24-hour digital clock, which provides four control functions and a "sleep" timer.

The aluminium front panel and knobs are attractively styled in a satin gold anodised finish which should be quite durable. Located on the left side of this panel are five slider controls for a simple "two octave" graphic equaliser. To the right of this equaliser is a multi-function solid-state display, which can provide readouts of either AM or FM, station frequency, stereo, time of day, and timer settings. Normally it displays time of day (on the 24-hour system), but if either AM or FM radio is selected it shows the frequency to which the receiver has been tuned.

Just to the right of this display are 10 pushbuttons and above them is a horizontal strip of eight separate miniature red LEDs, labelled 1 to 8. Pushbuttons 1 to 8 serve to switch-select a total of eight preset frequencies on both the AM and FM bands. Pressing one of these buttons results in a readout of frequency on the display (together with AM or FM as appropriate) and illumination of the LED whose number matches that of the pushbutton. The numbered pushbuttons also double for setting the clock and timer functions.

Another line of rectangular LEDs beneath the digital display serves to indicate amplifier "status" (ON, and coming on/going off), 25kHz shift in FM tuned frequency, and FM signal strength. Below again is a row of small pushbuttons with the first three controlling display of the timer and "sleep" functions, and the fourth shifting the FM tuned frequency up by 25kHz – at the same time illuminating the associated LED.

The remaining four pushbuttons serve as the input (source) selector and are of the "momentary contact" type incorporating miniature LEDs to indicate which input has been selected. In addition, these selector buttons also act as the "on" buttons for switching the receiver "on". If the receiver is switched off, pressing any one of these buttons will switch it on.

To the right again are two rectangular momentary contact pushbuttons for "scanning" (tuning) up or down. They also double for shifting timer displays in certain modes.

Underneath the above pushbuttons is another row of pushbuttons (nine rectangular – lock in, lock off) which select loudspeaker A and/or B systems, equaliser defeat, "subsonic" filter, 8kHz low pass filter, "loudness", "mono", auto/manual tuning, and "threshold" for auto tuning.

On the right hand side of the front panel are four knobs for tape machine selection, volume, balance, and timer/clock function selector. The tape selector switch has comprehensive facilities for not only listening to either one of two decks, but also for recording from tape 1 to tape 2 and vice versa (without affecting other programs passing through the amplifier).

From the foregoing it will be seen that the clock/timer accounts for a large part of the controls and display. It is therefore worthwhile explaining its characteristics and operation.

The clock is crystal-controlled, and runs continuously with four penlight cells providing battery backup when the unit is unplugged from the mains. Whilst ever the receiver is connected to a live power point, clock display is available, with it being permanently on when the receiver is switched "off".

Clock display is always on whenever phono or AUX is selected, but is replaced by either AM or FM plus a readout of frequency when AM or FM is selected. However clock display may be momentarily recalled by pressing the clock "call" button, or left permanently on by pressing the clock "display" button.

Lack of space prevents us from describing the many features provided for programming the SR 8100DC but suffice to say that they are quite complex, allowing you to set it up to record or play any one of a number of sources at up to eight pre-determined times. All of these settings are stored in RAM and will not be lost even if the unit is turned off and mains disconnected, as there is the battery backup supply which also powers the clock circuitry (but not the display).

Being a synthesizer tuner, the SR 8100DC is tuned in discrete steps, rather than being continuously variable. On FM these steps are in 50kHz increments, covering the international band from 87.50MHz to 108MHz. Normally the 50kHz steps cover the standard frequen-

cy allocations, but as some overseas cable broadcasting stations do not comply with the regular channel allocations, Marantz have provided a manually selectable +25Hz frequency shift facility. Selection is indicated by a red LED. In rare cases where a station could suffer interference from an over-modulated adjacent channel, this facility may solve the problem, even though the desired channel would be mistuned.

Use is made of the tuning/scan buttons to tune into a station. This may be done in either an "auto" or "manual" mode. In the auto mode, a scan button is momentarily pressed and the tuning circuitry will automatically tune upwards or downwards – according to which scan button was operated – until the next station's carrier is reached. Tuning then ceases, and the muting is disabled after approximately one second.

In the manual mode, the tuning circuitry only varies whilst a scan button is held pressed. Thus, as with conventional continuously variable tuning, one sometimes overshoots the desired station, and fine tuning is achieved by alternately pressing the upwards and downwards scan buttons. Unless one knows the desired station frequency, manual tuning is somewhat frustrating as the mute is implemented whenever a scan button is pressed – and is not disabled until a second after the button is released. Thus the only indication of an unknown station's carrier is that provided by the signal strength LEDs.

For these reasons most people will prefer to use the automode which makes it relatively easy to sequence through the stations situated in the band. Further, the "scan threshold" switch enables selection of the field strength of stations at which auto scanning is to be stopped. Thus, if only local stations are required, the scan threshold would be set to "HI", but if one wishes to "scan" all receivable stations, set the selector to the "LOW" position.

Tuning on the AM band is carried out in exactly the same way as already described for the FM band. Band limits on AM are 522kHz and 1611kHz, and the normal scanning steps are 9kHz. The same comments as previously made for choice between manual and auto tuning on the FM band apply equally to AM operation.

Scanning from one end to the other on the AM band takes about six seconds, and a "long" 18 seconds on the FM band. Frankly, this reviewer was irritated by the slowness of operation of all tuning functions. Even when changing stations directly by pressing the numbered keyboard buttons, the one-second "muting" delay seems overlong, especially compared with the conventional pushbutton automobile radio (which provides virtually instantaneous change from station to station). One would think that a delay of, say, one-tenth of a second should suffice for muting all switching clicks.

Instead of the usual AM ferrite-rod antenna, the SR 8100DC is supplied with a small loop antenna which may be released from its hinge, and hung on a nearby wall for improved reception. Cord length is one metre.

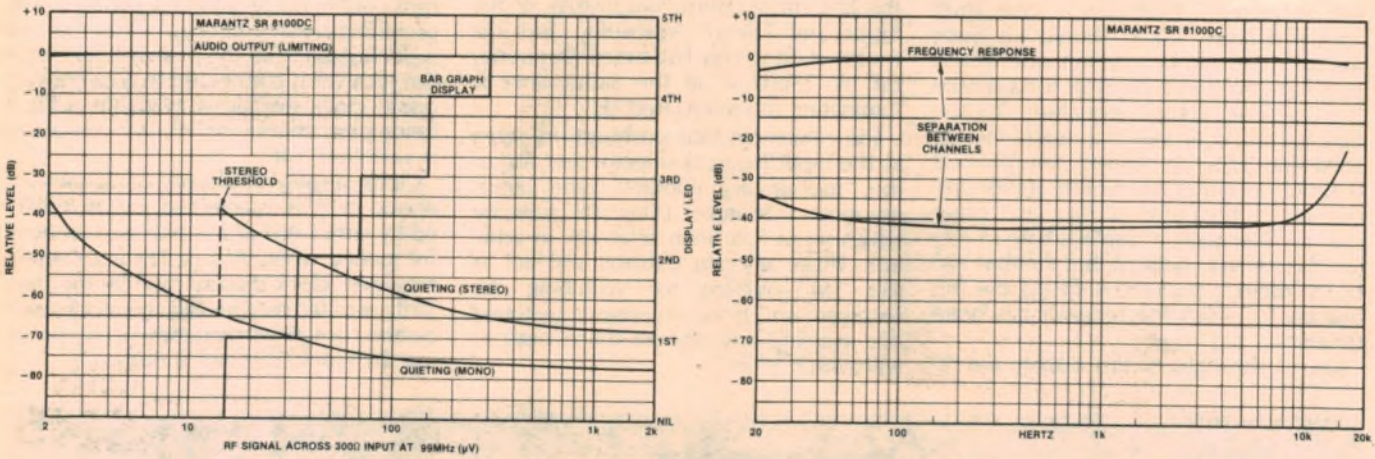
Overall dimensions of this receiver are 416mm wide x 118mm high x 390mm deep, with the mass being 11kg. The 390mm depth could pose problems in some installations.

Marantz specify a power output of 80 watts per channel with 0.03% distortion when feeding 8Ω loads; and 88 watts into 4Ω loads. After our standard one-hour preconditioning at 40% of rated output, we measured the performance of the SR 8100DC. The maximum power output at the onset of clipping, with both channels driven, is 105 watts into 4Ω, 90 watts into 8Ω and 55 watts into 16Ω. With only one channel driven, the figures rose to 130, 105 and 65 watts respectively.

At 90 watts per channel (simultaneously) into 4Ω loads, distortion was 0.01% at 1kHz, rising to 0.03% at 10kHz and 0.05% at 20kHz. At 80 watts per channel into 8Ω loads, distortion was 0.02% at 1kHz, and rose to 0.05% at 10kHz, and 0.07% at 20kHz. For essentially the same distortion, it delivered 50 watts per channel into 16Ω loads.

These are excellent figures, and make the SR 8100DC the most powerful receiver (or amplifier) we have tested during the past year. In common with other high power amplifiers, the case became very hot during these power output tests. So adequate space should be left around and above the SR 8100DC. As usual, all tests were carried out using a regulated 240 volt AC source.

As expected, the SR 8100DC's ability to handle square waves was excellent. A small, well damped oscillation appeared only with capacitive loads of 0.2μF or larger. Tests for stability with sinusoidal input signals and varying capacitance shunting the load, indicate that the SR 8100DC can be considered to be unconditionally stable.



At left are the quieting curves while at right are the frequency response and separation curves for the Marantz SR 8100DC.

Unweighted signal-to-noise ratio on the AUX input measured 81dB with respect to 80 watts into 8Ω, corresponding to 62dB below 1 watt output. This was predominantly hiss, and could be heard on medium sensitivity loudspeakers in a domestic environment.

On the phono input the unweighted signal-to-noise ratio is 78dB with respect to an input level of 5mV at 1kHz, which is state-of-the-art performance.

Phono input overload occurred with 220mV input at 1kHz, which is a more than satisfactory figure. The ultimate sensitivity (to produce 80 watts into 8Ω) measured 2.9mV at 1kHz for the phono input, and 170mV for the high level inputs.

Frequency response on the high level inputs is within ±0.5dB from 20Hz to 25Hz, 1dB down at 35kHz and 3dB down at 70kHz. RIAA equalisation on the phono inputs is excellent, being within ±0.25dB between 30Hz and 20Hz and only −0.5dB at 20Hz.

The separation between channels was

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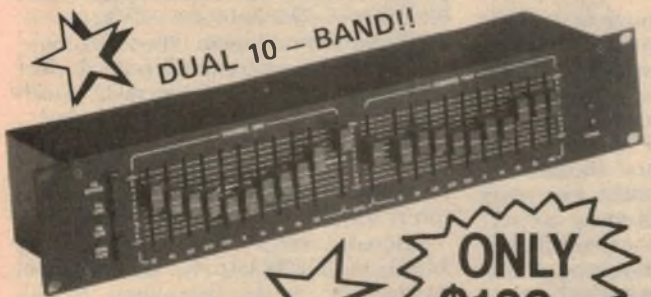

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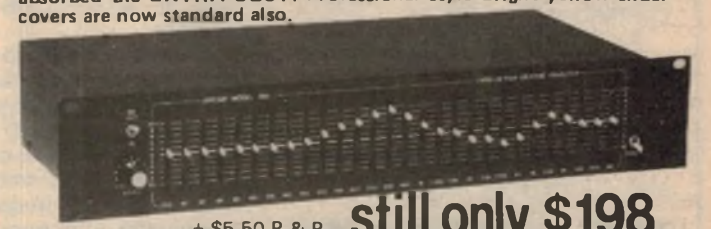

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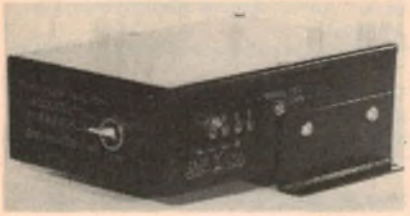

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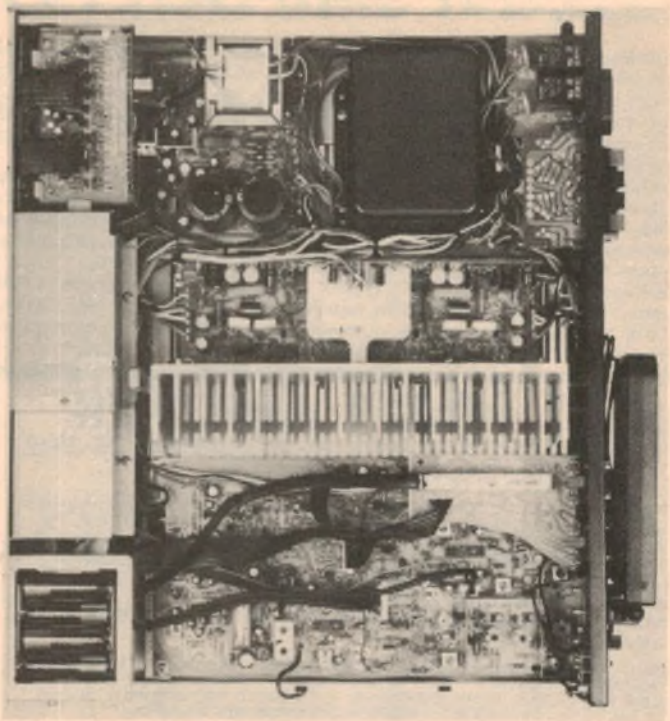
Marantz SR 8100DC



At right, the interior of the Marantz SR 8100DC receiver. Notice the battery compartment for the standby supply.

essentially the same for both phono and auxiliary inputs, measuring 61dB at 1kHz, 42dB at 10kHz and 36dB at 20kHz. Whilst these figures are not as good as those obtained on some other amplifiers, they are better than the figures for most pickup cartridges, FM tuners and cassette decks.

Attentuation rate of the high and low pass filters is a maximum of only 6dB per octave, with the −3dB points being at 50Hz and 6kHz respectively. In common with most other amplifiers this attenuation rate is really too gentle for the filters to be truly effective, and the 50Hz turnover point for the "subsonic" filter means that it can affect the very low frequency content of program material.

The loudness facility lifts the response 2½dB at 400Hz, 6dB at 200Hz, then "shelves" to 11dB at 50Hz. At the high frequency end, the response is boosted 3dB at 5kHz, "shelving" to 6½dB at 15kHz.

As mentioned earlier, the tone controls are in the form of a "two octave" graphic equaliser. Centre frequencies are 50Hz, 200Hz, 800Hz, 3.2kHz and 12.8kHz, with the measured maximum boost and cut being 9dB. At maximum boost, the circuit Q (centre frequency divided by bandwidth) is approximately one. And unlike shelf-type tone controls, all sections have a "resonant" characteristic which results in minimal boosting of subsonic and ultrasonic frequencies.

Turning our attention to the tuner section of this receiver and referring to the quieting curves, it can be seen that the SR 8100DC produces a very good performance, indeed. Note that the RF limiting threshold is reached with some 2 to 3μV input; and that the 50dB quieting figure is achieved for inputs of 3½μV mono, and 35μV stereo. In stereo mode automatic switchback to mono occurs for RF input levels less than 14μV.

An interesting point is the omission of an adjustable muting control. However, as the tuner output is itself muted during any tuning operation (as previously described), provision of the conventional muting control would be superfluous.

Frequency response was within ±0.5dB between 50Hz and 16kHz, falling to −2dB at 30Hz. Separation between channels is displayed on the accompanying graph, and is more than adequate.

Harmonic distortion in the mono mode was 0.11% at 100Hz, 0.17% at 1kHz and 0.3% at 6kHz. In the stereo mode the distortion at 100Hz was 0.15%, at 1kHz it was 0.2%, and at 6kHz it rose to 2%. This latter figure seems to be due to intermodulation with the 19kHz pilot tone in the detector circuit; even though the pilot tone itself is very well suppressed by Marantz' pilot tone cancelling circuit.

In common with most other FM tuners, the AM section is the poor relative. Simple circuitry with high selectivity results in very narrow bandwidth, and thus a severely attenuated high frequency response. At the risk of sounding repetitious, we still believe that manufacturers should provide better quality AM.

Listening tests confirm that this Marantz SR 8100DC is an excellent receiver. It can be thoroughly recommended to anyone interested in acquiring a high quality high-power system.

Recommended retail price of the SR 8100DC receiver is $799 including sales tax. Further information can be obtained from high fidelity retailers, Marantz (Australia) Pty Ltd, 19 Chard Rd, Brookvale, NSW 2100.

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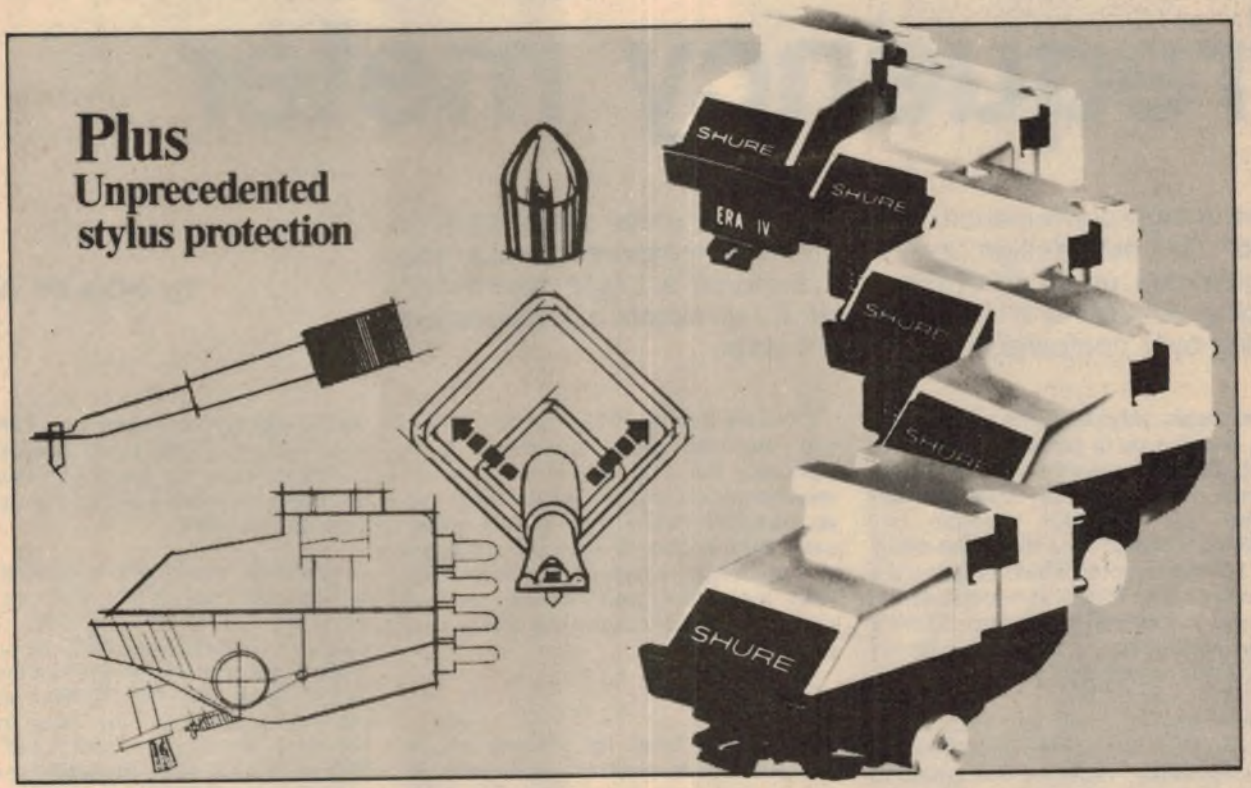

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AE161

Build this up-to-the-minute LSI design

500MHz 7-digit frequency meter

Want a high-performance digital frequency meter that's easy to build? This new design uses just five ICs, measures period and frequencies up to 500MHz, and features a bright seven-digit display. At around $135 for the kit, it represents a considerable saving over comparable commercial units.

by RON DE JONG

Once again, advances in IC technology have enabled us to present a new DFM with better performance, yet fewer components, than any of our previous designs. In 1970, for example, we published a design for a three-and-a-half-digit 70MHz counter which employed a total of 43 ICs. That was superseded in 1973 by a four-and-a-half-digit 200MHz design employing 24 ICs, and followed by 200MHz seven-digit versions in 1977 and 1978 using 12 ICs.

Confirming this trend, our latest offering more than halves the number of ICs used previously, reducing the count to just five (not including the power supply regulators). There is far less internal wiring than before and construction is more straightforward. Construction should take you no longer than three or four hours.

Prototype (below) measures to 500MHz and features period measurement, 7-digit resolution and switchable gating times.

We think that you'll like the new styling too. Because there are fewer components, the PCB assembly is much more compact and fits comfortably into an attractive PacTec high-impact plastic case. Add a fancy Scotchcal front panel and you've got a high-performance DFM with looks and performance to rival commercial units costing many times the price.

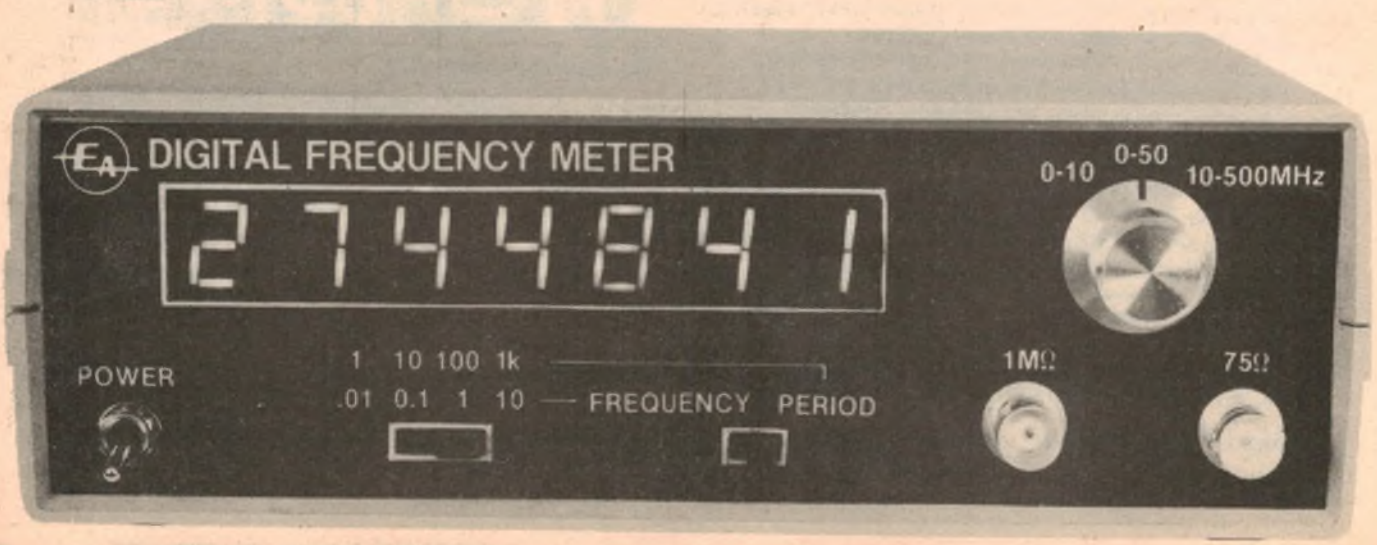
FEATURES

Use of the latest LSI circuitry means new features at minimum extra cost. As can be seen from the photograph, there are just four front-panel controls: a power on/off switch, a gating time switch, a function switch to select frequency or period measurement, and a range switch. In addition, the front panel carries two BNC input sockets and the seven-digit 12.7mm display.

Features not seen on previous "Electronics Australia" DFMs, but included here, are: leading zero blanking; provision for period measurements; and switchable gating times. Our new DFM will also run to 500MHz – compared to 200MHz (max) for previous designs – provided that you build in the optional prescaler circuitry.

Essentially, you have two options when building this new DFM – you can either build the full 500MHz version, or you can save yourself around $30 by building a 50MHz version. If you are not involved in VHF work, then the 50MHz version is the one to go for. All you have to do is leave out the two prescaler ICs (IC4 and IC5) associated with the 500MHz range. More about this later on.

Gating time is selected by a four-position slide switch which selects either .01, 0.1, 1 or 10 seconds. The longer the gating time, the more digits displayed and the greater the resolution. Of course, the update time also increases with increasing resolution. Selectable gating makes for a more versatile DFM – you can opt for fast update times when the situation demands it, or opt for maximum resolution.



Period measurement is another quite useful feature of this DFM and is not normally found on commercial units priced below $1000. It enables very accurate measurements of low frequency signals, ie, those below about 10kHz. In period mode, the gating time selector switch also selects the number of input cycles over which the period is to be measured – either 1, 10, 100 or 1000 input cycles – while the display reads in multiples of 0.1μs. For example, if 100 cycles was selected and the display read 8266312, then inverting this on a calculator gives 120.9729Hz – which is far more accurate than a direct frequency measurement of 120Hz.

The range selector switch has three positions: 0-10MHz, 0-50MHz and 10-500MHz. On the first range, measurements can be made up to 10MHz with 1Hz resolution (one second gating time), while the second range measures frequencies up to 50MHz with a resolution of 10Hz (the input frequency is divided by 10 on this range). The third range is for measurements from 10MHz to 500MHz and, since the input frequency is now divided by 100, the resolution is 100Hz.

As noted earlier, two BNC input sockets are provided on the front panel. One of these has an input impedance of 1MΩ shunted by about 50pF, and is used for the first two frequency ranges up to 50MHz. The second input has a nominal impedance of 75Ω and is used for the third range, ie, 10-500MHz. Input sensitivity is about 10mV RMS up to 30MHz, rising to about 100mV RMS at 50MHz.

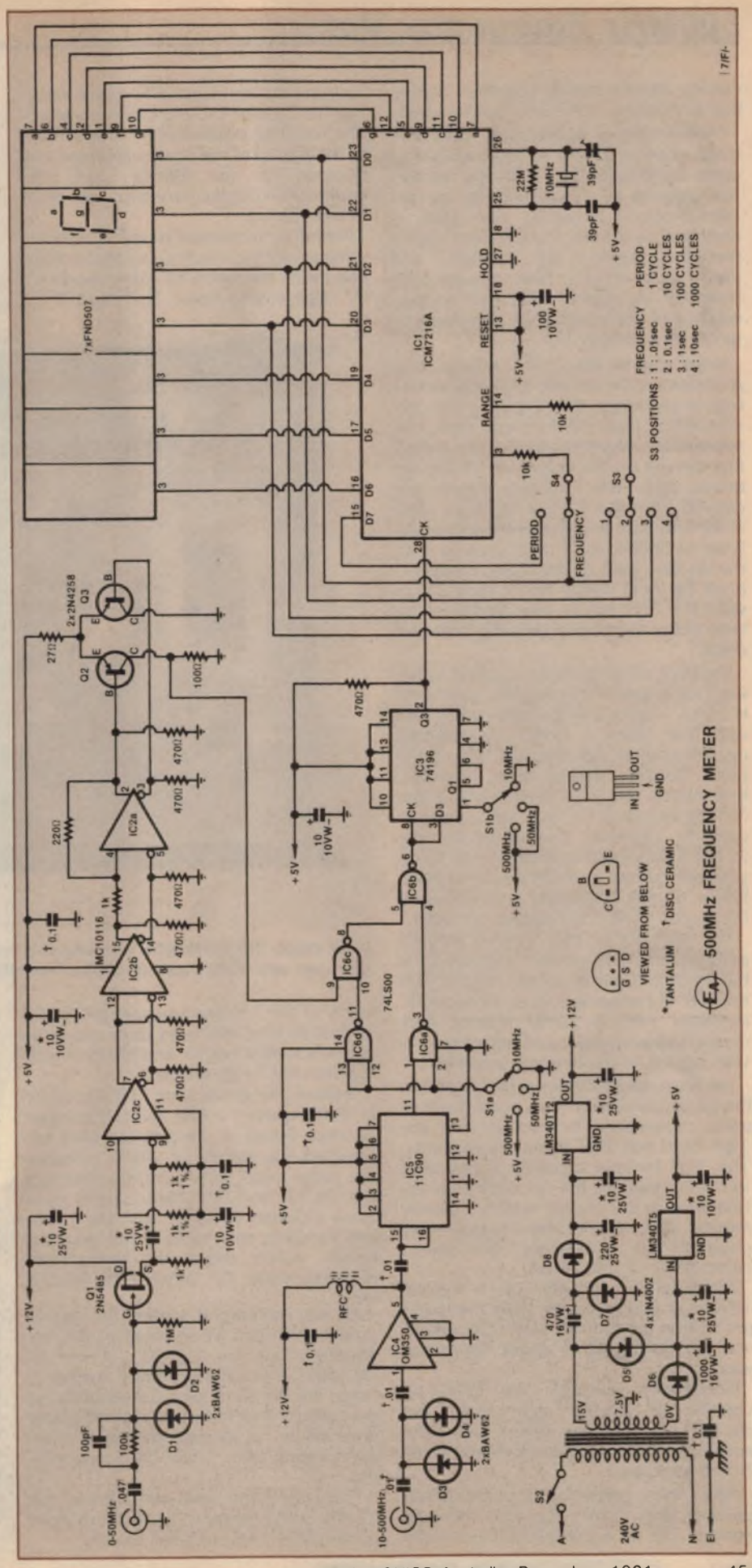
Accuracy of the frequency meter will depend on the accuracy and stability of the crystal timebase. This can be expected to be about 50 parts per million for most available crystals, which is quite adequate for this type of instrument.

Power consumption is fairly modest because of the multiplexed display. The unit is powered from the 240V AC mains and has a current drain of about 300mA from the +5V rail and about 70mA from the +12V rail. Overall power consumption is less than 7W.

HOW IT WORKS

Heart of the circuit is IC1, a 7216A counter chip made by Intersil, Inc, USA. This new LSI chip is virtually a complete 10MHz frequency counter and contains a high-frequency oscillator, a decade timebase counter, an 8-decade data counter and latches, a 7-segment decoder, digit multiplexers, and interface circuitry to drive 7-segment LED displays. All that has to be added to produce a working DFM is a power supply, input preamplifiers and prescalers, a 10MHz crystal, and a LED display.

Referring to the circuit diagram we can see that the 7216A directly drives a 7-digit display consisting of FND507 common-anode 7-segment LEDs. These displays feature large 12.7mm high digits and an integral red plastic filter. This, together with the fact that the displays



can be directly butted together, means that a separate red filter is not required.

Multiplexing is a common technique used when there are a large number of digits in a display since it greatly reduces the amount of wiring and the current consumption. Basically, one digit is displayed at a time, starting with digit 0 then progressing in turn to digit 7 and then back to 0. This sequence is repeated so quickly that, due to persistence of vision, all of the digits appear to be continuously lit.

In the case of the 7216A, multiplexing is performed by pulling each digit driver high in sequence, thus enabling the corresponding digit. At the same time, the appropriate segment drivers are pulled low turning on the segments for the required digit. The multiplex signals are derived from the 10MHz oscillator used in the timebase and the multiplexing rate is set at 500Hz; ie, it takes 2ms to scan the display. Each of the digits, however, is on for only 244μs rather than 250μs since the 7216 has an interdigit blanking time of 6μs to prevent ghosting between digits.

Segment drive current is quoted as being a minimum of 25mA while typically it is 35mA – quite a respectable value and one that gives a bright easy-to-read display even in high ambient light conditions. Readers should note, however, that there is also a "B" version of IC1 (the 7216B) intended for use with common cathode displays. Unfortunately, the 7216B is only capable of providing 10mA segment current and this results in insufficient display brightness, particularly if the popular FND500 displays are used.

The oscillator on the 7216A is actually a high gain CMOS inverter with pin 25 as the input and pin 26 as the output. This inverter is connected in a "pi-network" oscillator with a 22MΩ resistor connected between input and output to provide biasing of the inverter amplifier.

The load capacitance of the crystal in this circuit consists of the crystal shunt or static capacitance in parallel with the 39pF fixed and 39pF trimmer capacitors. The 39pF trimmer capacitor is provided to compensate for the normal frequency tolerance of the crystal, which is usually around 30ppm, and also for any stray capacitance, including the input capacitance of the 7216A.

Temperature stability of a typical 10MHz crystal is better than five parts per million (ppm) from −20°C to +80°C and the aging rate is about 5ppm per year.

Incidentally, although the 7216A is capable of driving eight digits we decided to only use seven, since the accuracy of the timebase does not justify 8-digit resolution.

Apart from operating as a frequency counter, the 7216A can also measure period. This is accomplished internally by using the input signal to gate through the 10MHz clock to the counter section. The resulting count will be proportional to the period of the input waveform and, because of the 10MHz clock, the counter will display period in units of 0.1 microseconds.

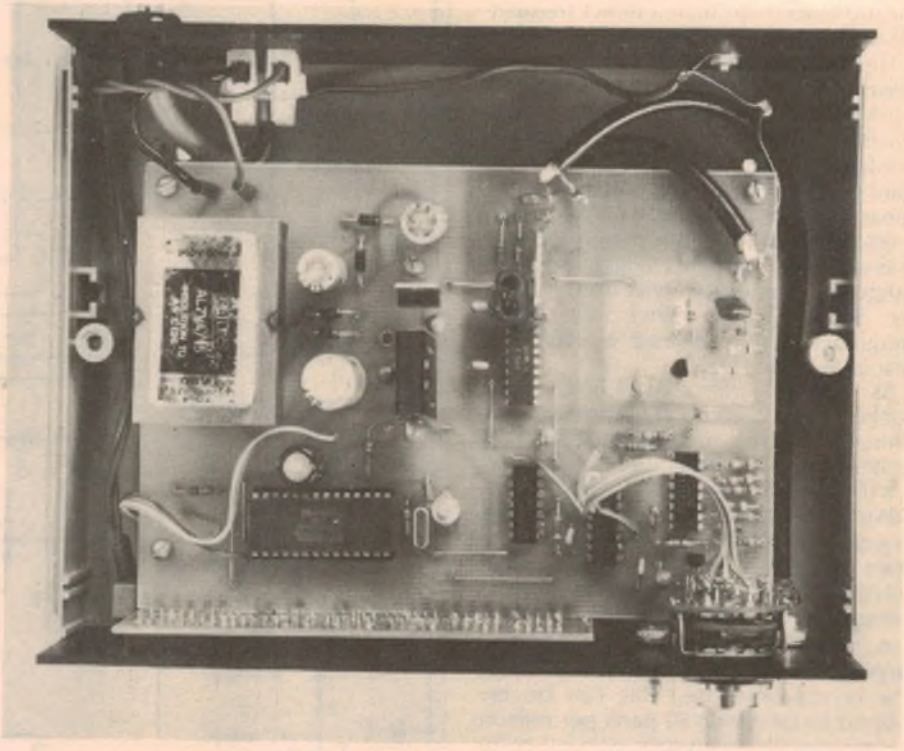
Period or frequency mode is selected using switch S4 which switches the Function input, pin three, to either the D0 or D7 digit enable lines. The internal circuitry of the 7216A compares this signal against its digit multiplex information to see which digit output and hence which function has been selected.

Similarly the gating time of the counter in the frequency mode and the number of input cycles in the period mode are selected via switch S3 which switches the range input, pin 14, to digit outputs D0, D1, D2 and D3. 10kΩ resistors have been included in series with the range and function pins to filter out any fast spikes which might be capacitively coupled from the other digit enable lines.

As we mentioned earlier the gating times which can be selected in the frequency mode are 0.01, 0.1, 1 and 10 seconds. The update times for each range are the same plus 0.2 seconds, so the update time for a one second gating time will be 1.2 seconds and for a 0.1 second gating time it will be .3 seconds, etc.

That covers the basic operation of the 7216A. Let's now take a look at the input preamplifier and prescaler circuits.

Looking at the 50MHz input first, the input signal is coupled in via a .047μF capacitor and a 100kΩ resistor and 100pF capacitor in parallel. Together with two BAW62 diodes, D1 and D2, this input circuit clips the input waveform to 600mV amplitude to prevent damage to the input preamplifier. The 100pF capacitor bypasses the 100kΩ resistor at higher frequencies to prevent attenuation due to the input capacitance of the following FET buffer stage Q1.

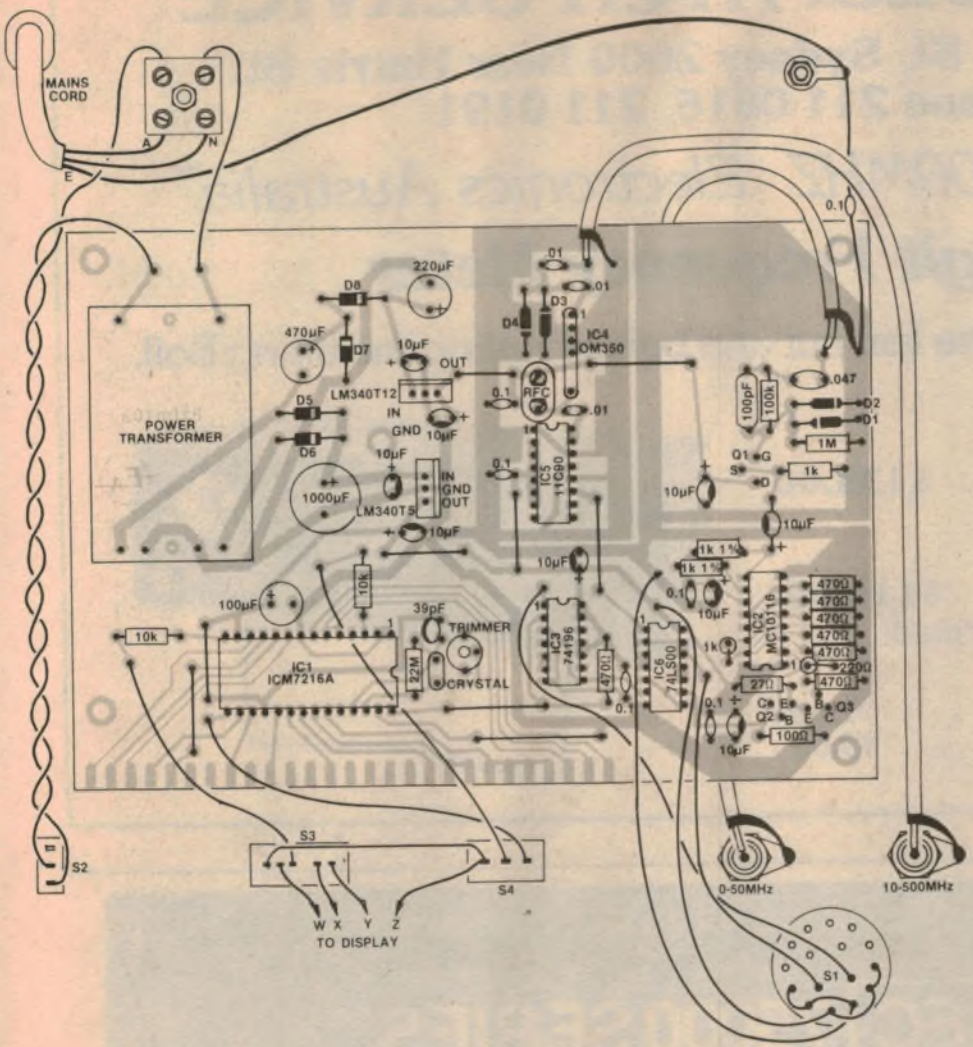


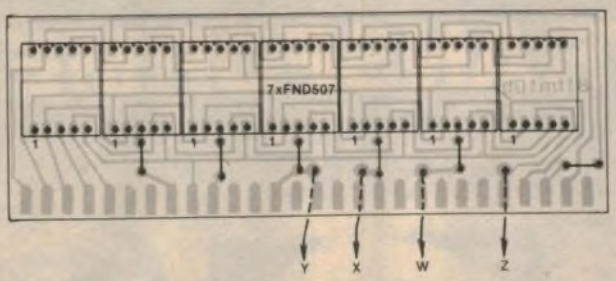
View inside the prototype, showing the completed PCB assembly. Keep all wiring tidy and use 75Ω coax between the BNC connectors and the PCB inputs.

Q1 is a 2N5485 VHF FET arranged as a source follower with the gate connected to ground via a 1MΩ resistor and self-biased via a 1kΩ source load resistor. This drives three cascaded ECL (emitter-coupled logic) receivers IC2c, IC2b and IC2a which comprise an MC10116 triple differential line receiver IC. This basic circuit is used in many commercial designs as well as in the last DFM we described in 1978.

Essentially, each ECL line receiver consists of an NPN differential pair with a constant current source in the "tail" and resistor collector loads. The collector of each transistor is buffered by an emitter follower providing complementary outputs. The emitter outputs are left open – ie, there are no internal pull-down resistors, so that ECL outputs can be OR-ed together to reduce the number of gates in a design. However, in this circuit external pull-down resistors are required on each output.

ECL outputs usually swing ±0.2V about





These wiring diagrams show the PCBs from the component side. The display PCB (right) butts against the main PCB at right angles and is soldered to it via the edge connector strips. Use mains-rated cable for all mains wiring.

PARTS LIST

1 PacTec plastic case, Model CM 86-225
1 printed circuit board, code 81fm0a, 160 × 110mm
1 printed circuit board, code 81fm10b, 115 x 40mm
1 Arlec AL7VA/15 transformer
1 10MHz crystal (parallel resonant)
1 13mm balun core
1 3-pole 3-position rotary switch
1 panel mounting 1-pole 4-position slide switch
1 panel mounting 1-pole 2-position slide switch
2 BNC panel mounting sockets
1 mains cable and plug
1 grommet/cable clamp
1 2-way mains terminal block
2 solder lugs
1 Scotchcal front panel, 197 x 59mm
1 TO-220 heatsink
½ metre 75Ω coaxial cable
1 tilting bail (optional)
4 19mm tapped brass spacers
½ metre 22B&S enamelled copper wire

SEMICONDUCTORS
1 11C90 prescaler
1 MC10116 triple differential line receiver
1 7216A universal counter
1 OM350 VHF preamplifier
1 74196 decade divider
1 74LS00 quad NAND gate
1 LM340T-5 regulator
1 LM340T-12 regulator
4 1N4002 diodes
2 2N4258 PNP transistors
1 2N5485 VHF FET
4 BAW62 diodes
7 FND507 common anode LED displays

CAPACITORS
1 1000µF 16 VW PC electrolytic
1 470µF 16VW PC electrolytic
1 220µF 25VW PC electrolytic
1 100µF 10VW PC electrolytic
5 10µF 25VW tantalum
4 10µF 10VW tantalum
5 0.1µF miniature ceramic
1 .047µF polyester
3 .01µF miniature ceramic
1 100pF ceramic or polystyrene
1 39pF NPO ceramic
1 39pF trimmer

RESISTORS (¼W, 5% unless stated)
1 x 22MΩ, 1 x 1MΩ, 1 x 100kΩ, 2 x 10kΩ, 2 x 1kΩ, 2 x 1kΩ 1%, 7 x 470Ω, 1 x 220Ω, 1 x 100Ω, 1 x 27Ω

MISCELLANEOUS
Mains-rated hookup wire, rainbow cable, machine screws and nuts, solder, etc.

SPECIFICATIONS

RANGES (FULL SCALE): 0-10MHz, 0-50MHz and 10-500MHz (optional).
OPERATING MODES: Switch selectable frequency or period measurement.
SENSITIVITY: 10mV RMS to 30MHz; 100mV RMS at 50MHz; typically less than 200mV on 500MHz range.
INPUT IMPEDANCE: 1 MΩ/50pF on 0-10MHz and 0-50MHz ranges; 75Ω on 10-500MHz range.
RESOLUTION: 1Hz on 0-10MHz range; 10Hz on 0-50MHz range; 100Hz on 10-500MHz range.
GATING TIMES: .01s, 0.1s, 1s and 10s; update times 0.2s longer.
ACCURACY: Typically better than .005% ±1 count uncalibrated.
POWER REQUIREMENTS: 240VAC, 7W.

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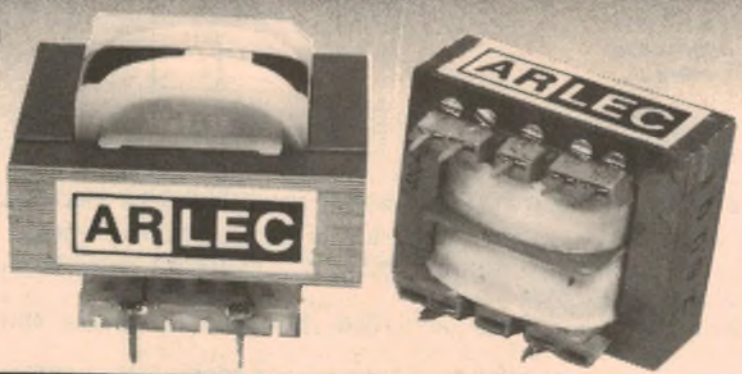

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a reference voltage of around 3.7V. This reference voltage is actually provided by the 10116 on pin 11 and we have used it to bias the first line receiver IC2c via two 1kΩ resistors. A 0.1μF capacitor and 10μF tantalum capacitor provide decoupling of the reference voltage.

The stage following IC2b is IC2a which operates as a Schmitt trigger by virtue of the positive feedback network consisting of the 220Ω and 1kΩ resistors. Input signals to this Schmitt trigger must exceed its two hysteresis trigger levels before the output of the trigger will change, so this stage provides a good deal of noise immunity as well as squaring up the input signal.

Assuming a swing of ±0.2V at the output of IC2a, the hysteresis voltage levels are ±0.15V which is greater than the maximum output offset voltage of IC2b so no bias adjustment of IC2c is required. Incidentally, we can also work out the theoretical sensitivity of the amplifier by dividing the hysteresis voltage by the gain of the two previous stages. This calculation gives a typical sensitivity of 6mV and since the gain of the FET buffer is about 0.5, the expected sensitivity of the unit is about 12mV peak.

The ECL outputs of IC2a are converted to TTL levels by transistors Q2 and Q3, both 2N4258 high speed switching transistors. Since the two ECL outputs from pin 2 and pin 3 swing ±0.2V about 3.7V then either Q2 or Q3 will be on. If, for example, pin 3 is low then Q3 will turn on and Q2 will turn off. Since one transistor will always be on, the current through the 27Ω emitter resistor will be virtually constant at around 32mA or so. The output from the stage is taken from the 100Ω collector resistor of Q2 and will swing between about 0.1 and 3.2V which is directly compatible with the following TTL stage IC6c.

IC6 is a 74LS00 quad NAND gate which we have connected up as a two-input multiplexer. One input, pin 9 on IC6c, goes to Q2 (the 50MHz preamplifier output) while the other input, pin 1 of IC6a, goes to the 500MHz prescaler. One of these two inputs is selected via switch S1a and passed to the output of the multiplexer, pin 6 of IC6b.

With switch S1a set to the 10MHz and 50MHz positions, pin 2 of IC6a is pulled low, disabling it and forcing its output, pin 3, high. IC6d inverts the low signal from S1a, setting pin 10 of IC6c high. IC6c is then enabled and acts as an inverter, passing the signal from Q2 to pin 5 of IC6b. Now since the other input of IC6b is high, the output of IC6b is just the signal from Q2.

When S1a is switched to the 500MHz position, IC6d is enabled and IC6c disabled so that the signal from the 500MHz prescaler is passed to the output of the multiplexer.

THE PRESCALER

The optional 500MHz prescaler circuit is quite straightforward. Diodes D3 and D4 clip the input signal as before, and this is then fed to an OM350 hybrid VHF preamplifier which offers about 18dB of gain. The output of the preamplifier and the power supply are combined on pin five of the OM350.

Power is applied to the OM350 via an RF choke and the output capacitively coupled to IC5, an 11C90 ECL decade divider. Pin 16 of this device is the clock input and pin 15 is an internal bias reference specifically intended for biasing an AC-coupled clock input.

Complementary ECL outputs are provided from the 11C90 as well as a separate TTL output which we have connected to the multiplexer IC6. A separate TTL earth is also provided on the 11C90 so that the crowbar currents of its TTL "totem pole" output stage are not fed back to the input.

So far we have a 50MHz and a 500MHz prescaler and a multiplexer to switch from one to the other. What we also require is a programmable divider to divide by one for signals up to 10MHz and divide by 10 for signals up to 50MHz and from the 500MHz prescaler. This could be done by simply switching a decade divider in or out but we decided to use an electronic switching circuit that avoids taking any signal lines to the range switch.

This is accomplished by using a standard 74196 decade divider which features four outputs (Q1, Q2, Q3 and Q4) as well as four parallel inputs (D1, D2. D3 and D4) which can be loaded into the counter using the load input, pin 1. To get the counter to divide by 10 the load input is switched high and the counter functions normally.

For frequencies below 10MHz switch S1b sets the load input of IC3 (pin one) to ground, which effectively disables the counter and forces the outputs of the counter to follow the parallel inputs. Since we have also connected the multiplexer output to the parallel input D3, corresponding to output Q3 of the counter, the input signal is just passed through as is – in other words it is divided by one.

Note that we have used the Q3 output of the counter rather than Q4 because, if you examine the normal BCD counting sequence, Q4 is low for counts zero to seven and high only for counts eight and nine. Since the 7216A has a minimum input pulse length (50ns high or low), the clock waveform must be as square as possible for it to reach its maximum specified frequency of 10MHz. The Q3 output is high for four consecutive counts and low for six, and thus has the advantage of a much squarer output.

View of the prototype fitted with the optional tilting bail. The 1MΩ input is used for the 0-10 and 0-50MHz ranges while the 75Ω input is used for the 500MHz range.

The electronic switching used in the multiplexer and the divider is slightly more complex than if the signals had been switched directly but it really simplifies construction in that wiring layout is non-critical – at least as far as the constructor is concerned!

One final point about the divider circuit: we have added a 470Ω pull up resistor on the output of IC3, pin 2. This is to raise the voltage level of a logic high from the TTL output to make it acceptable to the CMOS input of the 7216A. According to specifications, the 7216A requires a clock signal of 2.5Vp-p centred about 2V, ie, a high is 3.25V.

The power supply consists of an Arlec AL7VA/15 PCB mounting

transformer which is full-wave rectified by diodes D5 and D6 and filtered by a 1000μF 16VW capacitor. This is then regulated down to 5V via an LM340T-5 three-terminal regulator. The 10μF tantalum capacitors at the input and output of the regulator provide decoupling and stability.

A regulated 12V supply is also provided for the OM350 preamplifier and the FET input stage by using a voltage doubler consisting of the 470μF and 220μF capacitors plus diodes D7 and D8 to generate around 18V. This is then regulated down to +12V via an LM340T-12 regulator.

CONSTRUCTION

Construction is simplified by having all of the components mounted on a main printed circuit board (PCB) labelled 81fm10a and measuring 160 x 110mm. The FND507 displays are mounted on a separate display board labelled 81fm10b and measuring 115 x 40mm. This butts against the main board and is soldered to it via edge connector strips on each board.

The first step in construction is to mount the links, resistors and capacitors on the main PCB. Use the component overlay diagram as a guide to component placement and pay particular attention to the orientation of the tantalum capacitors and diodes. Mount all of the ICs but use a 28-pin socket for the 7216A, which should be left out until the board has been completed.

The appearance of the OM350 bears no resemblance to the familiar DIP or TO-5 can IC package. Instead, it has five leads in line and has a small resin-coated body. It looks rather like a multi-lead miniature ceramic capacitor.

The RF choke forms the output load for the OM350. It is wound on a 13mm balun core with six turns of 22 B&S enamelled copper wire. Carefully scrape away the enamel insulation from the leads before soldering the choke into circuit.

If you elect to leave out the 500MHz range, then omit ICs 4 and 5, D3 and D4, the RF choke, and the four associated 0.1μF disc ceramic capacitors (the 0.1μF disc ceramic on pin 14 of IC6d should be left in circuit). Pin 1 of IC6a should be pulled high by connecting a wire link between the vacant pin 6 and pin 11 holes of IC5.

Mount the FND507 displays on the display board, soldering just two diagonally opposite pins on each display first. Now check to see that the displays are properly seated and aligned before soldering the remaining pins.

The display board and main board can now be soldered together by butting them together at 90 degrees with the tops of the edge counter strips on the display board just visible on the top (component) side of the main board. Solder two of the strips together first, then adjust the boards so that the displays are parallel to the main PCB. Now solder the remaining strips.

We mounted our unit in an attractive PacTec plastic case, Model CM-86-225, measuring 206 x 159 x 64mm. Before drilling the mounting holes it is necessary to fit the Scotchcal front panel. As supplied, the label will not be cut to size so score along the border with a sharp knife, then bend the aluminium back and forth to effect a clean break. Carefully apply the Scotchcal label to the plastic front panel, making sure that it is correctly positioned.

Note: Before fitting, the Scotchcal label should be given a coat of hard-setting lacquer, such as "Estapol", to prevent scratching.

Drill mounting holes for the BNC sockets and switches and file out the square cutouts for the LED display and slider switches. The board is mounted next using 19mm tapped brass spacers and positioned so that the displays just protrude through the front panel. We glued our slider switches into position with epoxy adhesive in preference to using countersunk screws beneath the Scotchcal.

To keep the unit running cool and thus minimise any variation in crystal frequency we recommend that ventilation holes be drilled. In our unit, we drilled a row of five 5mm holes in the bottom of the case, about 20mm from the front, and a second row of five holes along the top of the back panel to facilitate convection.

The LM340T5 5V regulator becomes quite hot during operation and should be fitted with a small TO-220 heatsink. Readers should note that the 11C90 IC also runs quite hot, while the 7216A counter IC gets warm. The transformer also runs slightly warm.

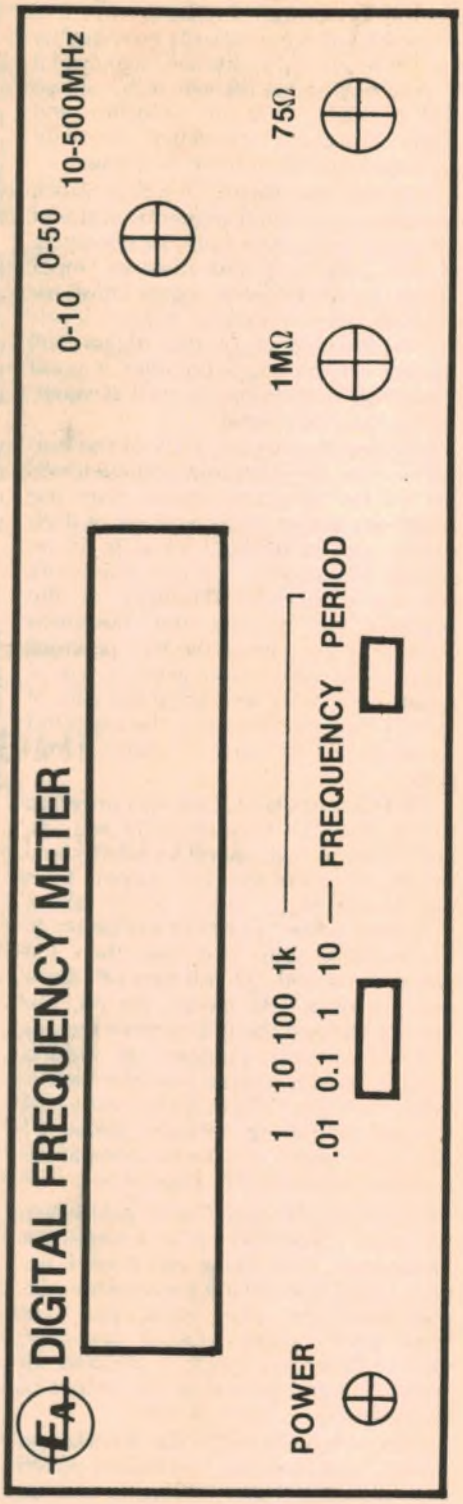
Complete the wiring to the board using the wiring diagram as a guide. Note that 75Ω shielded coax is required to connect the two input BNC sockets to the PCB inputs (see photograph). Rainbow cable can be used to make a neat connection to the slider switches and range switch, and for the four connections to the display board.

The mains cord enters through a hole in the rear panel and is clamped in position using a cord grip clamp. The active and neutral leads are terminated in a two-way mains terminal block, while the earth lead is terminated to a solder lug on the right-hand side of the rear panel (see wiring diagram).

Be sure to use mains-rated wire for connections to the power on/off switch.

A 0.1μF capacitor is used to earth the circuit to prevent interference from noise spikes. This capacitor is connected between the earth lug on the rear panel

FRONT PANEL ARTWORK

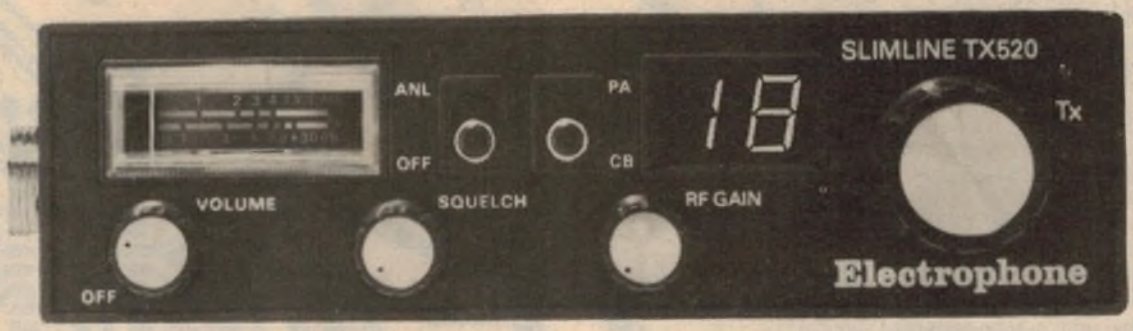


We estimate that the cost of parts for this project is approximately.

$110

for the 50MHz. Extra parts for the 500MHz version will add another $25. These price include sales tax.

ELECTROPHONE



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and the earth lead to the 0-50MHz input preamplifier.

As you may have noticed from photographs of the unit, we installed a tilting bail so that the unit can be inclined for a better viewing angle. For readers who want to add this extra feature, we understand that the bails are available from Radio Despatch Service, 869 George St, Sydney 2000 [phone (02) 211 0816].

Recheck your wiring and component orientation and, satisfied that all is correct, switch the unit on and check the +5V and +12V supplies. If these are OK switch the unit off and insert the 7216A, taking the usual precautions against static damage.

When the unit is subsequently switched back on, the display should show four zeros with the gating time switch set to the 10s position, three in the 1s position, two in the 0.1s position and one in the .01s position. Don't worry if the display shows an occasional low random count. That's just due to electrical noise in the immediate environment getting into the sensitive input stages of the counter and is perfectly normal.

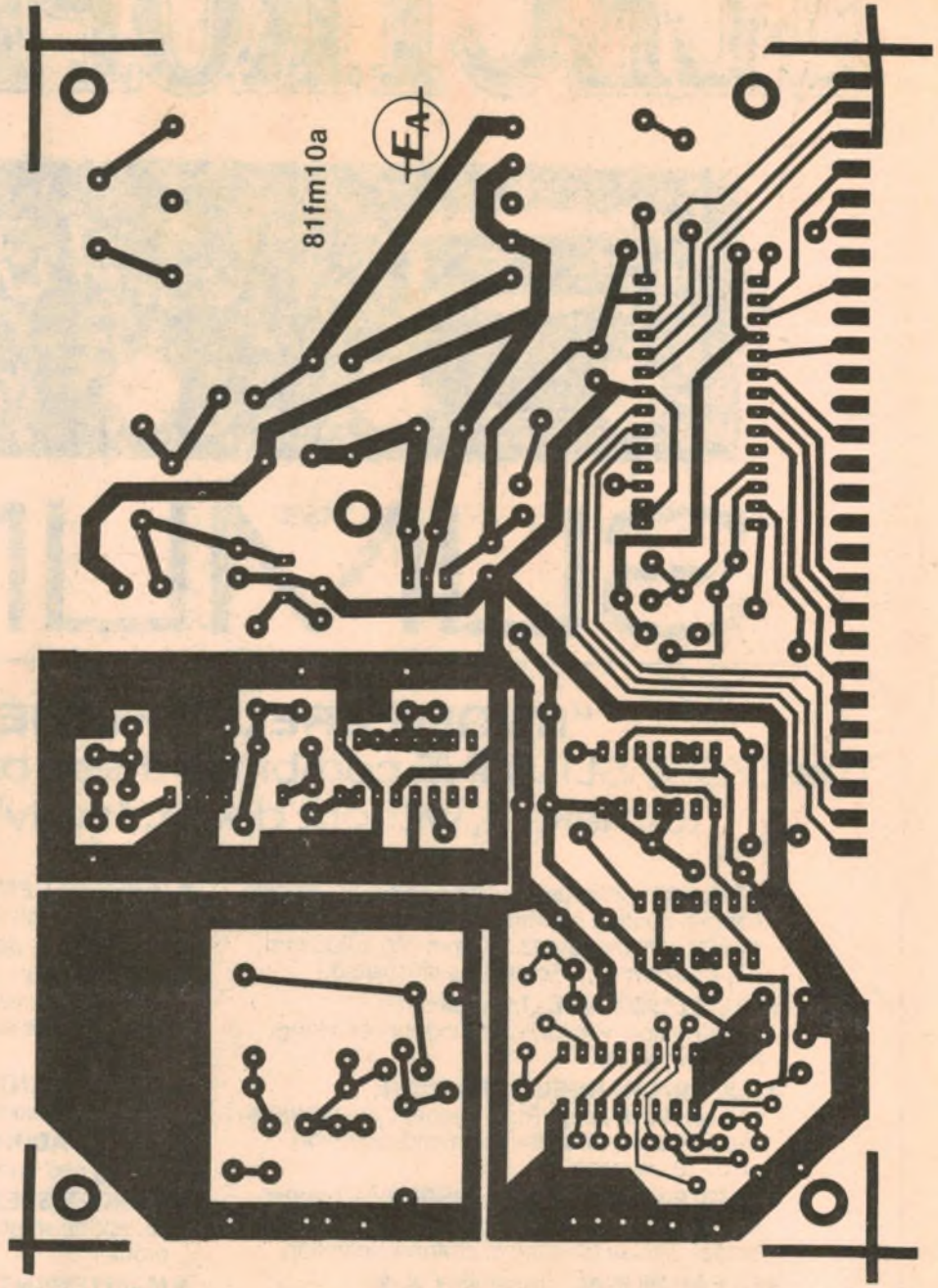
In fact we can use this noise to help check out the counter. As a quick test, insert a short length of tinned copper wire into the 1MΩ input and set the unit to 0-10MHz, frequency and 1s gating. The display should now show a high random reading and, by touching the wire, you may even get all seven digits to light. The other ranges can be checked in similar fashion, the actual number of digits displayed depending on the frequency of the noise.

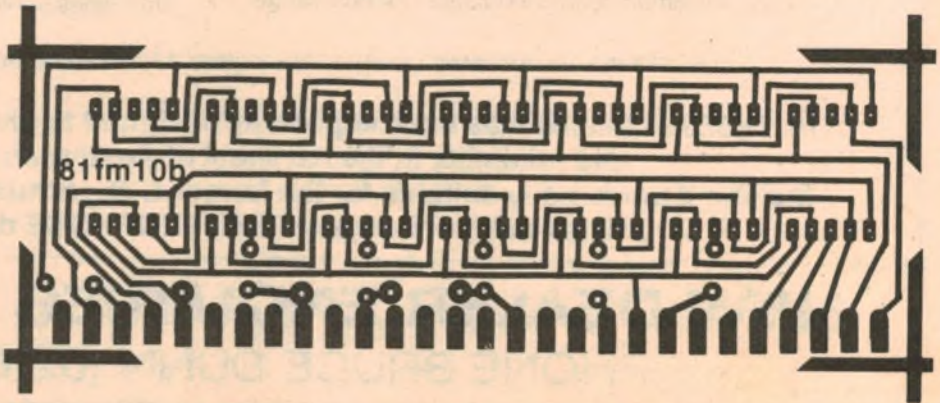
Don't forget to use the 75Ω input for the 10-500MHz range.

If you have access to a signal generator, it may be used to give the DFM a final checkout. Alternatively, you can use the meter to measure several known frequencies, eg, the output of a CB radio or amateur transceiver, or the 4.433619MHz PAL ident frequency found in colour TV receivers.

Accuracy of the frequency meter without calibration is typically .005% ±1 count, which is adequate for most applications. For those requiring greater accuracy, we shall detail an accurate calibration procedure next month. Also featured will be a useful troubleshooting procedure that you can follow in the event of difficulty.

NOTE: We are aware that at least one retailer will be offering a version of this design using the ICM7216B counter IC and common cathode displays. We regret that "Electronics Australia" will not be in a position to offer detailed advice to readers who encounter difficulties with this modified version.





Here are actual-size artworks for the two PCB patterns. Finished boards are available through the usual retail outlets.

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Since we started the Golden Reel Awards three years ago, there have been over 200 recipients worldwide, including six in Australia. More than $200,000 has been donated on their behalf.

Congratulations to all of them. The masters on both sides of the microphone.

AMPEX

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Ampex Australia Pty Ltd, 21 Terra-Cotta Drive, Blackburn, Victoria 3130.

AMP 014

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A special novelty project for the festive season!

Electronic Christmas Decoration

Your Christmas decorations this year can look quite different from your neighbour's with this flashing LED-illuminated Christmas tree picture. Set it up on your wall or mantlepiece as a Christmas conversation piece. It is easy to build and we have provided the artwork for you on the opposite page.

by NICK YULE*

It all came about one rainy October afternoon when one of our staff walked into the Technical Editor and asked, "Whaddawegunnado for Christmas?". In dazed soporific fashion, the Tech Ed, who had been quietly estivating** after lunch and otherwise trying to maintain a low profile, replied, "Whaddya mean whaddawegunnado?". Patiently, it was explained that we should have a special project to help celebrate Christmas.

Needless to say, it just had not crossed the Tech Ed's mind that Christmas would actually occur in December, the issue that he was working on at the time. But then in agile and creative fashion, he cast his mind forward to that festive season: "Christmas trees, presents under the Christmas tree, lights on the Christmas tree and so on". And so it came to pass that these visions were crystallised by a staff artist and are presented here for you to produce your own unique Christmas decoration.

While it is usual for the decorative lights on a conventional Christmas tree to flash on and off at a slow rate, the light-emitting diodes (LEDs) on our Christmas illustration can be arranged to flash in groups of three or four. The LEDs can be obtained in colours of red, green, orange and yellow and these can be intermingled in the four groups or each group can be made one particular colour.

A small printed circuit board carrying two ICs and four transistors drives the LEDs and it can be powered from batteries or a 9-volt DC plugpack. If neither of these are to hand, you can always use a donkey on a treadmill.

There are three parts to the circuit: an oscillator, a counter and an interface. IC1 is a quad two-input NAND gate which is wired as a conventional three-inverter oscillator (the fourth NAND gate is unused). Since both inputs of each NAND gate are tied together, each gate works as an inverter.

The time-constant of the oscillator is defined by the series-connected capacitors at pin 4 of IC1 and the 220kΩ resistor. The series connected capacitors will have an effective value of 2.35μF or half the nominal value of one capacitor.

The oscillator works as follows: Since each inverter has a change in polarity between input and output, the 2.35μF capacitor will be charged alternately in one direction and then the other, forcing all inverters to change state (from low to high or high to low) simultaneously. For example, when the output of IC1c is high and its input is low, the 2.35μF capacitor will charge towards the positive supply to the point where the input of IC1a is pulled high enough to force all the inverters to change state. The square wave output has a frequency of approximately 0.7Hz. Incidentally, the two capacitors are connected back-to-back to effectively produce a bipolar capacitor. If a single electrolytic capacitor was used here it would be reverse-polarised on every half-cycle of the oscillator.

IC2 is a decade counter with ten decoded outputs and a reset connection. We have wired it to count to four and then reset. So instead of counting to ten it counts to four continuously and is clocked forward by each positive transition of the oscillator ouput from IC1c. Each decoded output stays high for one clock cycle which means that each output, and thereby each set of LEDs, will stay on for about 1.4 seconds.

Each decoded output is buffered by a 10kΩ resistor and NPN transistor which drives a maximum of six LEDs via two series resistors. The transistors are the interface mentioned above.

Our prototype used a rough sketch and shows all the LEDs illuminated together.

A CHRISTMAS POEM

It's one thing to call for a project,
That suits the holiday season,
It's another to think up a circuit,
That has any appeal to reason.
But our artist came up with this drawing,
All vibrant in blacks, greens and reds,
So we added a few bits and pieces,
And a dozen or so blinking LEDs.
You can put it together dear reader,
In your holiday leave or your sickies,
So pick up the bits from a dealer,
Like Jaycar, Irving or Dickies.

Anong.

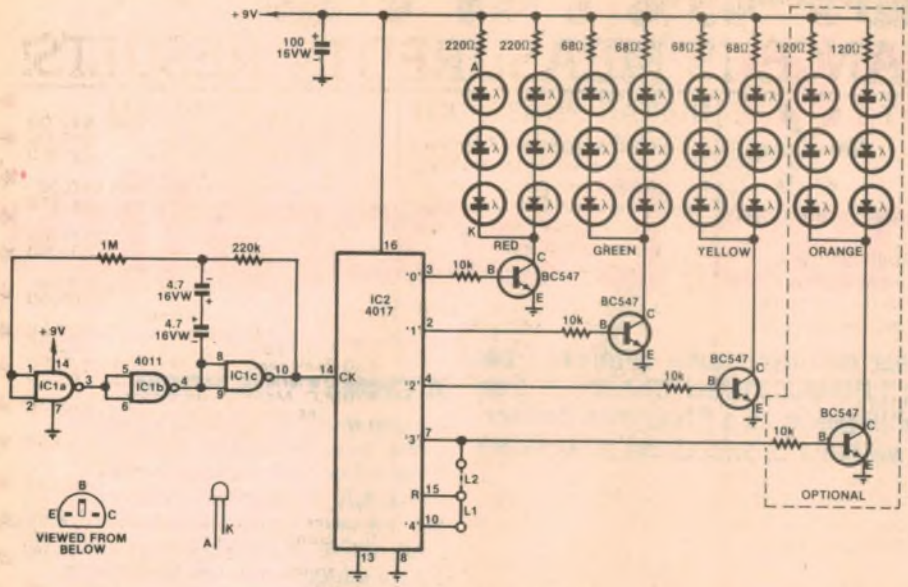
We estimate that the cost of parts for this project is approximately

$15

This does not include batteries or, alternatively, a DC plugpack.

*One of Santa's little helpers.
**Estivating: Habit of some fish, frogs and insects; burying themselves in the mud during a long hot summer.

Electronic Christmas Decoration



EA CHRISTMAS TREE LED FLASHER

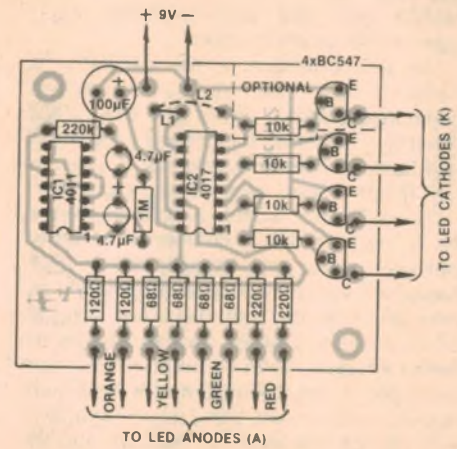
Note the different values of limiting resistors, depending on the LED colours.

PARTS LIST

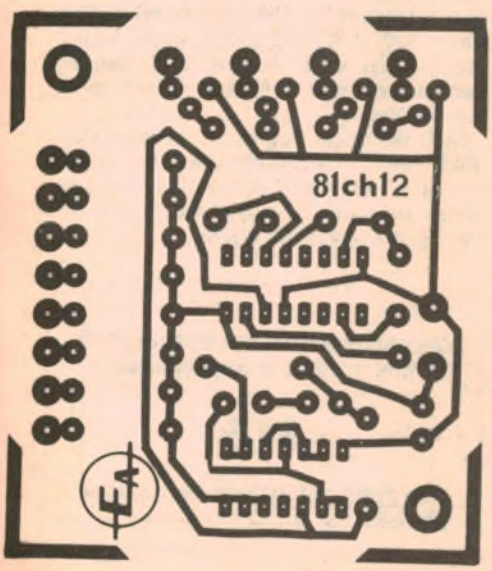
1 PC Board, 69 x 59mm, coded 81ch12
1 4017 CMOS decade counter
1 4011 CMOS quad two-input gate
4 BC547 NPN transistors
24 LEDs, 6 red, 6 orange, 6 yellow and 6 green
1 100µF/16VW PC electrolytic capacitor
2 4.7µF/16VW PC electrolytic capacitors

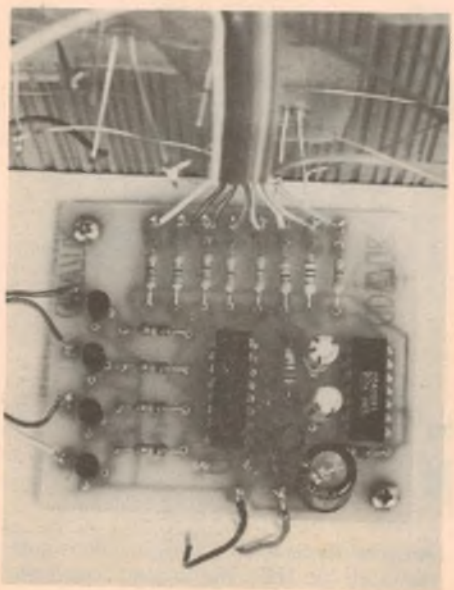
RESISTORS (¼W, 10% tolerance)
1 x 1MΩ, 1 x 220kΩ, 4 x 10kΩ, 2 x 220Ω, 2 x 120Ω, 4 x 68Ω.

MISCELLANEOUS
6 x 1.5V C-size cells, or 1 9V DC plugpack, rainbow cable, hookup wire, timber, PVA glue, solder.



Above is the component overlay for the PC board which is also depicted below.





The circuit can be powered by six 1.5V C-size cells connected in series to make 9 volts or, more economically, from a 9V DC plugpack.

CONSTRUCTION

All the circuit components apart from the LEDs are mounted on a small printed circuit board measuring 69 x 59mm and coded 81ch12. The board may be wired with three transistors and six current-limiting resistors to drive 18 LEDs or, as we wired it,, with four transistors, and eight current-limiting resistors to drive 24 LEDs. If you wish to have the former option, install link two; if not, install link one.

Note that the current-limiting resistors vary in value depending on what colour LEDs you are using. If you wish to mix the colours in a particular string, the limiting resistor value should be 120Ω or selected so that the LED current through a particular string is less than 40mA.

PC pins should be installed on the board to simplify external connections. You will need 15. Install all the resistors first and then the three electrolytic capacitors and transistors. Watch the polarity of these components.

Now remove the CMOS ICs from their conductive foam and install them in the board. Use a soldering iron with its barrel connected with a flying lead to the negative supply input on the board and solder the positive and negative supply pins on the ICs first. These are pins 14 and 7 for IC1 and pins 16 and 8 for IC2. Now solder the remaining pins of the ICs.

THE BIG PICTURE

Cut out the glorious artwork on the page opposite page 53 and use PVA glue to affix it to a sheet of three-ply, hardboard or stiff cardboard which is itself fixed to a suitable piece of timber so that it will stand upright. Punch and drill holes in suitable locations for the 24 LEDs so that they are a push fit. Make sure your hands are clean during this task so that the artwork remains clean.

We fitted LEDs into Santa's eye sockets so that they flash on and off. We used green LEDs here because we thought they looked less gruesome then red. Of course, to be really whimsical, you could have the eyes flashing alternately.

Now install the PC board on the timber foot and wire the LEDs to it in whatever pattern you desire. Now apply power and the four sets of LEDs will flash in a slow sequence. If you wish to speed up the process, you should reduce the 4.7µF capacitors but note that both these capacitors should have the same nominal value.

The betting in the EA office at the moment is that commercial versions of this project will be available for Christmas in 1982. Why not build yours before the trendies latch onto it? And remember, you saw it first in "Electronics Australia". Merry Christmas!

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8 CHANNEL MIXER KIT
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RING FOR THE PRICE

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*8 balanced inputs, 2 outputs * Mic, line, line -20dB inputs * * Input attenuator * Bass, treble and mid range equalisation * * Foldback send, effects send * 19" rack mount * 5 band graphic on masters * VU meters * Console mount version will be available * XL-connectors used.

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Based on Aug. '81 "hobby Electronics"

ONLY $26.50 including all parts

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478M.M. Moving mag. preamp (as above)	$19.50

EA KITS

Graphic analyser EA4/81	$89.00
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P.C. Birdies EA5/81	$14.95
2 channel Infra Red remote control EA5/81	$65.00
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Photon torpedo EA9/81	$29.50
Cassette deck audio test unit EA10/81	$45.00
Jaycar CLEF string synthesiser	$445

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We stock "Blue Chip" 0.1uF By-pass capacitors – low inductance type for de-glitch of RAM & CPU circuits. The inductance of ordinary ceramics does not guarantee suppression of fast rise time pulses. Blue Chips are used by the pro's but you can use them too because they aren't expensive!!

ONLY 30 cents each

They measure a tiny 5mm square.

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$5 – $9.99	$1.00
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EA 500MHz FREQUENCY COUNTER KIT

This fantastic new SECOND GENERATION frequency counter is the result of years of expertise in DFM design at EA. The Jaycar 500MHz DFM conforms exactly to the original EA design. BEWARE OF ADVERTISED KITS THAT DO NOT USE THE SPECIFIED DESIGN OR COMPONENTS. THEY MAY HAVE INFERIOR PERFORMANCE.

STANDARD KIT IN MAGNIFICENT PAC-TEC BOX

50MHz VERSION **$119**

500MHz OPTION ONLY $26 EXTRA

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- runs directly from 240V mains
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- produces high intensity electric field
- output around 7.5KV
- Will not necessarily produce ozone in standard form
- Ideal for those who wish to 'try' an ioniser at an economical price

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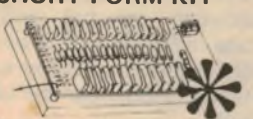

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Based on the short form IONISER.

- redesigned PCB
- High efficiency emitter head
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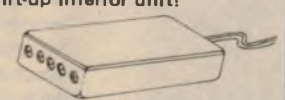
- only 2-core mains flex protrudes from the box

Why not make one as a Christmas present for a friend?

– you can pay over $80 for a built-up inferior unit!



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*12" Woofer 50W nominal C-300L05	$29.95
*8" Woofer 15W nominal C200L09	$12.00
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*5" Wide range 12W nominal C130K03	$9.50
*6" Wide range 20W nominal C160K03	$12.50

We also stock Foster mid-range P.A. Horns & other units too numerous to mention.

DON'T FORGET US FOR ETONE SPEAKERS EITHER!

DRUM SYNTHESISER KIT

JOIN THE DRUM REVOLUTION

Original design from the UK magazine "Electronics and Music Maker" April 1981.

This self-contained unit can produce a variety of fixed and falling pitch effects triggered either by tapping the unit itself or striking an existing drum to which the unit is attached!!

The Jaycar "SYNTOM" Drum Synthesiser comes complete with a high quality PRE-DRILLED moulded all ABS* box (even the lid) with professionally silkscreened front panel. It is not a cheap looking utility box!

FEATURES: Decay from less than 0.1 second to several seconds. Pitch control – sweep control and volume on/off.

These controls, when used in combination with each other enable the most popular drum synthesiser effects heard on commercial recordings to be obtained.

JUST PLUGS INTO ANY AMPLIFIER AND YOU'RE AWAY!!

* Box measures 152 x 80 x 47mm.

As used by WARREN CANN of "ULTRAVOX"

Send $2.00 and SAE for more information.

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Jaycar

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Kit includes detailed instructions

supply, which is included. Also ideal as an FM radio booster too. Instructions included.

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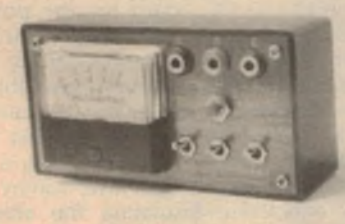


Cat. K-3052 **$19.75**

TV CRO ADAPTOR

This TV CRO Adaptor is an economical alternative to a conventional CRO. It converts any standard TV set into a large screen oscilloscope with a frequency response from 10Hz to 300kHz with a sensitivity of 100mV RMS for full screen deflection. Gives a good display at low frequencies which makes it ideal for all audio and Hi-Fi applications. This adaptor could also be used as a dramatic display for large audiences such as universities, schools, etc., or even a monitor for stereo systems.

Cat. K-3060 **$23.95**

DUAL TRACE CRO SWITCH

Convert your single trace oscilloscope to a dual trace with this money saver. Dual trace CROs have uses in almost every application. In fact, whenever you need to to compare two waveforms, the dual trace CRO is the best answer. Bandwidth is DC to 1MHz, AC 10Hz to 1MHz and Input Impedance is 100k shunted with 30pF.

Cat. K-3065 **$59.50**

DRILL SPEED CONTROL

This unit enables your drill to be slowed down to drill large holes in metal or even to be used as a screwdriver. Circuitry gives good torque at very low speeds. Suitable for most 240V 'universal' brush-type motors, up to 3A rating. The kit is supplied complete, down to the last nut and bolt, and that includes the mains cord/plug and output socket. Assembly instructions provided.

Cat. K-3080 **$13.95**

METAL DETECTOR

An induction balance detector which is the equivalent of detectors that cost hundreds of dollars. All electronic components, meter, box, coil wire etc. is supplied, all you supply is some dowel for the shaft and a former for the coil and you're ready to find your fortune!

Cat. K-3100 **$36.50**

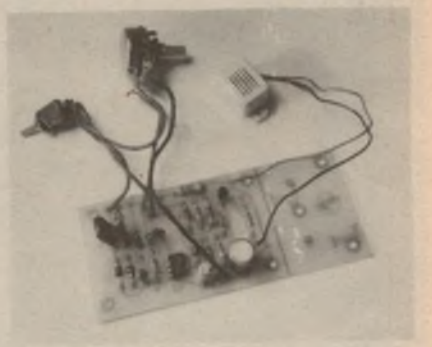
LED TACHOMETER KIT

This kit enables you to get the best from your car's engine. Displays engine speed in analogue form in an illuminated row of LEDS. This form of display indicates your engines performance at a glance. Used with 12V positive or negative earthed systems and only 3 connections are required for installation. Complete instructions supplied.

Cat. K-3240 **$24.50**

SPEED SENTRY

Speed Sentry is an aid to better driving. An alarm will sound (or switch a warning light) when a preset speed is reached. Trigger speed is set by the driver, or at the flick of a switch, a pre-set speed may be monitored.



Cat. K-3245 **$12.75**

CAR ALARM

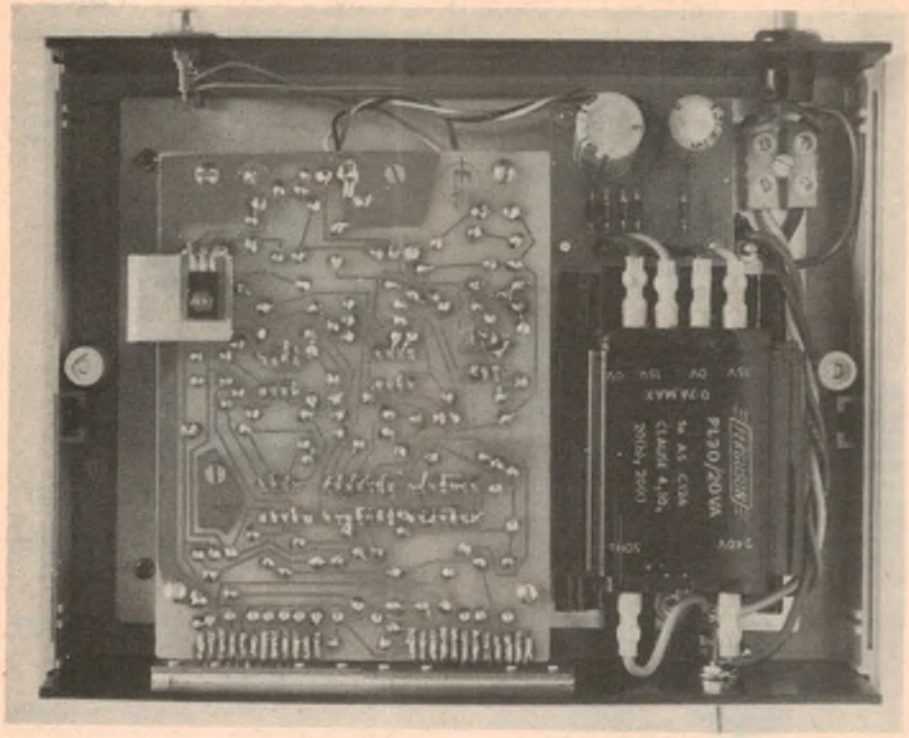
This alarm works on the principle of detecting voltage drop anywhere in the vehicle's electrical system caused, for example, by the interior light coming on when a door is opened, the brake pedal pressing to energise the stop lights, starting the engine, turning the headlights on, etc. It is very easy to install as it simply connects to a point which is normally 'live' at all times e.g. clock or starter solenoid. Facility is also provided for the alarm to be triggered if an external triggering point is earthed, such as the bonnet or boot opening, detection by way of a mercury tilt switch. This alarm includes an LED which flashes once per second when the alarm is set.

Cat. K-3253 **$28.50**

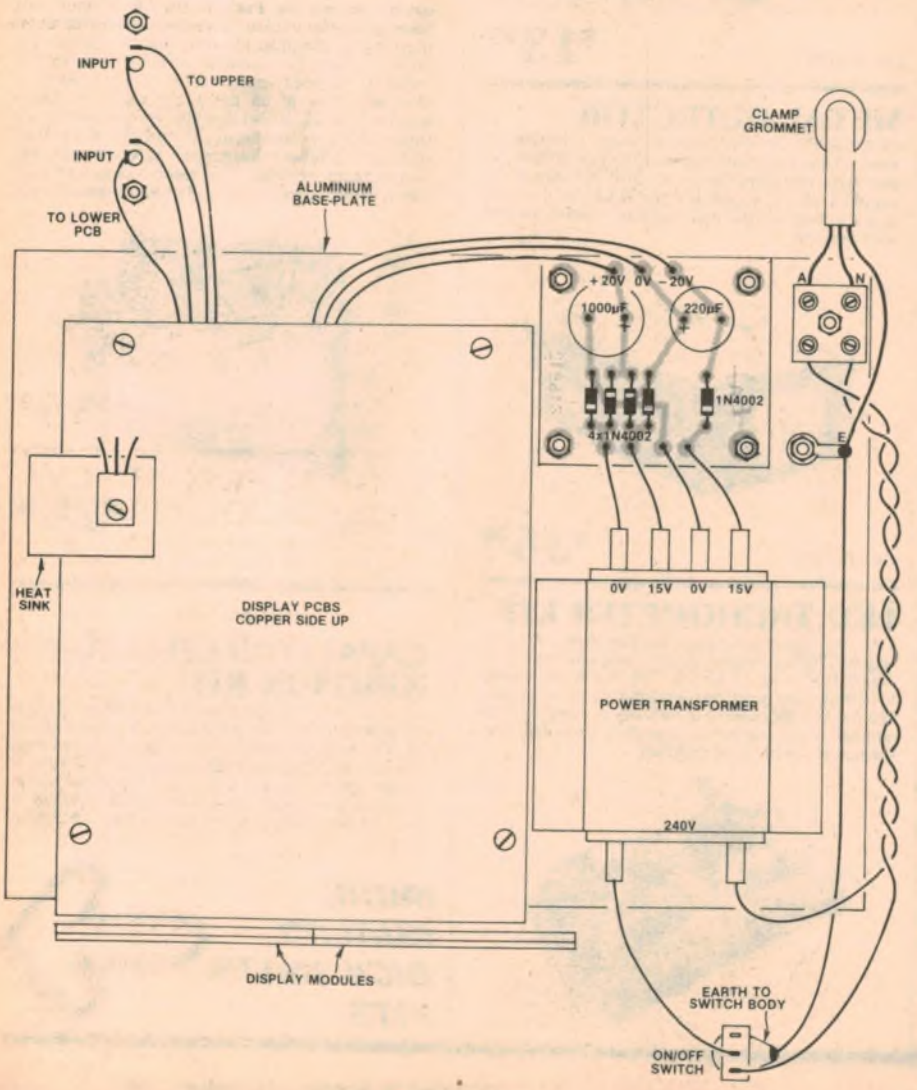
CAPACITOR DISCHARGE IGNITION KIT

All cars with conventional 'Kettering' ignition systems can be fitted with this simple, easy-to-build kit. The kind of results you can expect from using this kit are: Plugs and points last up to 10 times longer, engine stays in tune much longer, vehicle is much easier to start, even on cold, wet mornings. It also simply disconnects back to your standard ignition.

MORE QUALITY DICK SMITH KITS



At right is an interior view of the prototype, together with the power supply and input wiring details.



washer is necessary to isolate the metal of the transistor from the heatsink. No bush is necessary as the body of the transistor has an integral plastic bush.

The LED modules are wired to the PC boards with tinned copper wire and this method is shown on the exploded diagram. The wires are fed into the holes on the modules from the rear of the PC board or the side opposite the LEDs. These are soldered in place and bent upward for 15mm and then bent outward. These wires are then soldered to the copper pads on each PC board.

The spacers can be connected to the top display PC board; the screws to connect them to the PC board should be longer than the spacer so that there is enough thread to screw into the second spacer below the second PC board.

Before actually screwing the second lower PC board to the first PC board, wire the interconnecting wires between the two PC boards and bring wires out from the top PC board for the power supply. With the lower spacers on the lower PC board, the system can be put aside and the power supply assembled.

An aluminium baseplate measuring 180 x 130mm is used to support the transformer and PC boards. This is to keep all the mounting screws within the case, effectively insulating the screws which cannot be earthed to the plastic case. This baseplate is affixed to the base of the case with self tapping screws. A longer screw is used to support the terminal strip. Holes can be drilled in the baseplate for the transformer, small power supply PC board, earth screw and self tapping mounting screws.

The slots for the display LEDs can now be drilled and filed on the front panel as well as the hole for the on/off switch. At the rear panel, holes can be drilled for the RCA panel sockets and cord grip grommet. The entire unit can be assembled and the wiring completed. Note the extra earth lug on the switch body.

The Scotchcal label can be applied to the front panel. Be careful to place it square on; once the label touches the

We estimate the cost of parts is

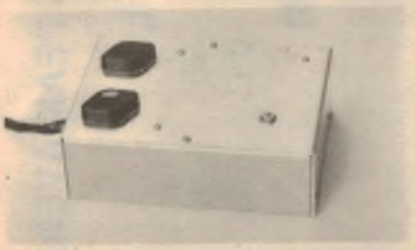
$37

for one display board and

$110

for a stereo unit complete with power supply and PacTec case.

Only top quality components used



Cat. K-3280 **$33.50**

CORE BALANCE RELAY

This kit could save your life and protect your equipment. The Core Balance Relay electronically detects earth fault currents and then trips a relay which cuts the power. The relay cannot be reset until the fault has been corrected. Designed to run to 240V, this unit is portable and built into a tough moulded plastic case. Comes complete with special front label.

Cat. K-3315 **$52**

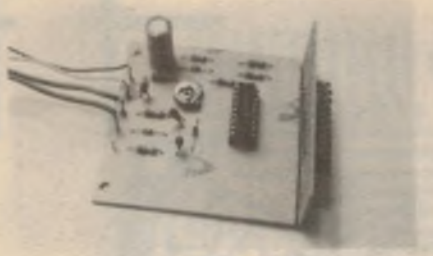
NEGATIVE ION GENERATOR

You've heard about Negative Ion Generators and their benefits, now you can buy the kit and build one yourself. This kit runs on 12V which means that it may be used in your car, as well as making it safer to use. Also includes exclusive Dick Smith emitter head, power pack and tough moulded plastic case. Full instructions supplied.

Cat. K-3335 **$38.50**

LED LEVEL METER

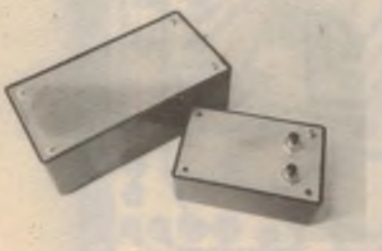
This unit will display the sum of the peak channel output voltages (power), or use two for separate stereo readouts. Readout power level is displayed by 10 green light emitting diodes, one yellow indicating maximum power and red for overload. Full solid-state circuitry, all components mount on a small printed circuit board with the display conveniently attached at right angles for easy mounting of the finished unit. Simple power supply requirement of 10V-16V or DC at 50mA.



Cat. K-3370 **$14.95**

INFRARED LIGHT BEAM RELAY

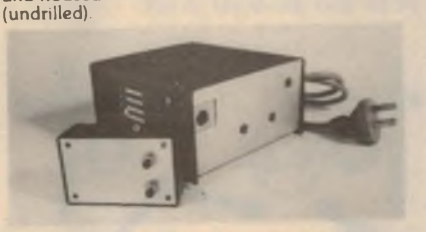
This light beam trigger uses an invisible beam of light which makes it ideal for burglar alarms, photographic triggering, etc. Depending on conditions, this unit has a range of up to 5m and there are no lenses to adjust. Battery power gives the unit around 50 hours of continuous operation.



Cat. K-3375 **$38.50**

2 CHANNEL INFRARED REMOTE CONTROL

An inexpensive 2 channel remote control with a range of 20m and will control 2 appliances independently. Use it to control your alarms, stereo, radio, in fact just about anything you can think of. The transmitter is battery powered and enclosed in a small 'zippy' box whilst the receiver is mains powered and housed in a handsome metal instrument case (undrilled).



Cat. K-3380 **$65.95**

DIGITAL CLOCK/ THERMOMETER

This kit gives you all the features of a digital alarm clock as well as a digital thermometer. The thermometer will display in either Fahrenheit or Celsius and the clock will even turn your radio on for you. Fitted with an alarm (speaker included) and snooze button, the clock is mains powered with battery back-up. No case is included with this kit.

Cat. K-3436 **$49.50**

LEDS AND LADDERS

Based on the old 'Snakes and Ladders' game, we've replaced snakes with LEDs! This kit has been updated with new circuitry and simplified controls so the whole family can enjoy playing. Complete kit includes front panel sticker and 'zippy' box.

Cat. K-3390 **$16.50**

LOTTO/POOLS SELECTOR

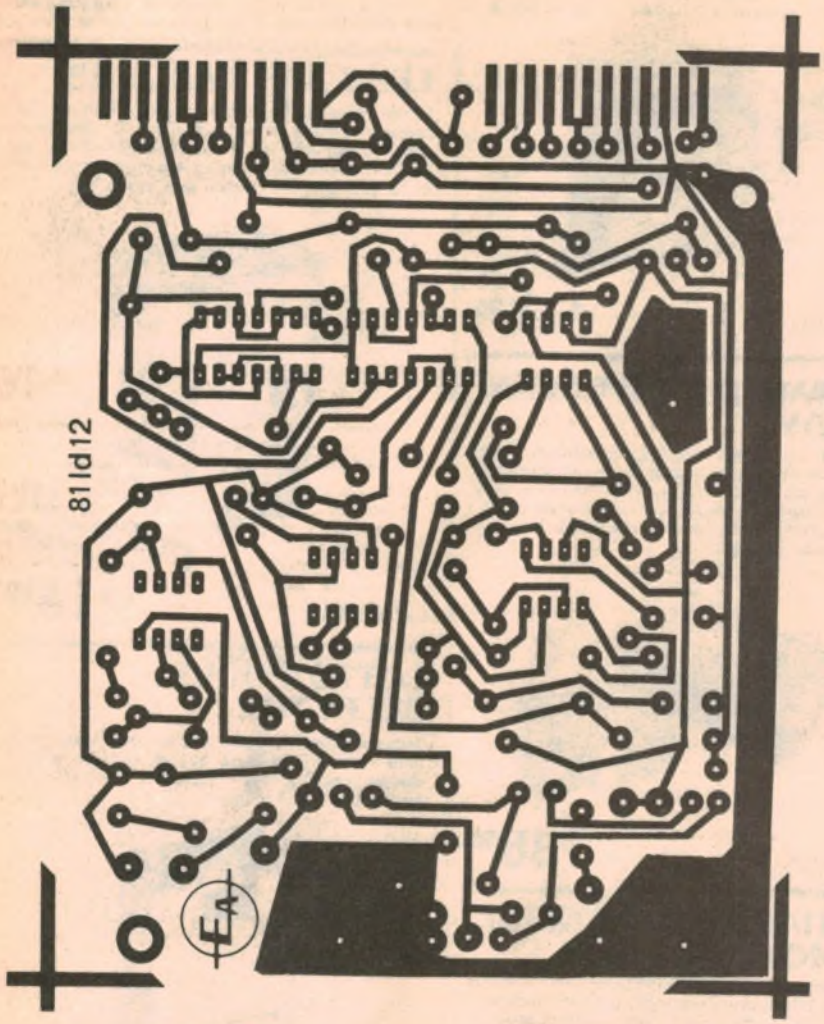
This miniature electronic marvel could help you to your first million! Push button, with large LED display makes it easy. Supplied with an attractive front label. Good luck!

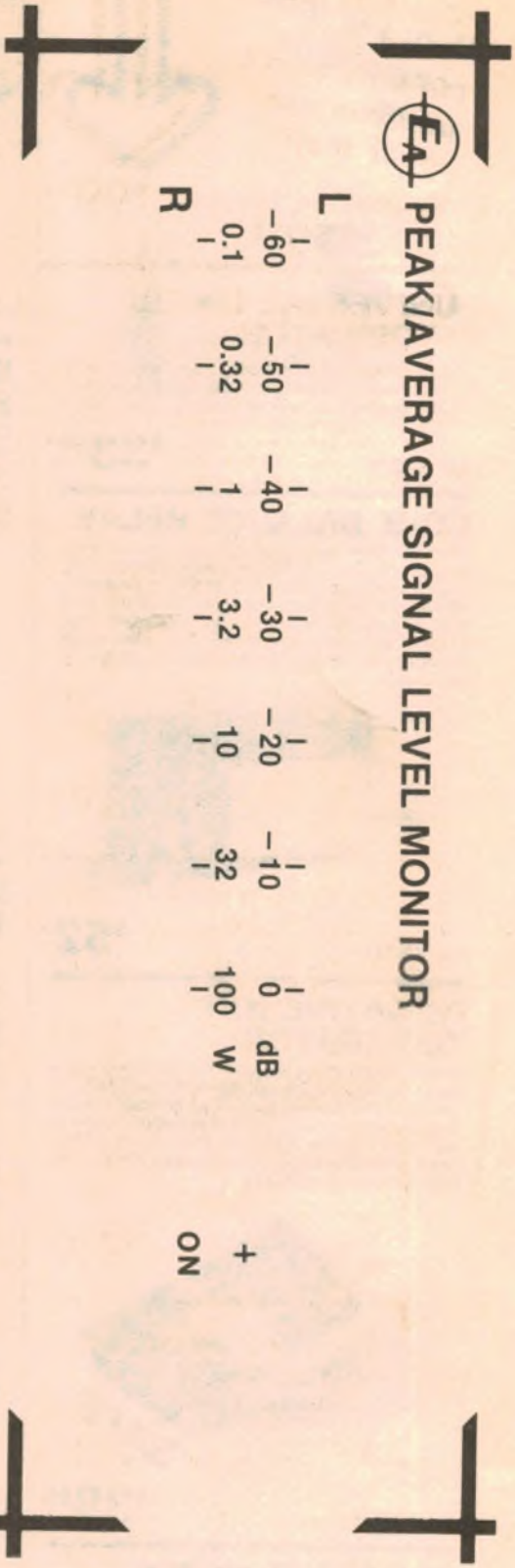
Cat. K-3392 **$19.95**

DIGITAL FREQUENCY/ PERIOD COUNTER

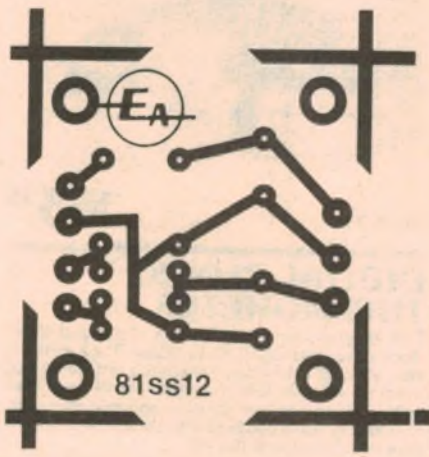
(500MHz with optional prescaler) Not only a frequency meter, but also a period counter for accurate high resolution, low frequency measurements. Based on a design by Electronics Australia DEC 81, this professional class instrument rivals the features of fully built up units many times the price.

MORE QUALITY DICK SMITH KITS





Actual-size artworks for the two PCBs and the front panel.



front panel it cannot be removed without buckling the Scotchcal. Cut the previously prepared holes through the Scotchcal with a sharp utility knife (such as the Stanley brand).

At this stage the offset voltage adjustments can be made. Short the signal inputs and turn up the trimpot closest to the display modules until the two lowest LEDs light. This trimpot controls the offset associated with IC4. By turning the trimpot associated with IC3 (adjacent to the IC4 trimpot) it should now be possible to adjust this until the peak and average indications on the display overlap. This causes the upper LED to be brighter than the lower LED. Now turn down the IC4 trimpot until both LEDs are extinguished. The same procedure should be followed with the second module.

With a program signal applied the LEDs should display a bar and a peak single LED which travels ahead of the main average signal level bar. The sensitivity can be adjusted with the trimpot associated with the op amp, IC1, at the opposite side of the PC board to the offset trimmers.

When all the checks and adjustments have been completed, the display modules can be affixed to the front panel with a few judicious dabs of a suitable epoxy adhesive.

If it is decided that the displays are to be fitted within an existing piece of equipment, the main PC boards can be located at another position, perhaps in a separate housing. The PC boards and the display modules can then be interconnected with rainbow cable. Make sure that the decoupling capacitor for VLED on each display module is bypassed with the 10μF capacitor on the module rather than the main PC board.

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Case extra **$19.95** Cat. H-2505

UNIVERSAL TIMER/ STOPWATCH

All-purpose counter that can be used as a stopwatch, countdown timer or event timer. Large, bright 4 digit LED display and selectable timing rates between 0.01 and 1.0 secs make this timer ideal for sporting events or even darkrooms, wherever keeping accurate time is important. Wiring the unit for any of seven different functions is also possible.

Cat. K-3435 **$39.50**

STEREO BOOSTER AMP

An easy-to-build kit which can economically upgrade the power of your car's stereo radio or cassette to 12.5W RMS per channel. Fitted with a bypass switch for comparison purposes and works with all negative earth electrical systems.

Cat. K-3493 **$29.50**

13.8V 6 AMP PEAK POWER SUPPLY

5 Amps continuous and 6 Amps peak (depending on heatsinks used). This kit includes the M-2000 heavy duty transformer, circuit board and electronic components. This kit does not include case or heatsinks.

Not Illustrated

Cat. K-3449 **$35.50**

VIDEO MODULATOR KIT

This RF Modulator Kit uses only one transistor. The unit is enclosed in a small tinplate box to minimise radiation and all components are mounted on a small printed circuit board. A simple and very useful kit

Cat. K-3462 **$4.75**

LOW DISTORTION AUDIO OSCILLATOR

This Audio Oscillator uses the characteristic low noise of a VMOS device to give an ultra-low distortion output. All the components mount on a single printed circuit board and construction is very straightforward. This kit comes in a sturdy chassis with black perspex front panel, silkscreened with white lettering. LED power indicator also acts as a dial marker.

Cat. K-3467 **$67**

SHORT WAVE ANTENNA KIT

Get the best possible reception from your shortwave receiver with this kit. Specially designed for Dick Smith by an expert in short wave receivers. This kit comes complete and ready to build and needs no soldering.

Not Illustrated

Cat. K-3490 **$9.95**

SOUND LEVEL METER

This unit will measure noise in its many forms. Measures levels of less than 20dB to levels greater than 120dB with fast or slow response times. This allows you to measure peak or average levels. A large VU meter gives easy readings and the meter range is selectable in 9 steps. The kit is mounted in a 'zippy' box and is battery powered.

Cat. K-3476 **$35.50**

BENCHMATE

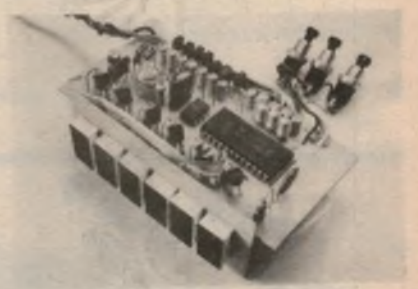
A handy piece of equipment for the test bench. The Benchmate is a regulated power supply, variable between 1.25V and 16V at currents of up to 1A. It also doubles as a audio amplifier capable of delivering a little over 1W rms. The kit comes complete with a sturdy metal instrument case (undrilled), transformer and all the parts and instructions you need, plus a self-adhesive front label for that professional finishing touch.

Cat. K-3478 **$46**

6 DIGIT 12V CLOCK

This extremely easy-to-build clock kit ideal for cars, boats, aircraft, etc. Bright red LED digital readout, large 8mm high, and chronometer accuracy, quartz crystal controlled, this is the only clock kit with seconds display. This kit operates from any 9-19V DC source; use a simple power supply or plug pack for 240V DC operation. Highly detailed instructions included.

Power supply to suit (Cat. M-9514)



Cat. K-3495 **$19.75**

AUTOCHIME

Autochime is an electronic door chime kit based on the latest microprocessor technology. An exclusive design, this unit plays one of 24 different tunes every time you press the front door button. Perhaps you like one tune in particular, this is also possible. This kit contains all parts necessary to built the project.

NOTE: Front panel is supplied undrilled

Cat. K-3502 **$31**

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build - it - yourself computer

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It's the ideal way to start learning about this fascinating branch of electronics.

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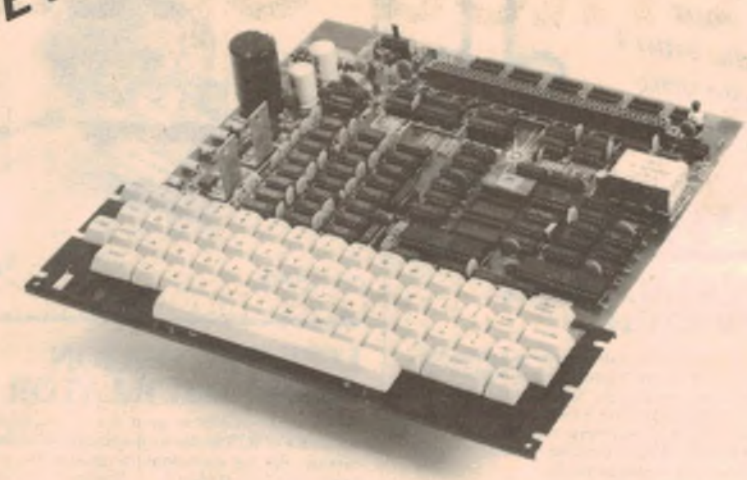

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BASIC KIT ONLY $295
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DSE/A089/LM

Vented Speaker Systems — Pt 3

A computer program to do the calculations

Following up on our series on the design of vented speaker enclosures, a South Australian reader has sent us a program which takes the drudgery out of the mathematics required. Using this program [and a computer!] readers can calculate the best enclosure design for a given speaker, determine the frequency response of an existing design or vary speaker and box parameters at will and simply "play around".

by G. D. MAYMAN

It has been shown by A. N. Thiele in his papers "Loudspeakers in Vented Boxes" (Proc IRE(Aust), 1962, reprinted Jour Audio Eng Soc, May-June 1971) and "Loudspeakers, Enclosures and Equalisers" (Proc IREE, Nov 1973) that the response of a loudspeaker mounted in a vented or sealed box can be accurately predicted, within the piston range of the speaker, where the relevant loudspeaker parameters are known. The mathematics involved are somewhat complex, and the accompanying Basic language program was written to relieve the author of the tedium of performing the necessary calculations repeatedly.

The "piston range" of a loudspeaker is that range of frequencies within which the cone of the speaker moves as a solid rigid piston, and extends from DC to an upper limit which depends on the pnysical characteristics of the cone. As a general rule, the upper limit of the piston range may be found by dividing 12,000Hz by the effective cone diameter in centimetres; thus a 20cm unit with an effective cone diameter of about 15cm would have a limit frequency of about 850Hz. There are many exceptions to this rule however.

When a speaker is operated at frequencies above its piston range, some parts of the cone tend to move out of phase with other parts, and the cone as a whole may be moving in a number of complex modes at the one time. As a result, the frequency response is characterised by a number of very sharp peaks and dips (sometimes only a few Hz wide) and cannot be predicted in any more than very generalised terms.

Within the piston range, however, the loudspeaker and its enclosure have a response identical to that of a multiple high-pass filter, whose response can be very accurately calculated by simple means. If the calculated response shows any peaks or dips within the pass band, the addition of correctly designed filter stages within the driving amplifier may be used to correct these deficiencies, giving a response characteristic which is corrected for both amplitude and phase.

Unfortunately the data normally supplied by loudspeaker manufacturers does not include many of the factors required for these calculations. Thiele, however, shows how to perform various tests to measure the required parameters of the loudspeakers. The test methods are simple and require a minimum of equipment. Most home constructors would have at least some of the equipment, and should be able to borrow the rest.

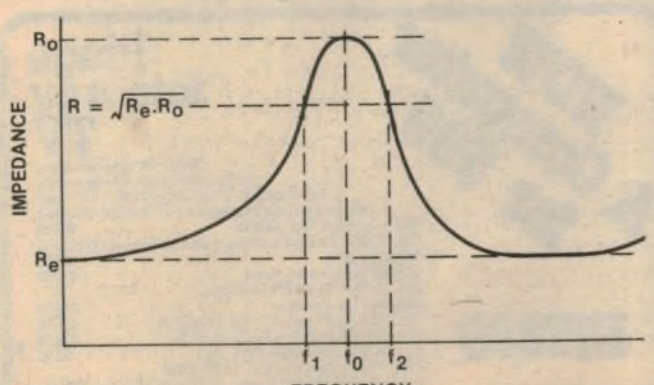

FIG. 1

Fig. 1 Measured impedance of voice coil of woofer in free air, plotted against frequency.

Measuring speaker parameters

Most of the tests require accurate measurements of the impedance of the loudspeaker; I usually use the following method which appears to be sufficiently accurate for the purpose.

Connect a 10kΩ resistor in series with the output of the audio oscillator and set the oscillator for about 10 volts output. Connect the output of this resistor to a high impedance millivoltmeter, and connect together the "earthy" sides of the millivoltmeter and the oscillator. Calibrate the system by connecting a 100Ω resistor across the millivoltmeter terminals and adjusting the output of the oscillator until the millivoltmeter reads exactly 100 millivolts. The 100Ω resistor may now be removed (after switching the millivoltmeter range to protect the meter), and the unknown load connected. The voltage across the unknown load, in millivolts, is numerically equal to the impedance of the load, in ohms, since the initial calibration sets the output current of the oscillator to exactly one milliamp.

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OR BUILD YOURSELF THESE SUPERB ETI 4000/1 SPEAKERS

The ultimate build-it-yourself hi-fi speakers. This is the ultimate performance design by ETI based on the Philips range of high quality drivers. Acoustic suspension design with 4 drivers – each operating only in its optimum frequency range. This gives minimum distortion, maximum fidelity sound – and at a price that's half that of most commercial speakers of this quality. Kit is sold in two parts: the component kit which contains all drivers, crossover components and wiring; and the cabinet which is supplied fully assembled – all you need to do is mount the drivers and wire it up.

4000/1 Speaker kit Cat. CE2430 **$499**
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★ Measures up to 50MHz (optionally 500MHz)
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And the Electronic Agencies kit is absolutely complete – don't buy kits with parts that aren't as specified by Electronics Australia.
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60 keys individually switched contacts.
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Yes, we've expanded our range of hi-fi speakers yet again! This is a top quality unit from the Philips range. Features a 300mm paper cone, rubber surround and very low distortion.
★ 35-1800Hz
★ Resonant frequency 22Hz
★ Magnet mass 850g
★ Power handling capacity 80W RMS max
★ Sound pressure level 89dB 1W/1m
Model number AD12200/W8 Cat. CE2126

New Foster Guitar Speakers $109

Model C380K80 380mm cone; 16 ohm voice coil; 180W continuous power; magnet weight 1821g; cast frame; 80mm voice coil; frequency range 40-4500Hz. Cat. CE2375

Model EE00K08 16 ohm impedance; 50W maximum power; Magnet weight 567.5g; 35mm voice coil; 300mm cone; Frequency range 60-4000Hz. Cat. CE2370
$49.95

A merry Xmas From Bill & Staff

NOW A Computer for $99

ETI660

Plugs into any TV

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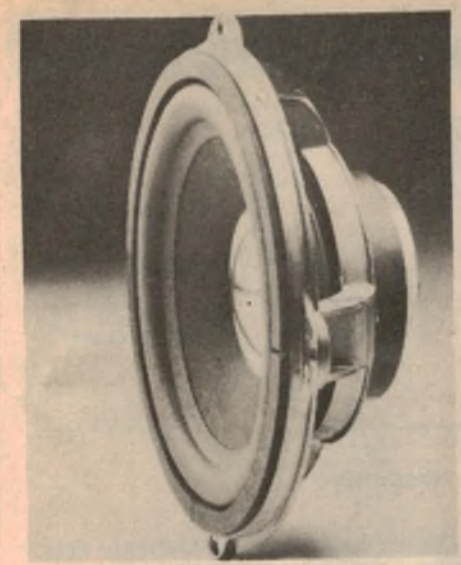
Cat. KE6602 Colour option $13.50
Cat. KE6603 Video RF modulator including die-cast box $14.50
Cat. ME7712 Plugpack to suit 8VAC/1A $11.95
Cat. HE9660 Double sided glass PCB $29.50
Cat. SE1000 Pushbutton keys only $1.90
Extra RAM option: converts to 3K RAM. 4 x 2114 normally $19.80 special price $17.00 Cat. ZE6114



Magnavox 8MV Mk 2 20cm high-power woofer. V_{AS} = 67 litres, f_s = 35Hz, and Q_t = 0.39

The above method is accurate to within 1% for impedances up to about 200Ω but the accuracy falls off as the unknown impedance approaches the value of the series resistor, in this case 10kΩ.

Two series of measurements are required on the loudspeaker. The first is performed with the speaker in free air; it should be suspended by wires so that there is no reflecting surface within about 500mm in any direction. A quiet environment (free from air gusts) also helps. A curve of impedance versus frequency is made, with the frequencies being measured to within 0.1Hz. The curve should have a shape similar to Fig. 1.

The following points should be noted from the curve:

- Re, the impedance at very low frequencies or DC,
- Ro, the impedance at resonance, where the curve reaches its peak,
- Fo, the frequency of the resonance,
- F1 & F2, the two frequencies, one above and one below the resonant frequency, where the impedance is equal to the square root of the product of (a) and (b) above.

The second series of measurements involves mounting the loudspeaker in a vented enclosure – any enclosure will suit, provided the volume is accurately known, with due allowance for internal bracing, ducting on the vent, etc. Thiele used a "calibrated test enclosure" consisting of a large ceramic flower pot with volume exactly one cubic foot (28.32 litres) and with the drain hole acting as a vent to tune the "box" to about 50Hz.

Measurement of the impedance versus frequency characteristic of the speaker under these conditions should give a curve similar to that of Fig. 2. The fre-

```
10 'LOUDSPEAKERS IN BOXES ... TRS-80 LEVEL II
20 'G.D. MAYMAN, 25TH MARCH 1981
30 '
50 GOSUB 1060
100 PRINT
110 PRINT "COMMAND LIST"
120 PRINT"   TYPE S TO AMMEND SPEAKER DATA"
130 PRINT"   TYPE B TO AMMEND BOX DATA"
140 PRINT"   TYPE F FOR FREQUENCY RESPONSE"
150 PRINT
160 PRINT "COMMAND....";:GOSUB 4100
170 IF X$="S" THEN GOSUB 1000:GOTO 150
180 IF X$="B" THEN GOSUB 2000:GOTO 150
190 IF X$="F" THEN GOSUB 3000:GOTO 150
200 GOTO 100:'INVALID COMMAND
1000 PRINT "PREVIOUS DATA ON SPEAKER..."
1010 PRINT "FREE AIR RESONANCE          ";INT(FS*100+.5)/100
1020 PRINT "TOTAL Q IN SYSTEM           ";INT(Q*100+.5)/100
1030 PRINT "EQUIV COMPLIANCE VOLUME     ";INT(VS*100+.5)/100
1040 PRINT
1050 PRINT"INPUT NEW DATA....":GOTO 1080
1060 PRINT "INPUT LOUDSPEAKER DATA..."
1070 PRINT
1080 INPUT"FREE AIR RESONANT FREQUENCY (HZ) ";FS
1090 IF FS<=0 THEN 1080
1100 PRINT"Q OF SPEAKER IN FINAL SYSTEM..."
1110 INPUT "(TYPE 0 IF UNKNOWN)";Q
1120 IF Q>0 THEN 1340
1130 INPUT "DC RESISTANCE OF SPEAKER (OHMS)";RE
1140 IF RE<=0 THEN 1130
1150 INPUT "IMPEDANCE AT RESONANCE (OHMS)";RO
1160 IF RO<RE THEN 1150
1170 R=SQR(RE*RO)
1180 PRINT "WHAT ARE THE TWO FREQUENCIES WHERE THE
1190 PRINT"IMPEDANCE ="INT(R*100+.5)/100
1200 INPUT "    (A) ABOVE RESONANCE....";F2
1210 INPUT "    (B) BELOW RESONANCE....";F1
1220 Q1=FS/ABS(F2-F1)*SQR(RO/RE)
1230 Q2=Q1/(RO/RE-1)
1240 PRINT "THE TOTAL RESISTANCE FEEDING THE LOUDSPEAKER"
1250 PRINT "INCLUDING THE AMPLIFIER OUTPUT IMPEDANCE"
1260 PRINT "          TOTAL WIRING RESISTANCE"
1270 PRINT "          CROSSOVER NETWORK ETC..."
1280 INPUT "TOTAL =";RS
1290 IF RS<.25 THEN PRINT "THAT'S INCREDIBLY LOW!"
1300 Q3=Q2*(RS+RE)/RE
1310 Q=Q1*Q3/(Q1+Q3)
1320 PRINT:PRINT "TOTAL Q IN SYSTEM   ";INT(Q*100+.5)/100
1330 PRINT
1340 PRINT "EQUIV COMPLIANCE VOLUME (LITRES)"
1350 INPUT "TYPE 0 IF UNKNOWN";VS
1360 IF VS>0 THEN 1480
1370 PRINT
1380 PRINT "FROM MEASUREMENTS ON SPEAKER IN VENTED BOX,"
1390 INPUT "VOLUME OF BOX IN LITRES =";VB
1400 PRINT "THE FREQUENCIES OF THE TWO IMPEDANCE PEAKS,"
1410 INPUT"     (A) BELOW THE DIP, F = (HZ)";F1
1420 INPUT"     (B) ABOVE THE DIP, F = (HZ)";F2
1430 INPUT"   AND THE FREQUENCY OF THE DIP (HZ) =";F3
1440 IF F3<=F1 OR F2<=F3 OR F1=0 THEN 1400
1450 VS=VB*(F2*F2-F3*F3)*(F3*F3-F1*F1)/(F1*F1*F2*F2)
1460 PRINT
1470 PRINT "EQUIV COMPLIANCE VOLUME ="INT(VS+0.5)"LITRES"
1480 PRINT
1490 IF Q<.9 THEN 1540
```

(continued on p74)

quencies of the two peaks should be noted and also the frequency, Fb, of the dip between them. Because the dip is "flat bottomed" particular care should be taken in reading its frequency. Thiele used the average of five or more readings to minimise errors, alternately creeping the frequency upwards and downwards towards the dip on each reading.

One other parameter is required to run the program; the "total impedance feeding the loudspeaker", made up of loudspeaker output impedance (usually very close to zero), plus the total resistance out and back of the connecting wires and the resistance of any crossover network used. It is unusual for the total of these impedances to be less than about 0.5Ω. Where the wiring runs extend to more than five metres and a crossover network is used, a typical figure would be (say) 1.0Ω or possibly higher, unless special heavy duty leads were used.

USING THE PROGRAM

Once the above data is available the program may be used to calculate the "optimum" box for a given loudspeaker, or the user may "experiment with" various box sizes and let the program calculate the response in each case until a suitable design is found.

Originally the program shown here was written in TRS-80 Disk Basic and we have modified it to run on a Level II system without disks. The modification required was the elimination of the "DEF FN" statement (allowed by Disk Basic, but not provided in Level II Basic). So that the program can also be run on other types of computers, the author has not used the INKEY statement of Level II Basic, replacing it with a routine using the more widely available INPUT statement.

Users of Disk Basic can restore the program to its original form by adding line 40 as follows: 40 DEF FNR(X)=INT(X x 100 + 0.5)/100 and replacing each occurence of INT(X x 100 + 0.5)/100 with a call to the previously defined function, using the statement FNR (X), or FNR(FS) etc as the case may be. Fifteen lines are affected by this change.

Note that the apostrophes which begin lines 10, 20 and 30 of the program listing are an abbreviation of the REM statement, and should be changed if the program is run on a non-TRS-80 system. Apart from this, no statements which are peculiar to Level II Basic are used in the program, so that it can be run on any computer which uses Microsoft Basic, such as the Exidy Sorcerer or an Apple with floating point capabilities. With some minor changes in the names of variables the program could also be run on the Super-80.

Thiele has shown that the response of

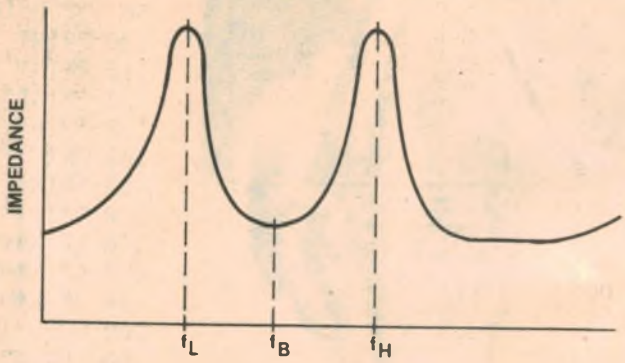


Fig. 2 Impedance versus frequency curve of voice coil of woofer in a vented box. The average of five or more readings should be taken for f_B.

FIG. 2

```
1500 PRINT"Q FACTOR PRECLUDES CALCULATION OF OPTIMISED BOX."
1510 PRINT"TRY"INT(VS+.5)" LITRES, TUNED TO"INT(FS+.5)"HZ"
1520 PRINT "AND EXPERIMENT.":VB=VS:FB=FS
1530 RETURN
1540 PRINT "SHALL I CALCULATE AN OPTIMUM BOX";
1550 GOSUB 4000:IF X$="N" THEN RETURN
1560 PRINT "PLEASE STANDBY....."
1570 FB=FS
1580 VB=SQR(.5)*VS*FS*FS/(FB*FB)
1590 GOSUB 5000
1600 E=LOG(Q*FH/(FS*(1-FB*FB/(FH*FH))))
1610 IF ABS(E)>.1 THEN FB=FB-SGN(E)*FB/20:GOTO 1580
1620 IF ABS(E)>.01 THEN FB=FB-SGN(E)*FB/200:GOTO 1580
1630 PRINT
1640 PRINT"THE OPTIMISED BOX PARAMETERS ARE"
1650 PRINT"        VOLUME";INT(VB*100+.5)/100;" LITRES"
1660 PRINT"        TUNED FREQ";INT(FB*100+.5)/100;"HZ"
1690 PRINT"POSSIBLE VENT DIMENSIONS ARE"
1700 X=FB*FB*VB/3.01E4
1710 S=X*X:IF S<25 THEN S=25
1720 L=S/X-.9*SQR(S)
1730 IF L<2.5 THEN S=2*S:GOTO 1720
1740 PRINT"        AREA"INT(S*100+.5)/100" SQ CM"
1750 PRINT"        DIAMETER (ROUND VENT)";
1760 D=SQR(S*.31831)*2:PRINT INT(D*100+.5)/100;" CM"
1770 PRINT"        TUNNEL LENGTH";INT(L*100+.5)/100;" CM"
1780 RETURN
2000 PRINT "AMMEND BOX PARAMETERS"
2010 PRINT "PREVIOUS PARAMETERS WERE"
2020 PRINT"        VOLUME";INT(VB*100+.5)/100;" LITRES"
2030 IF FB=0 THEN PRINT     "SEALED BOX":GOTO 2070
2040 IF S>0 THEN GOSUB 1740:GOTO 2060
2050 GOSUB 1700
2060 PRINT"        TUNED FREQUENCY";INT(FB*100+.5)/100;"HZ"
2070 PRINT"NEW DATA....."
2100 INPUT"     VOLUME (LITRES) = ";VB
2110 IF VB<=0 THEN 2100
2120 PRINT"     TUNED FREQ (HZ) = "
2130 INPUT " (IF SEALED OR UNKNOWN, TYPE 0)";FB
2140 IF FB>0 THEN RETURN
2150 PRINT"    VENT AREA (SQ CM)"
2160 INPUT"  (TYPE 0 IF SEALED)";SA
2170 IF SA=0 AND FB=0 THEN RETURN
2180 INPUT"    TUNNEL LENGTH (CM)";LA
2190 LA=LA+.9*SQR(SA)
2200 FB=SQR(3.01E4*SA/(LA*VB))
2210 PRINT"        TUNED FREQUENCY =";INT(FB*100+.5)/100;"HZ"
```

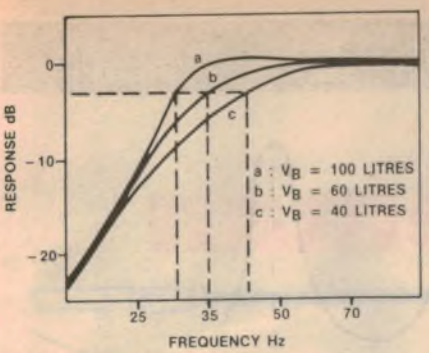


Fig. 4

Response curves for the Magnavox 8MV Mk2 with three different box sizes.

any loudspeaker mounted in any box can be predicted with great accuracy where the parameters are known, and a relatively simple equaliser may be devised to be incorporated into the amplifier at a suitable point to give an overall flat response within a specified frequency range. This approach is little used, although it allows a very marked extending of the low frequency response of a small speaker system.

The reader is strongly urged to obtain a copy of Thiele's later paper on the subject. Even if the mathematics are above one's level of comprehension, the various aspects of the subject which are discussed, particularly in the latter parts of the paper, are very interesting, and open up a wide field of possibilities for the creative designer who wants to get that little bit more out of his system.

Vented speaker systems by computer

```
2220 RETURN
3000 PRINT "FREQUENCY RESPONSE"
3010 X=1.258925:F=10/X
3020 N=0
3030 F=F*X:F=INT(F*100+.5)/100
3040 UA=FB*FB/(F*F)
3050 UB=FS*FS/(F*F)
3060 UX=1-UA-UB*(1+VS/VB)+UA*UB
3070 UY=FS/(F*Q)*(1-UA)
3080 E=1/SQR(UX*UX+UY*UY)
3090 E=20*LOG(E)/LOG(10)
3100 PRINT"F ="F,INT(E*100+.5)/100;"DB"
3110 N=N+1:IF N<10 THEN 3030
3120 IF F>900 THEN RETURN
3130 INPUT"TYPE 1 TO CONTINUE";S$
3140 GOTO 3020
4000 INPUT " (Y OR N)";X$
4010 X$=LEFT$(X$,1)
4020 IF X$="Y" OR X$="N" THEN RETURN
4030 GOTO 4000
4100 INPUT X$
4110 X$=LEFT$(X$,1)
4120 RETURN
5000 REM CALCULATE FREQUENCIES OF IMPEDANCE PEAKS
5010 X=1/(FS*FS)
5020 Y=(1+VS/VB)/(FB*FB)
5030 Z=2/(FS*FS*FB*FB)
5040 X1=X+Y:X2=SQR(X1*X1-Z-Z)
5050 FH=SQR((X1+X2)/Z)
5060 FL=SQR((X1-X2)/Z)
5070 RETURN
```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The Serviceman

How to "reorganise" a frustrated musician!

While youth has its undoubted advantages, I am glad that, as a neighbourhood serviceman, I have been around long enough to build up a friendly clientele, plus a reasonably broad background of experience. As you might imagine, I am about to share a couple of experiences which should support that sentiment.

The first involved a nearby resident who, amongst other things, is a keen amateur organist. On this particular Saturday afternoon, he had elected to eliminate a few extraneous noises in his own instrument by cleaning the note and rocker contacts with a small paint brush moistened in WD-40. I gather that it was a job he had done on other occasions quite successfully.

Unfortunately, on this occasion, it didn't work out that way. When he lowered the manuals back into place, the instrument was completely mute. That would have been disturbing enough at any time but the whole purpose of the exercise had been to facilitate some serious practice for a church function next day.

Hence his apologetic but urgent telephone call: "Please . . . could I pop in and find what he had done wrong?"

I have the average serviceman's enthusiasm for Saturday evening house calls but, if one's business depends on the goodwill of the local community, personal emergencies have to be recognised. So I found myself faced with an unfamiliar instrument, aided only by an unfamiliar circuit that had been photo-copied too many times for its own good!

Yes, the instrument had been working right up to the time when the owner had decided to "fix" it. There was a certain irony in his explanation.

But all he had done was to lift up the hinged sections carrying the rockers and the respective manuals and clean the contacts. Nothing else had been touched.

However, it seemed reasonable to assume that he had inadvertently shorted a signal or supply line, perhaps by nudging a contact or a component. So I proceeded accordingly – and gingerly!

When I switched the organ on, there was a sound of some activity down in the bowels of the instrument, which the owner said was the mechanical noise of the rotating Leslie speaker. But there was certainly no signal, no amplifier noise, and not even an indicator "on" light.

Presumably the amplifier was dead.

Round the back of the instrument I spotted a screw-in fuse and it didn't take long to establish that the fuse wire was smeared all over the glass. It had been rated at 0.5A and I substituted the lightest one I had on hand – a 1A type. It lasted about as long as it took to press the "on" switch.

Maybe my organist friend had somehow managed to put a short across the HT line.

However, when I started to check the area where he had been working, it became fairly evident that the supply to the control section of the organ was decoupled from the main 35V source and that a short in this section would scarcely blow the main fuse. Maybe I should take a look at the main amplifier, even though it was not even in sight!

"Yeah . . . not bad . . . but what they're looking for now is oboe players!"

This involved removing the back panel of the instrument, revealing a compact transistorised amplifier and a separately mounted step-down transformer delivering, I guessed, around 30V. I sincerely hoped that the transformer was not the problem – at this hour on a Saturday evening.

To check it, I disconnected the low voltage leads to the amplifier, replaced the fuse and switched on. Fortunately, the fuse remained intact and the transformer was cleared. What next? Ah yes, the bridge rectifier – an encapsulated unit about the size of a large postage stamp and about 7 or 8mm thick.

It was a bit of a hassle to get at but, when it did manage to isolate the connections, I found a virtual short-circuit between all four of them. A further check seemed to indicate that the HT line was apparently free of shorts – so it seemed simply a case of a faulty rectifier.

Not having on hand a direct – or even an approximate – replacement, I contrived a bridge from four separate silicon power diodes. That done, the organ sprang back into life, much to the relief of its owner – and to yours truly. A certain serviceman could go back home and resume what remained of his Saturday evening relaxation.

A RED HERRING!

Obviously enough, the breakdown had had nothing to do with the owner's efforts to clean the contacts. The fact that it happened when he switched the organ on again was pure coincidence.

But the coincidence was sufficient to put me off the track, prompting me to spend time probing around portions of the organ which I would not normally have connected with a blown fuse.

Ah well . . .

There is a postscript to the foregoing story. About a month or so later, the same man phoned to ask whether I could take another look at the instrument – not so urgent this time, but it had a problem which was getting noticeably worse.

He explained that, for some time, the organ had suffered from a "scratching" noise through the loudspeakers, that

could be heard plainly in the room when nothing was being played. But it had been getting gradually louder and more persistent and had now compelled him to have something done about it. Could I possibly help?

Remembering the barely readable circuit that I would have to work from, I was anything but keen, but was finally persuaded.

When I got to see the organ again, and listen to the noise, I was able to establish readily that the problem was in the main amplifier. Turning the pre-set volume control right off cut all sound from the keyboards but left the noise unaffected. But, when I took a close look at the amplifier, I made up my mind that it would be serviced on the workbench – or not at all.

Unfortunately, getting it out involved unsoldering a variety of leads and, since I wasn't sure where each one went, I made a careful note of them so that I could get it all together again later. As mentioned earlier, the mains transformer was a separate item and, having established that it supplied about 30V AC to the bridge rectifier in the amplifier module, I decided to leave it where it was. I would be able to substitute for it on the bench.

HARD TO GET AT!

Back at the workshop, and with the dubious help of the almost unreadable circuit, I identified the general configuration of the circuitry and a few of the major components. But the smaller ones remained a mystery, barely visible inside the tunnel-like construction. It remained to couple the amplifier to a 30V AC supply and to a monitor speaker, and see how far we got.

At least the noise appeared on cue and it was then a matter of attacking it as best I could.

Checking backwards through the circuitry, I spied what was almost certainly the coupling capacitor to the composite push-pull output stage and, by judicious prising and de-soldering, I managed to free one leg from the copper pattern.

The noise had disappeared, which pointed the finger at one or other of the preceding stages. So I remade the connection and tried again.

Some more peering and back-tracking led me to another very similar capacitor, which was probably the preceding interstage coupler. When I managed to prise that one free, the noise again disappeared, thereby confirming what I had suspected all along: the problem was in the first preamplifier stage. But where?

Measurement of the collector and emitter voltages gave logical figures and substitution of another resistor for the collector load made no difference either to the voltages or the noise. But a heavy bypass from base to ground eliminated the noise almost completely.

That left the transistor itself as the possible culprit, or something in the bias network. I hoped it wouldn't be the tran-

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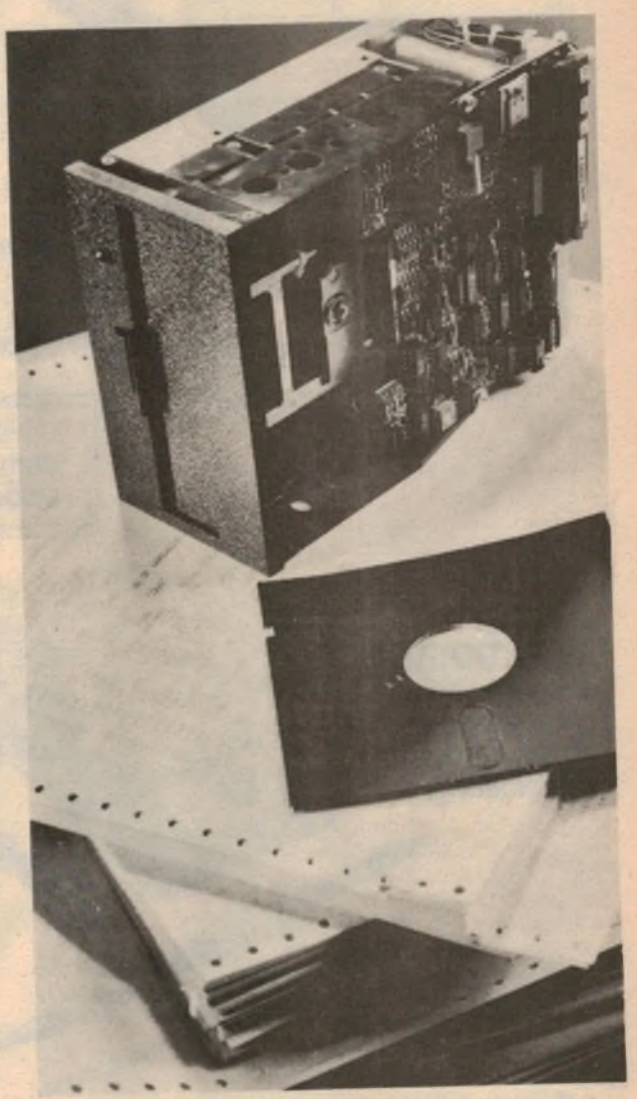

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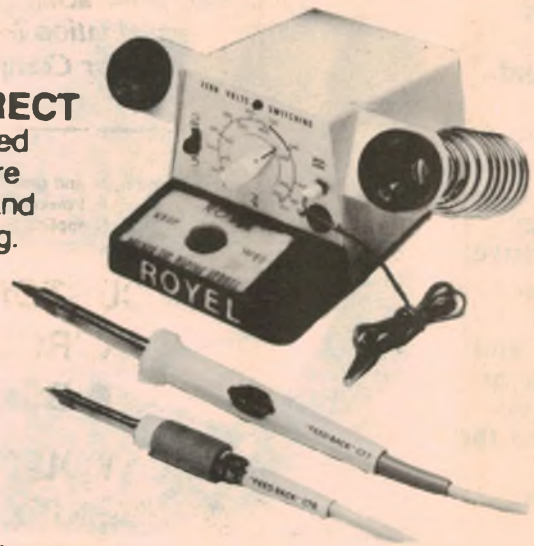

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by JOHN CLARKE & LEO SIMPSON

For many years now, the so-called VU meters used for signal monitoring on amplifiers and cassette decks have just not been up to the task of accurately monitoring audio signal levels. Even if the meters did comply closely with the VU standards, they left the user ignorant of the amplitude of signal peaks. Now, with the increasing potential for very wide dynamic range in program material, the VU meter is quite inadequate.

That is the reason why some of the newer upmarket amplifiers and cassette decks are using such impressive dot/bar graph displays. To meet this need, we have designed a new Peak/Average Signal Monitor module which may be used in a number of ways to upgrade the signal monitoring in your stereo system. You can take the basic PC board module, or a pair of them, and build them into a new or existing amplifier. They would be ideal for use in the large mixers employed by bands and in discos.

Alternatively, you could take our approach and build two modules into a self-powered, free-standing unit which will not look out of place sitting alongside the rest of your stereo equipment.

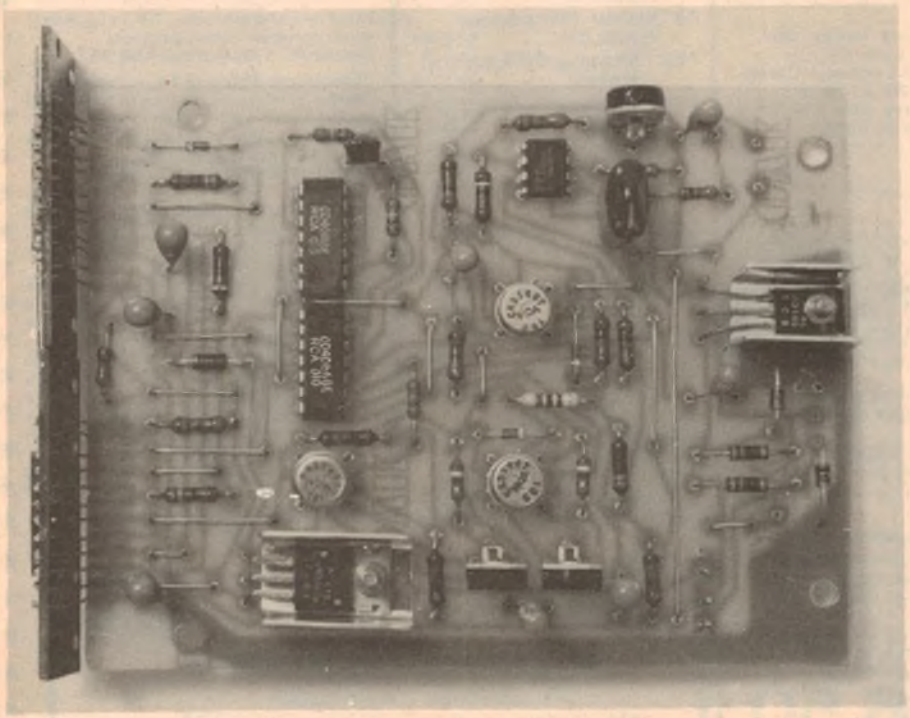
We have used the new NSM 39152 integrated LED display modules from National Semiconductor Corporation. With two of these modules attached to our PC board, you have a monitor which gives a bright green 20-LED display with each LED representing a signal increment of 3dB for a total range of 60dB. The display has two modes which are operated simultaneously. In the bar mode, the display represents the RMS value of the monitored signal and performs with the same characteristics as a VU meter.

In the dot mode, the display also gives the RMS value of the signal waveform being monitored but with much faster attack times, so that it gives a true representation of the amplitude of short tone bursts and transients. To do this, there are two rectifier circuits, one for the bar display and one for the dot display and the NSM 39152 modules are switched between the bar and dot modes at a rate of 600Hz so that as far as the eye is concerned, the display is continuous. Thus the display can be said to be multiplexed.

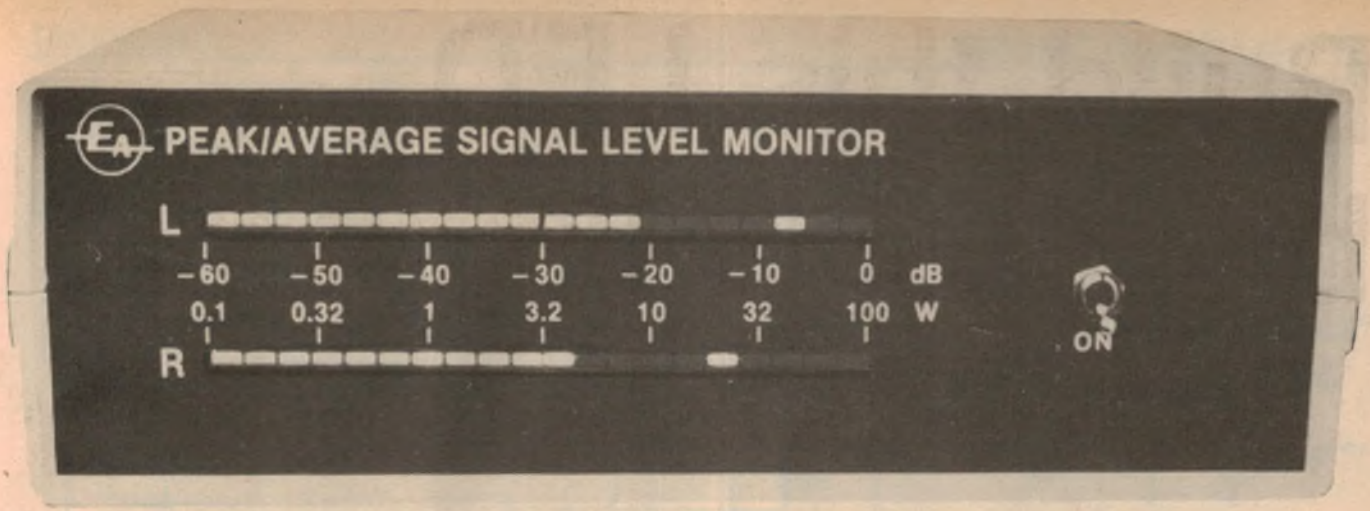
The NSM 39152 modules actually employ the LM3915 chip which has been available for some time now. The chip is encapsulated in a blob of black epoxy resin on the back of the small PC board which measures 51 x 22mm. Chip connections are brought out to one edge of the board while the array of 10 rectangular LEDs runs along the other edge.

Fig. 1 shows the circuit schematic of the NSM 39152 module (which is essentially the same for each type in the NSM 3900 series). Inside the chip are 10 comparators, one for each LED. The non-inverting input (designated with a + sign) of each comparator is connected to a voltage divider string which provides each comparator with a reference voltage which represents a 3dB step above or below its neighbouring comparator.

All the inverting inputs of the 10 com-



View of one of the completed display boards. Note that the power supply components are not needed for the second board of a stereo pair (see overlay diagram).



The completed stereo version will make an attractive addition to your hifi equipment.

parators are tied together and driven from a buffered version of the input signal. As the input voltage rises above the reference voltage for each comparator, the comparator output goes low and turns on the associated LED.

Also shown in Fig. 1 is the mode select amplifier. This controls logic within the chip to determine whether the resulting display will be a bar or a dot.

Twelve connections are provided along the bottom edge of the NSM 39152 module board with the extreme lefthand connection being identified as number one. The connections are as follows: 1, VLED; 2, LED 1; 3, GND; 4, V+; 5, Rlo; 6, Signal in; 7, Rhi; 8, Ref out; 9, Ref adj; 10, Mode; 11, LED 9; 12, LED 10. Connecting resistors to pins 8 and 9 of the NSM 39152 module allows setting of the full-scale reference level (the voltage level at which LED 10 lights) and the selection of the value of LED current.

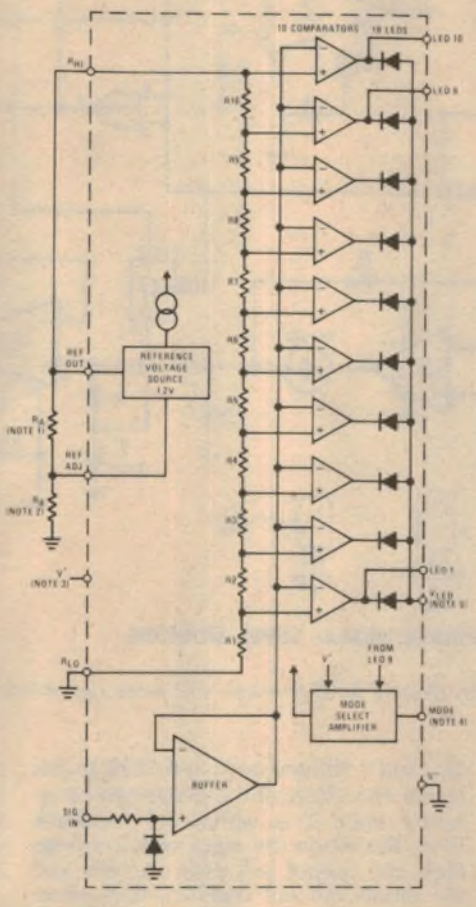
CASCADING

Now let us discuss how we have employed the NSM 39152 modules. We will first discuss how two of these modules are cascaded to give a display range of 60dB and then discuss the rectifier circuitry. Refer now to the complete circuit diagram.

There are essentially two ways in which two NSM 39152 modules can be cascaded. The first way is to set the reference voltages so that the reference voltage for module 1 is 30dB below the reference for module 2 and tie pin 6 of both ICs together. However, the result of this is that the signal voltage required to turn on the first LED in module 1 is only a few millivolts. In practice, this is not really workable since the DC offset voltage of the internal buffer in the module can also be of the order of a few millivolts too. So, at best, the read-out will be inaccurate for low signal levels and at worst, LED 1 will not extinguish, even with no signal applied.

The method of connection recommended by National Semiconductor involves setting the reference voltage levels of the two modules equal and boosting the input signal to module 1 by 30dB. In our circuit, this task is performed by IC4, a FET-input operational amplifier. The DC signal from the rectifier is fed directly to pin 6 of module 2 and via IC4 to pin 6 of module 1. This means that the input signal must turn on all LEDs of module 1 before the first LED of module 2 can turn on.

Fig. 1: inside the NSM 3900 series modules



TYPICAL RESISTOR STRING VALUES

Resistor	NSM3914	NSM3915	NSM3916
R1	1.00k	1.0k	0.708k
R2	1.00k	0.41k	1.531k
R3	1.00k	0.59k	0.923k
R4	1.00k	0.83k	0.819k
R5	1.00k	1.17k	1.031k
R6	1.00k	1.66k	1.298k
R7	1.00k	2.34k	0.769k
R8	1.00k	3.31k	0.864k
R9	1.00k	4.69k	0.970k
R10	1.00k	6.63k	1.087k
Total	10k	22.6k	10k

Note 1: R_A determines I_{LED} and thus LED brightness

$$I_{LED} \geq 10 \left(\frac{1.25V}{R_A} + \frac{V_{FS}}{R_{DIVIDER}} \right)$$

Note 2: R_B determines full scale voltage

$$V_{FS} \cong 1.25 \left(1 + \frac{R_B}{R_A} \right) + I_{REF} R_B, \text{ where } I_{REF} \text{ is nominally } 80\ \mu A$$

Note 3: V^+ may be 3V to 20V, additionally, for proper operation $V^+ \geq V_{LED} + \geq V_{SIG} + 1.5V \geq V_{REF} + 1.5V$

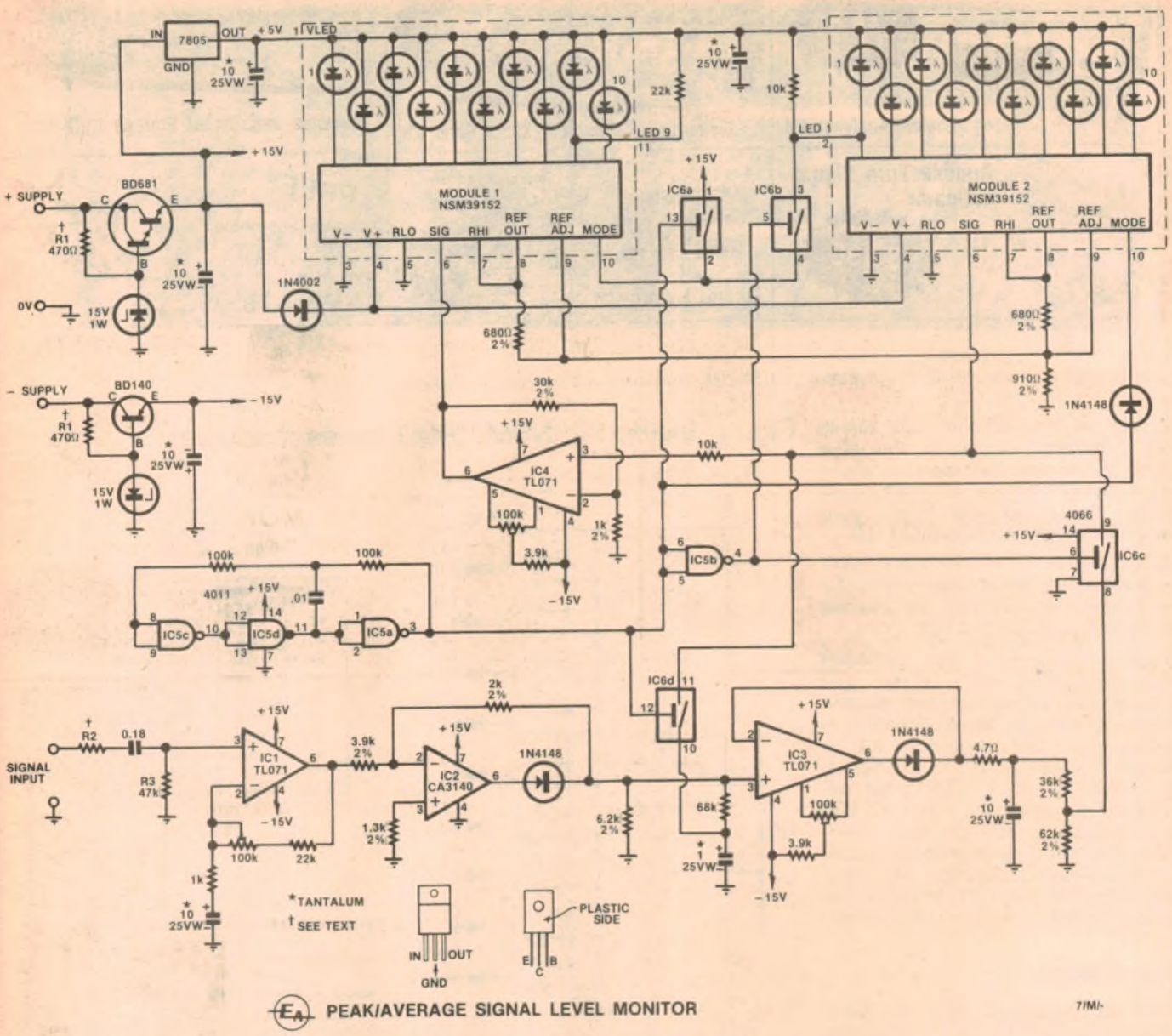
Note 4: Mode controls type of display. Connect to LED 9 for dot display and to V^+ for bar display.

Note 5: V_{LED} may be 3V—20V (see Note 3). V_{LED} may be limited by the driver circuit dissipation rating.

RECTIFIER CIRCUITRY

IC1 is a FET-input op amp which is wired as a non-inverting amplifier with gain variable from 23 to 123 times. This means that the input sensitivity for full-scale display can range from 69 to 369mV RMS although we assume that if the unit is used to monitor normal line signals on an amplifier, the full-scale sensitivity will be set to around 150mV RMS.

If the unit is to be driven from the out-



The circuit uses a multiplexing technique to display both average and peak signal levels.

put of a power amplifier then IC1 will be set to minimum sensitivity and the input signal attentuated by selection of R2 and R3.

IC2 is a CA3140 FET-input op amp and is connected in an unusual precision rectifier circuit which is suggested by RCA Corporation in their Linear Integrated Circuits databook. The circuit takes advantage of the single supply capability of the 3140 and its ability to swing the output voltage to within 0.2 volts of the negative supply so that it can act as a full-wave rectifier. Other precision full-wave rectifier circuits require at least two op amps.

To give full-wave rectifier response, IC2 works in two ways. When the output signal from IC1 drives the input low, IC2 works as a conventional inverting amplifier with gain set by the ratio of the 2kΩ and 3.9kΩ resistors, at 0.5128. In this mode, the effect of the diode can be ignored since it is within the feedback loop. But when the input of IC2 swings high, the output will drop to zero and the diode will not conduct, thus effectively disconnecting IC2 from the circuit. The three resistors around IC2 then act as a voltge divider, so that the effective gain for positive-going input signals is 0.5123, which is very close to the gain figure of 0.5128 for negative-going input signals. Voila! A precision full-wave rectifier. The only catch is that it can only drive a relatively high load impedance but that is no drawback in our application.

A low pass filter consisting of a 68kΩ resistor and a 1μF capacitor provides filtering of the full-wave rectified signal. It is this signal which is eventually fed to the LED display module. The response of the filter is such that the voltage across the capacitor reaches 99% of the final DC value in 300ms, which is the same as for a VU meter.

The unfiltered full-wave rectified signal from IC2 is also fed to the input of IC3 which acts as a peak hold circuit. It looks and works like a conventional single op amp precision rectifier in that it charges up the 10μF capacitor at its output to the peak of the input waveform. A resistive attentuator across the capacitor then adjusts the output to a value which is equal to the filtered output of IC2.

With a 4.7Ω resistor limiting the charge current into the 10μF peak hold capacitor, the attack time of the circuit is very fast, at around 50 microseconds while the decay time is about one second.

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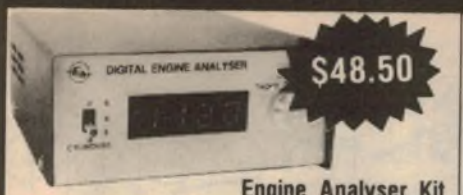

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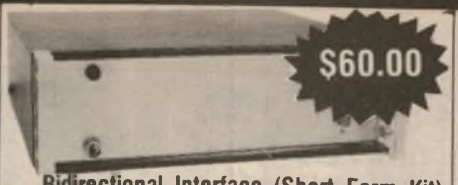

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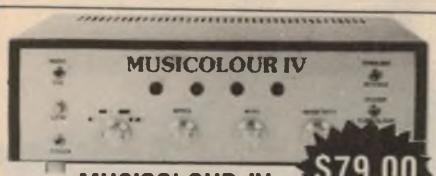

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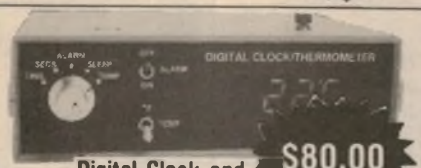

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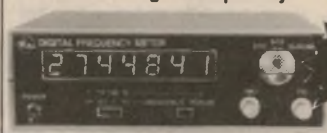

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The expected maximum output from the average and peak signal levels is 3.91 volts. This is calculated from the worst case maximum output from IC1 being 24Vp-p, which is full wave rectified to 12V peak and attenuated by 0.512. This gives 6.14 volts. The average waveform is therefore 0.637 x 6.14 volts = 3.91 volts. With this maximum voltage we have designed the maximum sensitivity of the modules to be 3.82 volts set by the 680Ω and 910Ω resistors.

MULTIPLEXING THE DISPLAYS

So now we have two rectified signals, one which will be used to indicate the average value of the signal (although calibrated to read the RMS value of a sinusoidal waveform) while the other is used to indicate the value of transients (again referred to the RMS value of a sinusoidal waveform). When the input signal is a steady state sine wave, both DC signal levels will be the same.

To enable both these values to be displayed on the modules, we had to arrange for circuitry to rapidly switch the inputs of the modules between the average and peak signals while simultaneously toggling the mode control pin to obtain bar and dot displays. This was done with a CMOS quad bilateral switch package, IC6, a 4066 which has low "on" resistance.

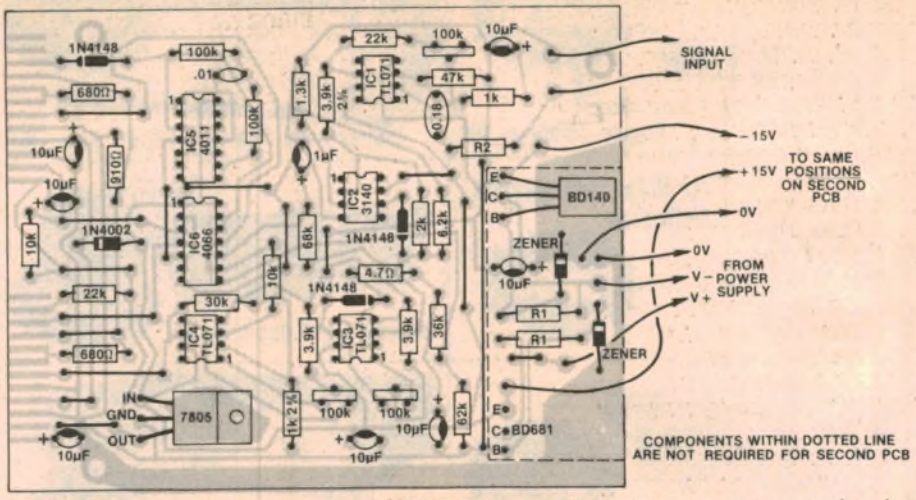
The average signal and the peak signal are both fed to the bilateral switches, IC6d and IC6c. The output of each switch connects to the signal input of module 2 and the input of the 30dB amplifier, IC4.

To ensure that the modules are in the correct mode, bar when the average signal passes and dot when the peak signal passes, extra switches are connected to the Mode input of module 1. When IC6a is activated, the Mode input is pulled high and when IC6b is activated the Mode input is then connected in the dot mode. Note that IC6a and IC6b are also controlled in a complementary fashion, such that only one of the switches is activated at the one time. IC5, a quad package of two-input NAND gates, is used to provide the control of the switches.

IC5a, IC5d and IC5c are connected as a standard three gate oscillator which operates in the following fashion. All three gates are wired as inverters. The 0.01uF capacitor is charged and discharged through the 100kΩ resistor connected to the output of IC5a. When the voltage across the capacitor reaches the switching voltage at the input of IC5c, the output of IC5d changes state and the capacitor begins to charge in the opposite direction. Consequently we have a 600Hz square wave oscillator.

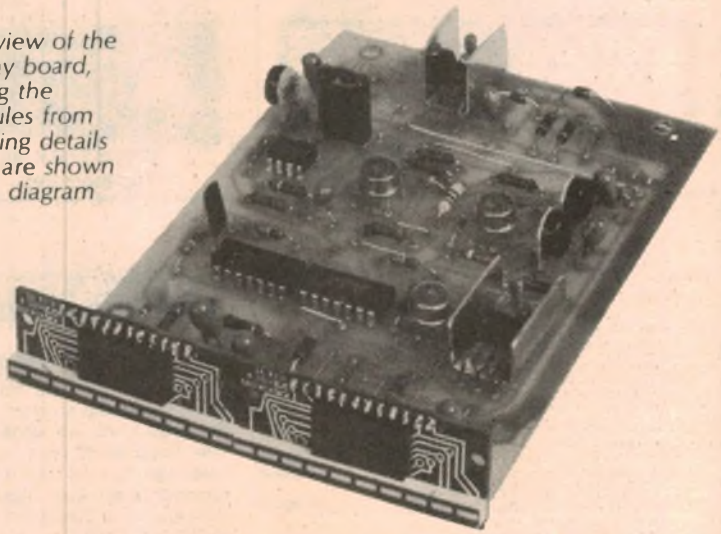
IC5b provides inversion of the oscillator, so that the bilateral switches can work in complementary fashion. A diode at the Mode input of module 2 places the module display in either dot or bar mode; by pulling pin 10 high for bar mode, or disconnecting pin 10 when the output of IC5a is low for dot mode. Since the bar mode is only selected when the Mode pin is within 20mV of the positive supply rail, we have also connected a diode in series with the supply rail to the module. This diode provides the same voltage drop as the diode connected to the Mode pin and so the voltage when the pin is high is well within the required 20mV window.

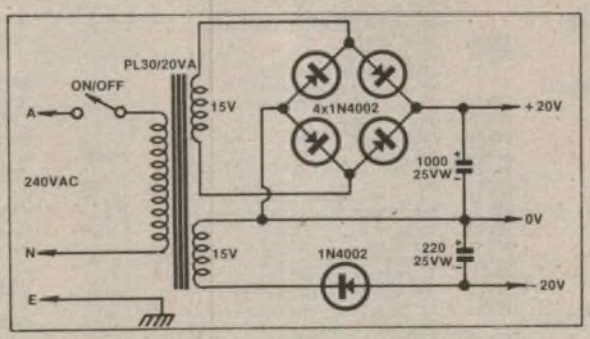
Power supply for the LEDs is derived from a 5V regulator, which provides a consistent voltage regardless of how



Fit small aluminium heat sinks to the 5V regulator and the BD681 transistor and make sure that you mount all polarised components the right way round.

Here is another view of the assembled display board, this time showing the 39152 LED modules from the front. Mounting details for the modules are shown on the exploded diagram on page 64.





This optional power supply circuit is used if the unit is to be self-powered.

PARTS LIST (For a Stereo Version)

2 PC boards coded 81ld12 and measuring 95 x 121mm
1 PC board coded 81ss12 and measuring 42 x 47mm
1 Scotchcal front panel measuring 59 x 197mm
1 Pac Tec case measuring 205 x 64 x 160mm
1 Ferguson low profile transformer, PL30/20VA
1 SPDT mains switch
1 dual RCA panel socket
1 2 way mains terminal strip
1 cord clamp grommet
1 length of mains cord and plug
2 earth lugs
4 19mm tapped brass spacers
4 9mm tapped brass spacers
1 piece of light gauge aluminium 180 x 180mm
4 25mm long screws to suit spacers
4 5mm long screws to suit spacers
12 screws and nuts
6 self tapper screws

SEMICONDUCTORS
4 NSM 39152 green logarithmic LED modules
2 CA3140 BiMOS op amps
6 TL071, TL081, CA4140, LF351 op amps
2 4011 quad NAND gates
2 4066 quad bilateral switches
1 BD681 Darlington NPN transistor
1 BD140 PNP transistor
2 15V 1W zener diodes
7 1N4002 rectifier diodes
6 1N4148, 1N914 signal diodes

CAPACITORS
1 1000µF/25VW PC electrolytic
1 220µF/25VW PC electrolytic
12 10µF/25VW tantalum
2 1µF/25VW tantalum
2 0.18µF metallised polyester
2 .01µF metallised polyster

RESISTORS (5% ¼W)
4 x 100kΩ, 2 x 68kΩ, 2 x 47kΩ, 2 x 22kΩ, 4 x 10kΩ, 4 x 3.3kΩ, 2 x 1kΩ, 2 x 470Ω, 5 x 100kΩ miniature vertical trim pots.

RESISTORS (2%, ¼W)
2 x 62kΩ, 2 x 36kΩ, 2 x 30kΩ, 2 x 6.2kΩ, 2 x 3.9kΩ, 2 x 2kΩ, 2 x 1.3kΩ, 2 x 1kΩ, 2 x 910Ω, 4 x 680Ω

NOTE: Components specified are those used in our prototype. Components with higher ratings may generally be used providing they are physically compatible.

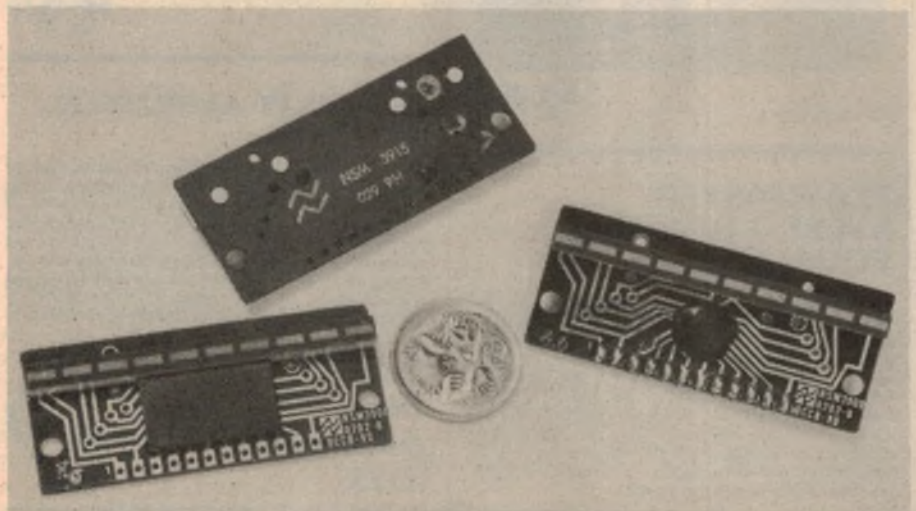
many LEDs are on at the time, to give consistent brightness. The 10µF capacitors from VLED to ground are necessary for stability for the modules.

The total current required by the 5V regulator is about 500 milliamps when all LEDs (in a stereo display) are alight. This poses a number of problems in the power supply. First, if the unit is to be powered from the positive and negative supply rails of an amplifier, you must determine that the power transformer can deliver the extra current while not prejudicing the performance of the amplifier itself.

Second, supposing that the amplifier has a generously rated supply which can comfortably feed the extra load, the voltage from the amplifier supply rails is likely to be too high to be supplied directly to a standard three-terminal regulator. To cater for this situation, the ±15V regulated supplies for the display boards are derived by zener-clamped series transistor circuits which can withstand a maximum input of 80 volts.

A BD681 Darlington NPN transistor is used for the +15V supply and it also feeds the 5V regulator. The relatively low current required for the minus 15V rail is catered for by a single BD140 PNP transistor. The circuit can be made to

Below: close-up of the 39152 modules showing their size compared to a 5c piece.



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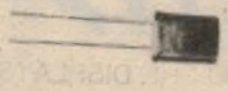

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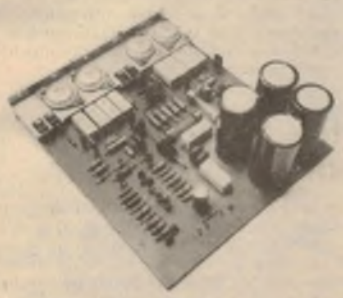

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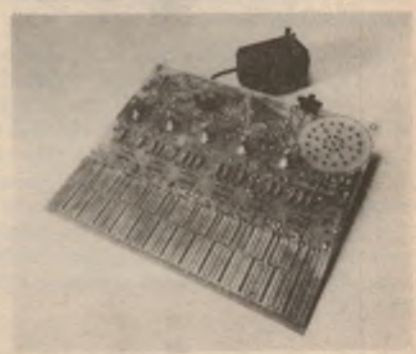

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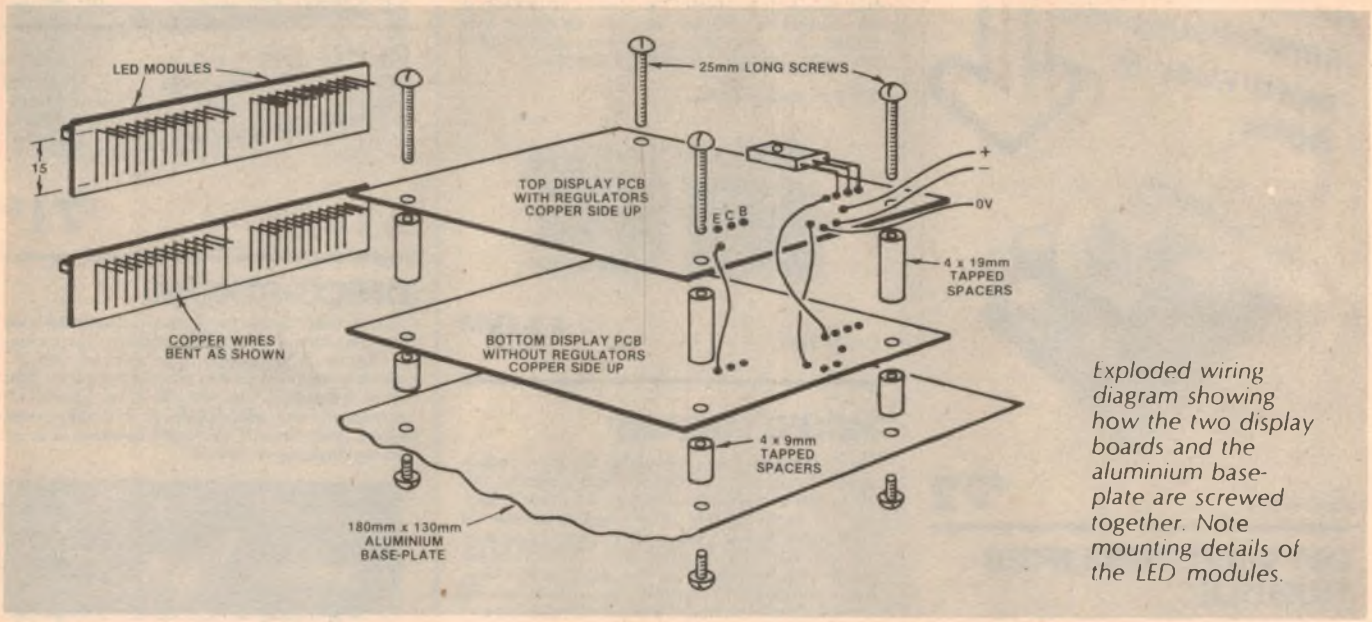

Exploded wiring diagram showing how the two display boards and the aluminium baseplate are screwed together. Note mounting details of the LED modules.

suit any input voltage up to ±80V by selecting the value and power rating of R1 for both the BD681 and BD140. R1 should be selected so that between 10 and 20mA flows through it for the particular input voltage condition.

We have provided a suggested power supply for the Signal Level Monitor consisting of a transformer with two 15 volt windings. A full wave rectifier with a 1000μF filter capacitor is used to provide the positive supply and a simple half wave rectifier for the low current negative rail.

We have designed two PC board patterns for this project. The first, measuring 95 x 121mm and coded 81ld12, is the display board and two of these will be required for a stereo version. The second board is for the optional power supply. It measures 42 x 47mm and is coded 81ss12. We mounted the boards and the transformer in a standard PacTec case measuring 205 x 64 x 160mm (W x H x D).

CONSTRUCTION

Before construction begins, it is necessary to decide upon what the Peak/Average Signal Level Monitor is to be measuring. If it is to measure the Tape level, then R2 can be a link as the 69mV to 369mV sensitivity is adequate for this application. For power measuring applications, R2 and R3 will have to be calculated. We have marked our scale up to 100W. For an 8Ω loudspeaker load, this corresponds to 28.3 VRMS and is calculated from the formula, power = V^2/R. For 100mV across R3, when there is 28.3V at the input of R2, then R2 should be 120kΩ and R3 470Ω.

Start work by placing all the links on the display PC board and soldering them in place. Next all the resistors and diodes can be positioned. Make sure that the diodes are oriented correctly as shown on the overlay diagram. Next the ICs can be soldered in place. Follow the usual precautions when soldering the CMOS ICs, IC5 and IC6. Solder the ground pin, (pin 7) and the Vcc pin (pin 14) first with an earthed soldering iron with the barrel connected to the ground of the PC board. Next solder the remainder of the pins. No special precautions are required with the op amps except to solder them quickly with minimum heat. Finally solder the capacitors in place observing their polarity.

If two PC display boards are to be made for the stereo version it is not necessary to wire in the two zener diodes, the R1 resistors and the BD140 and BD681 transistors on the second PC board. The second board derives its regulated supply from the first PC board as shown on the exploded diagram. The BD681 is mounted on the copper side of the PC board so that it clears the mounting screws and provision is then available for a heatsink.

Heatsinks are necessary for the BD681 transistor and the 5V regulators. We fashioned small U-shaped sinks for the voltage regulators from 22 x 35mm pieces of sheet aluminium. They are bent so that the sink is 22mm long, 13mm wide and 10mm high on both sides. Use a screw and nut to secure the heatsink to the regulator through the PC board. The BD140 will not require heat sinking unless the input voltage is much higher than the 20V of our recommended power supply. Make sure that the metallic body of the transistor, the collector, is isolated from the earth track beneath the PC board if a screw is used to secure it.

The heatsink for the BD681 is made from a 65mm long x 20mm wide strip of aluminium secured to the baseplate of the case. Bend the ends of the strip at right angles and with the holes drilled, the sink can be secured to the transistor and screwed from the baseplate. A mica

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sistor, because it was an unbranded unit, probably a PNP germanium (to judge by the age of the instrument) but perhaps a specially selected type for the important first-stage position.

Suiting my actions to that wish, I started to de-solder and disconnect the main 100kΩ collector-to-base resistor – only to see it fall completely to pieces. First one end and then the other simply fell away from the carbon body. Here was hope indeed.

And, when I replaced it with a new resistor, the amplifier came up with not the slightest trace of noise.

In fact, when I took it back and re-installed it in the organ, the owner asserted that it was quieter than it had ever been. Maybe he was over-reacting but perhaps not. Whoever had wired the board in the first place may well have over-stressed the resistor in bending the leads and damaged the bonds to the resistance element.

Perhaps the resistor had been "whispering" for years before it started to talk out loud!

BACK TO VALVES

For the next story, it is necessary to turn the clock back – or rather the calendar – by quite a few years.

It seems that, many years ago, someone built and installed in a smallish local church, a valve amplifier which has been doing sterling service ever since. However, the person concerned has moved out of the district and, when the amplifier gave trouble recently, the help of your humble serviceman was sought.

It transpired that the amplifier concerned had two microphone channels, with mixing, but that the two channels were no longer independent. With two microphones connected, both would be active when either microphone volume control was advanced. And, if one microphone was disconnected, hum and noise would be picked by the now disused preamplifier, even though its control was turned right off.

When the situation was described to me, my reaction was to suspect that a wiring fault had developed as, for example, a common earth return that had somehow became parted from the chassis earth.

In fact, that's what I looked for when the amplifier was duly delivered on to my workbench. But no such problem was evident. The wiring had been done quite well in the first place and everything seemed normal and intact. Yet the fact remained that the amplifier behaved exactly as described: both inputs were alive and well but the two potentiometers operated as if they were in parallel.

Taking a closer look, I noted that the microphones were fed to the respective grids of a twin triode valve, with the corresponding anodes fed through resistors, and capacitance coupled to the hot side of the mic volume pots.

Then I noticed that the two cathodes were joined together, to share a common 1kΩ bias resistor and bypass.

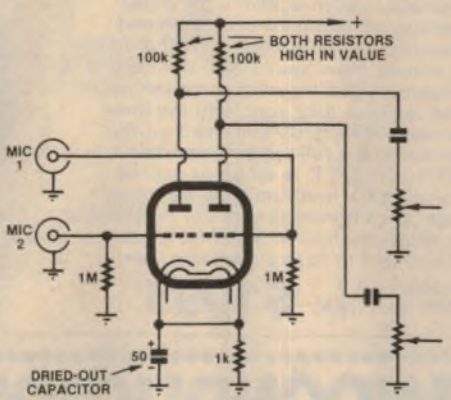
Aha! What if the bypass electrolytic had dried out? The two triodes would then be cathode coupled and that could explain their inter-dependence.

It took only a few moments to short the cathode link to chassis with the tip of a screwdriver and, while the preamplifiers would then have been operating with zero bias, it was quite evident that the interaction between the two channels had disappeared.

I could simply have replaced the dried-out electrolytic but decided to go to a little more trouble. I broke the connection between the two cathode pins and wired a separate 2000-ohm bias resistor between each cathode and chassis, shunting them with miniature 100μF electrolytics, which I happened to have on hand.

That fixed the interaction completely and, hopefully, for all time.

But, while poking around the mic preamplifier stage, I noted the two plate supply resistors – small 100kΩ Australian-made units that were quite infamous for their tendency to drift high, especially when carrying DC. Those resistors were responsible for many a service call in the early '60s!



A dried-out cathode bypass and two high value plate loads in one twin stage.

It came as no surprise therefore, when a check with the multimeter showed that the supposedly 100kΩ plate loads were much closer to 1MΩ. These, also, were replaced.

Checking over the rest of the wiring, I noted a couple more electrolytics of the same vintage as the one that had dried out, and a couple more suspect resistors. Replacing them involved neither a great deal of time or money and, within a few minutes, the old veteran amplifier was right back to normal.

If only all servicing jobs were as easy as that one, or all clients as grateful as the man who picked it up next day!

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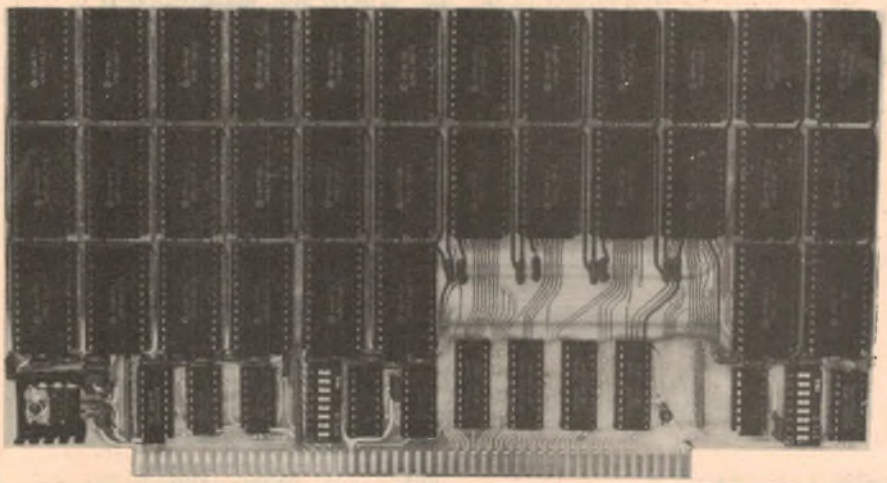

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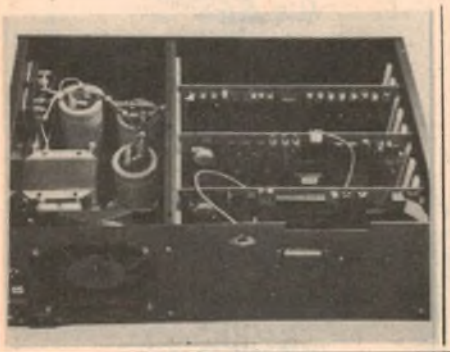

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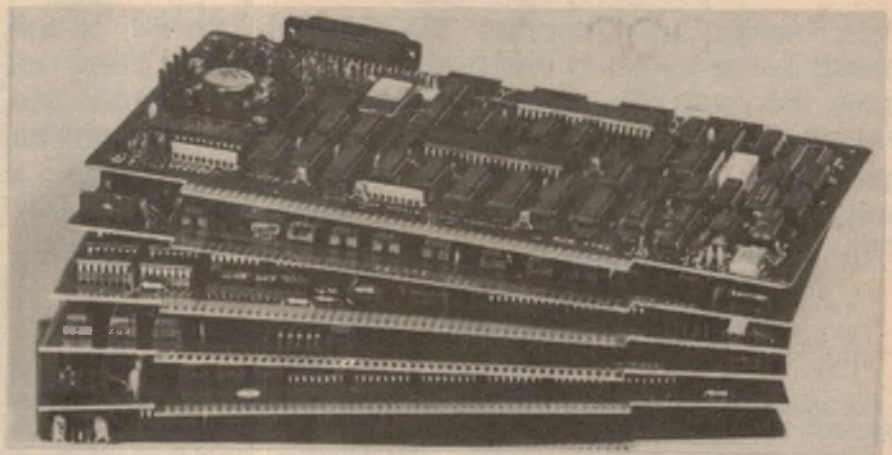

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Part three of this exciting electronic piano series

LYREBIRD

We describe the Voicing, Effects & Pedals circuitry

This month we describe the largest printed circuit board in the Lyrebird electronic piano. While it does not have the most ICs, it does have the most complex and varied circuitry with five quad operational amplifier packages, a CMOS quad 2-input gate package, a voltage controlled amplifier and a bucket brigade device. The circuitry controls the voicing, pedals and effects.

by LEO SIMPSON & GREG SWAIN

This third and final PC board to be described for the Lyrebird measures 213 x 173mm and accommodates a large amount of circuitry which may be split into three sections for convenience of description. The three sections are voicing filters, effects generator and pedal circuits. The voicing filters use 10 op amps comprised of IC1, IC2 (each a quad op amp package) and IC3c and IC3d.

Referring to last month's circuit description, the envelope boards are wired so as to produce five separate outputs which are fed to the five inputs in the voicing filter circuitry. Each input has a series diode which can really be regarded as part of the envelope board gating circuitry described last month.

IC1a, b, c, d and IC2a are wired as twin-T bandpass filters which are centred on different frequencies to make the lower octaves rich in at least the second harmonic. Because of the wide fundamental frequency range covered by the keyboard, this is at best a compromise, so that some notes will be bound to have a richer harmonic content than others. The Q of each of these bandpass filters can be adjusted by means of an associated trimpot (eg, RV5 for IC2a) so that a reasonably smooth transition is obtained between notes handled by one filter to the notes handled by the next filter.

IC2b is another twin-T bandpass filter which, in conjunction with IC2c, produces the harpsichord voice for the piano. Apart from IC2b, the outputs from the other five bandpass filters are passively mixed (ie, via RC networks) to provide three separate outputs which are then fed to the three low pass filters IC3c, IC3d and IC2d, which provide the three other piano voices (ie, Mellow, Bright and Normal).

The voice select switches normally short the outputs of the low pass filters to ground via 47kΩ resistors and the voice is "selected" by opening the appropriate switch so that the signal passes through to the effects circuitry. More than one voice can be selected simultaneously, if desired, and mixing is achieved via the 47kΩ isolating resistors.

EFFECTS CIRCUITRY

Three separate effects are produced by this circuitry. The first, tremelo, is amplitude modulation of the signal by a low frequency sinewave at about 1Hz. This effect is well known to most people as it has been used by vocalists and musicians ever since singing occurred!

The honky tonk effect is also familiar to most people although it is produced in a different way in the Lyrebird. In a conventional piano which has been "honky-tonked" the felts are usually removed from the hammers to make the strings sound more metallic. At the same time the strings are detuned (either deliberately or, in those days of yore, by neglect) to produce extra dissonances.

Since the Lyrebird has a master oscillator and fixed frequency dividers it is not possible to deliberately mistune it. Instead, the Lyrebird makes use of a bucket brigade device to delay the main piano signal which is then mixed with the undelayed signal to produce a slightly detuned sound which is quite reminiscent of a honky tonk piano.

The "Phase" effect is more difficult to describe but has been used frequently by rock bands over the years. It can best be described as a mixing effect of the

piano sound with that of a jet exhaust. It is quite an interesting effect but has nothing whatever to do with the function of a conventional piano, although it would be useful on an instrument for stage use. The Phase effect also makes use of the bucket brigade device.

The effects circuitry works broadly in the following way. First, the output from the voicing switches (shown as point A on the voicing filter circuit) is fed to op amp IC3b which functions as a buffer and gain stage. Output from IC3b is then fed to RV11 which adjusts the signal level to op amp IC8c and thence to the bucket brigade device, IC7. Output from IC3b is also fed to a resistor mixing network before being fed to IC4, a voltage controlled amplifier.

The bucket brigade device is aptly named and can be imagined as a long line of equal sized capacitors, arranged with a switching network so that charges can be passed along from one capacitor to the next. The rate at which the charges are passed along is set by the clock signal which is fed to pins 1 and 4. This arrangement can be used to delay an audio signal (which is passed along in little "packets" of charge) and the amount of signal delay is equal to the product of half the clock period and the number of stages, which in this case is 512. So, for example, if the clock frequency is 20kHz, half the clock period will be 25μs and the delay will be 12.8 milliseconds.

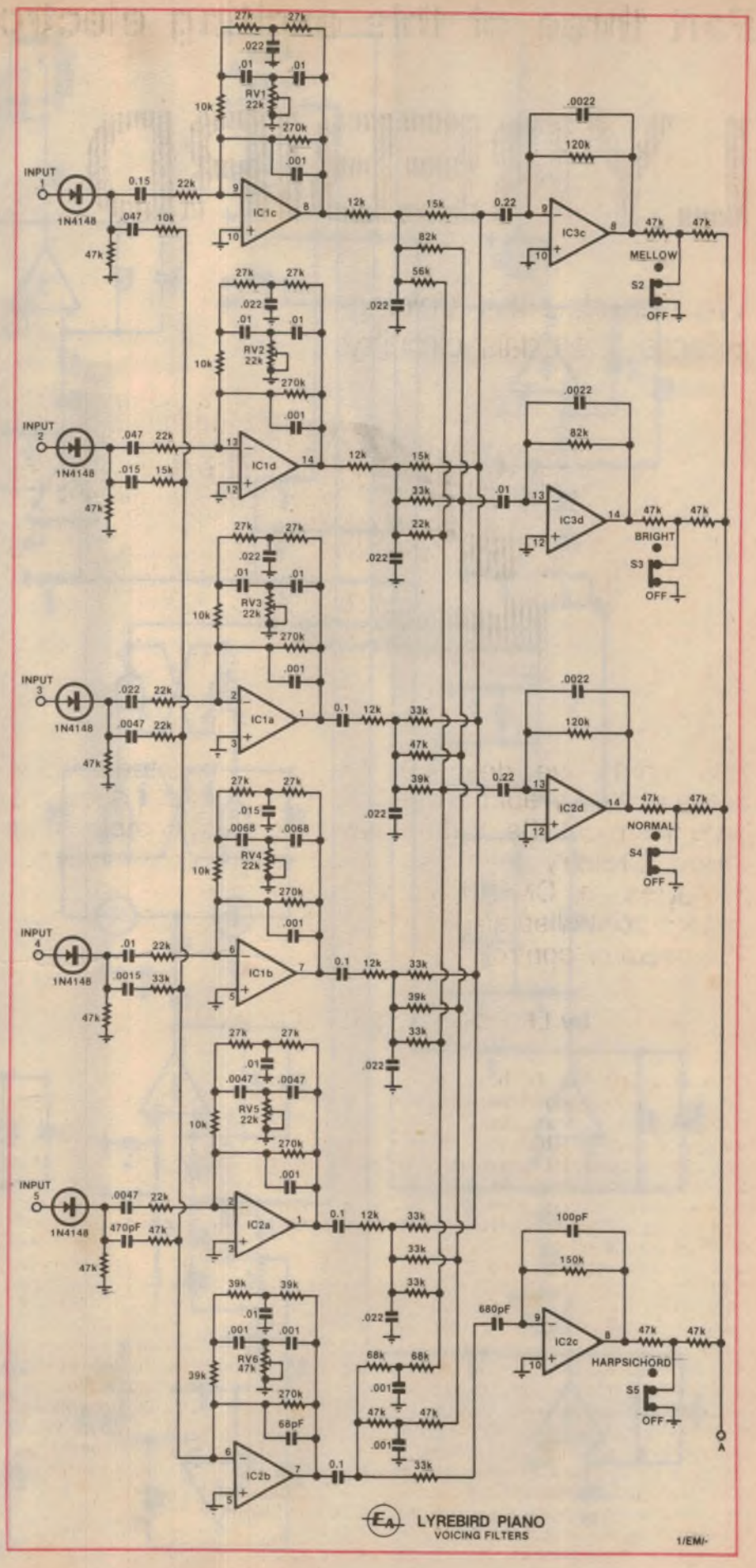
FREQUENCY-MODULATED CLOCK

The clock frequency is produced by IC6a and 6b and squared up by IC6c and 6d. The frequency of operation is about 25kHz and the complementary clock outputs appear at pins 10 and 11 of IC6. The clock frequency can be frequency modulated via the two diodes connected to pins 1 and 5 of IC6 and when the Phase effect is selected a low frequency signal generated by IC5c is applied to the clock via IC5d.

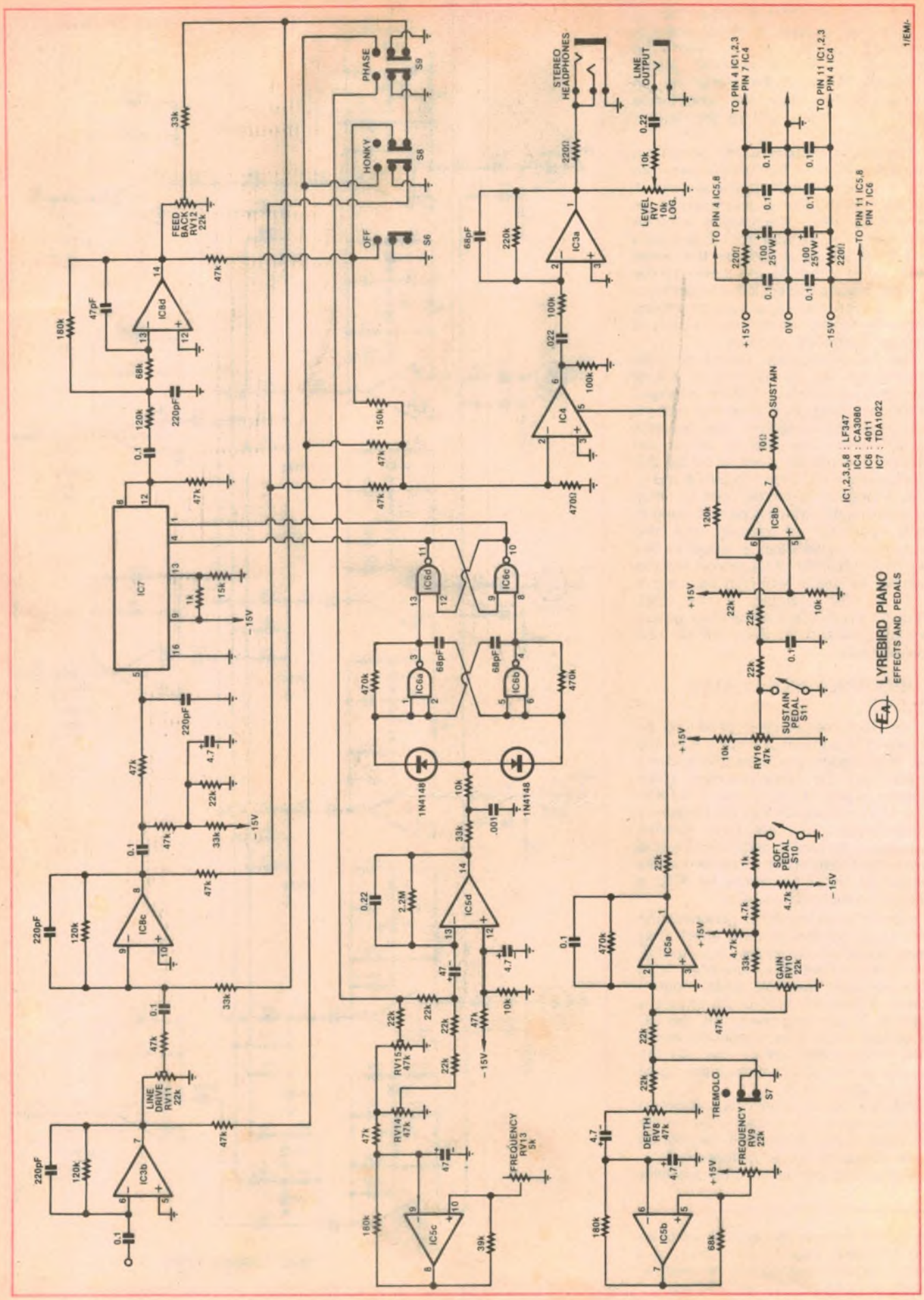
A similar oscillator, IC5b, generates the 1Hz signal for the tremolo effect. This signal is applied via op amp IC5a to IC4, the voltage controlled amplifier. IC5a also provides the soft pedal control action. When the soft pedal switch is opened, by pressing the pedal, the DC input applied to IC5a is reduced, which then reduces the voltage drive to the control pins of IC4 to reduce the signal level by about 10dB.

IC8b is a DC amplifier which applies a fixed voltage to the sustain input on the envelope boards (described last month) when the sustain pedal is depressed.

Finally, IC3a acts as a buffer amplifier



At right is the voicing circuitry, while on the following page is the effects and pedal circuitry. Voicing can be mellow, bright or normal with special effects.


LYREBIRD PIANO
EFFECTS AND PEDALS
IC1,2,3,5,8 : LF347
IC4 : CA3080
IC6 : 4011
IC7 : TDA1022
PHASE
HONKY
OFF
S9
S8
S6
FEED BACK RV12 22k
STEREO HEADPHONES
LINE OUTPUT
LEVEL RV7 10k LOG.
TO PIN 4 IC1,2,3 PIN 7 IC4
TO PIN 4 IC5,8
TO PIN 11 IC1,2,3 PIN 4 IC4
TO PIN 11 IC5,8 PIN 7 IC6
+15V
0V
-15V
SUSTAIN
SUSTAIN PEDAL S11
RV16 47k
SOFT PEDAL S10
GAIN RV10 22k
LINE DRIVE RV11 22k
RV15 47k
RV14 47k
FREQUENCY RV13 5k
TREMOLO
S7
DEPTH RV8 47k
FREQUENCY RV9 22k
IC7
IC8a
IC8b
IC8c
IC8d
IC6a
IC6b
IC6c
IC6d
IC5a
IC5b
IC5c
IC5d
IC4
IC3a
IC3b
1N4148

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FREQUENCY COUNTERS 600MHz or 1GHz
GATE TIME— 0.1, 1, and 10sec.
RANGES— 10MHz, 100MHz & 600MHz or 1GHz
SENSITIVITY— 10 to 20 mV on 10MHz range to 150mV RMS on top range
RESOLUTION— 1Hz on 10s 10MHz range on 8 digit meter – 0.1Hz on 10s 10MHz range on 9 digit meter.
TIME BASE— ± 1ppm for 40C°, – ± 5ppm per year.
NO BATTERIES SUPPLIED. Can take AC Adapter input.

FUNCTION GENERATOR 1Hz to 200kHz – 5020 SINE – 1% Dist, SQUARE – 250nSec, TRIANGLE SHORT PROOF, OUTPUTS-HIGH (10Vpp). TTL and LOW(40dB down). SWEEP INPUT, ± 10V for 100:1 FREQ. DC variable offset. Power 12VAC 300mA via jack. KIT $183.00. ASS $208.00.
(NB Distortion analyser required for kit)

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Multimeters	kit	assembled
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2035 Handheld LCD	$105.00	$130.00
2037 Handheld LCD	$120.00	$145.00
with temp probe (–50C° to + 150C°)		
2040A Auto ranging		$138.00

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8 dig 600MHz 8610A	$176.00	$196.00
9 dig 600MHz 8610B	$199.00	$224.00
9 dig 1GHz 8000B		$338.00

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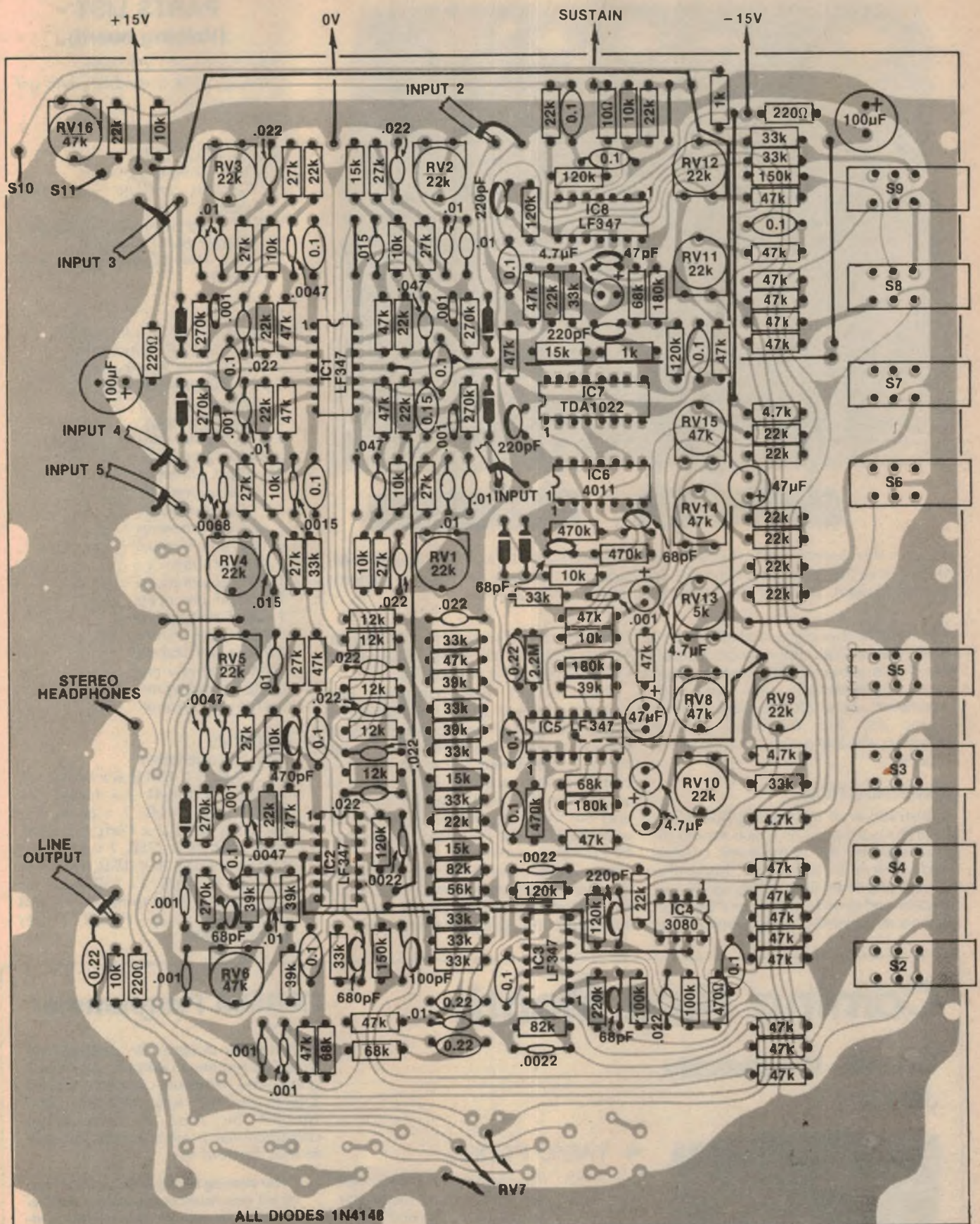
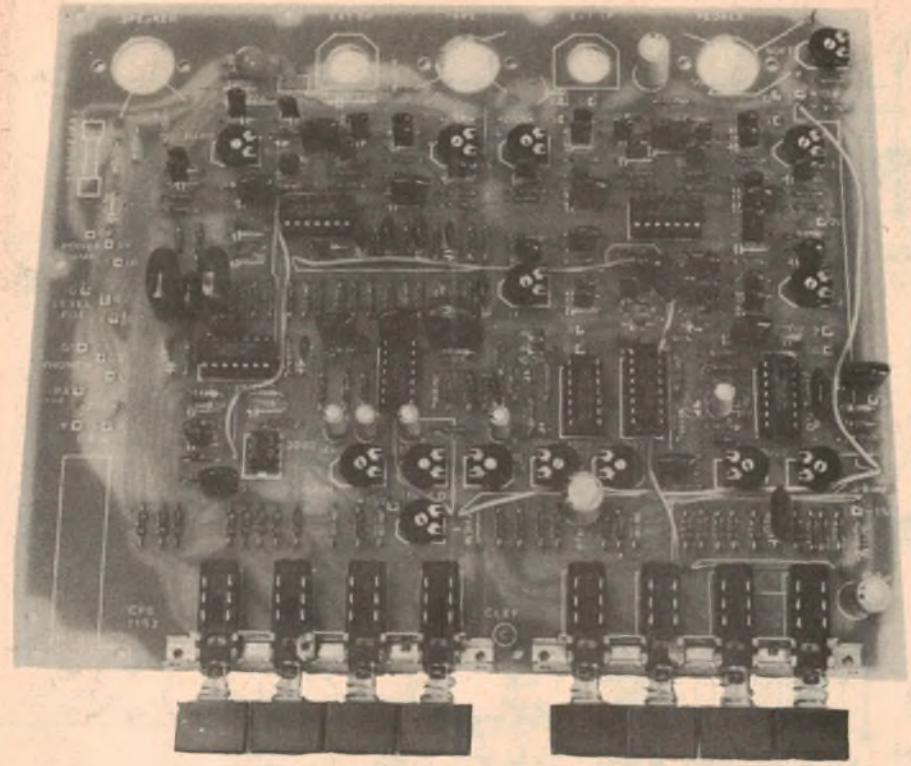


Component overlay for the voicing PC board, shown here slightly larger than actual size. If IC sockets are used, they should be good quality. Do not use cheap sockets; they're more trouble than they're worth!



Above is the assembled PC board. Readers should note that boards supplied in kits will not have the large punched holes. Note also that, because this board is common to other designs, some of the component positions are unused.

with a gain of about two, and follows IC4 which has a high impedance output. IC3a drives a pair of parallel-connected stereo headphones (low or high impedance) via a 220Ω current limiting resistor and also the 10kΩ volume control for the line output to an external amplifier.

CONSTRUCTION

Construction of the voicing board is a straightforward process which should be made easy by the component overlay which is close to actual size. Install the PC pins and links first, followed by the resistors and diodes. Make sure that the resistors are oriented so that their colour codes all run down or across the board, for ease of later checking. Observe the correct polarity for the diodes.

Next install the trimpots and capacitors. Once again, the polarity of capacitors should be observed (where electrolytics are specified). Then install the switchbank and solder all the pins. Note that there is a long link between S8 and S9. Finally, the ICs can be mounted and the mounting bracket fitted to the underneath of the PC board and secured by 7BA screws and nuts.

Next month we shall complete the description of the Lyrebird by presenting all the internal wiring details and the setting up and adjustment procedure.

PARTS LIST
(Voicing board)

1 PC board, 213 x 173mm
2 4-way switch assemblies, non self-cancelling
21 PC pins

SEMICONDUCTORS
5 LF347 FET-input op amps
1 CA3080 voltage controlled amplifier
1 4011 quad two-input NAND gate
1 TDA1022 bucket brigade
7 1N914, 1N4148 small signal silicon diodes

CAPACITORS
2 100µF/25VW PC electrolytic
2 47µF/25VW PC electrolytic
4 4.7µF/25VW PC electrolytic
4 0.22µF metallised polyester (greencap)
1 0.15µF greencap
13 0.1µF greencap
2 .047µF greencap
10 .022µF greencap
2 .015µF greencap
10 .01µF greencap
2 .0068µF greencap
4 .0047µF greencap
3 .0022µF greencap
1 .0015µF greencap
10 .001µF greencap
1 680pF polystyrene
1 470pF polystyrene
4 220pF polystyrene
1 100pF polystyrene
2 68pF polystyrene
1 47pF polystyrene

RESISTORS
(¼W, 5% tolerance)
1 x 2.2MΩ, 3 x 470kΩ, 6 x 270kΩ, 1 x 220kΩ, 3 x 180kΩ, 2 x 150kΩ, 5 x 120kΩ, 2 x 100kΩ, 2 x 82kΩ, 4 x 68kΩ, 1 x 56kΩ, 2 x 47kΩ, 6 x 39kΩ, 14 x 33kΩ, 10 x 27kΩ, 1 x 22kΩ, 4 x 15kΩ, 5 x 12kΩ, 10 x 10kΩ, 3 x 4.7kΩ, 2 x 1kΩ, 3 x 220Ω, 1 x 10Ω, 4 x 47kΩ trimpots, 9 x 22kΩ trimpots, 1 x 5kΩ trimpot, 1 x 10kΩ (log) potentiometer

Coming Next Month

On sale Wednesday, January 6

◄ YAESU FT-ONE

We review this state-of-the-art general coverage HF transceiver from Yaesu, the FT-ONE. Is this the Yaesu transceiver to end all transceivers? Find out in our review.

EPROM Programmer

Unlike other designs, this programmer does not require a computer to drive it and has no software – just the thing for future projects using EPROMs. And there'll be four or five other constructional project articles for you to look forward to.

*** 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.**

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Amazing new E.A. "Lyrebird" electronic piano
Has realistic piano sound!

TOUCH SENSITIVE
The harder you play it the louder it gets over 30dB range

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VOICING AND EFFECTS GENERATOR KIT EVG-2 $58.50
Includes P.C.B. and all components including switches, knobs and output sockets.

HARDWARE & CONTACTS PACK KIT HCP-2 $47.00
Includes all nuts and bolts, wire and switch mounting brackets. The contact pack includes silver contact springs, gold plated rod, rod supports, spacers and screws.

CABINET KIT CB-2 $82.50
Partially assembled cabinet with solid timber ends and front ready for oiling or staining and including pre-folded and punched black marviplate cover, plus front and rear panels, pre-punched and silk screen printed.

73 Note Keyboard including hinge for mounting KIT KB-73 $169.50

PEDAL ASSEMBLY KIT PA-2 $47.00
A free standing unit containing two pedals in a neat black box with rubber feet. Each pedal operates its own SPDT contact. Contacts have solder tags and a grommetted hole and cable clamp are included.

Complete construction manual — FREE with any of the above or $5.00 including postage

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6 Octaves F — F
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Fundamental Frequency Range

Master Oscillator 1.588 MHz
TOUCH CHARACTERISTICS
Dynamic Range greater than 30dB
Key Action approximately 50 grams
SOUND ENVELOPE
Touch Range 2 to 40mS
Attack Period less than 1mS
Early Decay 500mS nominal
Sustain 2 to 6 seconds
CONTROLS
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Mellow Voice Select
Bright Voice Select
Harpsichord Voice Select
Honky Tonk Voice Select
Tremolo Effect Select
Phase Effect Select
Sustain Foot Pedal
Soft Foot Pedal
Pitch Control
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Ever missed a 'sked'? With this superb world clock that can give you accurate time anywhere in the world, you won't be missing those important appointments ever again

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HAM CLOCK

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WARNING!

WORLD-WIDE SHORTAGE OF ELECTRONIC GAMES

Read what a leading electronics magazine had to say:

"If you are planning to buy a video game system this Christmas for the family, be warned - the complete production world-wide has already been sold this year!" *Electronics Today International Sept. 28 1981*

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This is an incredible learning aid for any kid who loves or hates maths! Many beaut math practice skills and games. An enjoyable way to learn. Cat. Y-1320

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Why not give something different for Xmas this year? This high quality silver pen has a built-in LCD clock in the stem. Also accepts refills. Your friends will be amazed — they'll probably want one too! Cat. Y-1030

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This clock - timer - alarm module has huge 8mm digits. Also is crystal controlled for accuracy & the claimed accuracy is within plus/minus 1.5 sec per day! Y-1050

ONLY **$19.50**

BUILD A CLOCK/THERMOMETER

(not illustrated)

CLOCK/THERMOMETER MODULE

Has huge bright red digit display, 6 display modes. Time and temperature display, alarm & control for clock, radio, etc. 12/24 hr - C/F Battery back-up facility. Y-1053. (For full design see E.A. Sept. 81).

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DIGITAL DIALLER WITH MEMORY

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If you think this looks like something out of Star Wars, you're probably right! Each time you switch it on it plays the famous Star Wars tune! has multi coloured display with realistic explosion & sound effects! Darth Vader had better flee from this galaxy fast!

Cat. Y-1153

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Jumpin' Galaxies!

SPACE JACK

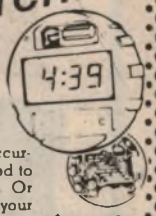
You've seen those Space Invaders games, well here's a new one! It even LOOKS like a spaceship! Shoot down enemy ships for the highest score. Great sound effects. Dr. Spock would raise his ears over this one!

Y-1151

ONLY $49.00

BUILD YOUR OWN WATCH!

LCD WATCH MODULE



Quartz controlled for accuracy, this unit can be used to make your own watch. Or even set it in the dash of your car! See what you can come up with. Y-1039

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CUTIE PHONE

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cat. Y-1179

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Circuit & Design Ideas

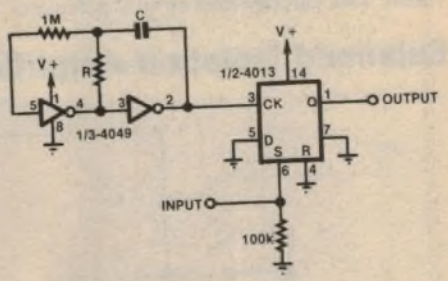
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Random Pulse Width Generator Uses Two ICs

Using two low cost CMOS ICs, this device generates a pulse whose width cannot be predicted. The basis of the design is that the state of a free-running multivibrator is constantly changing; and thus, at any instant, is unpredictable.

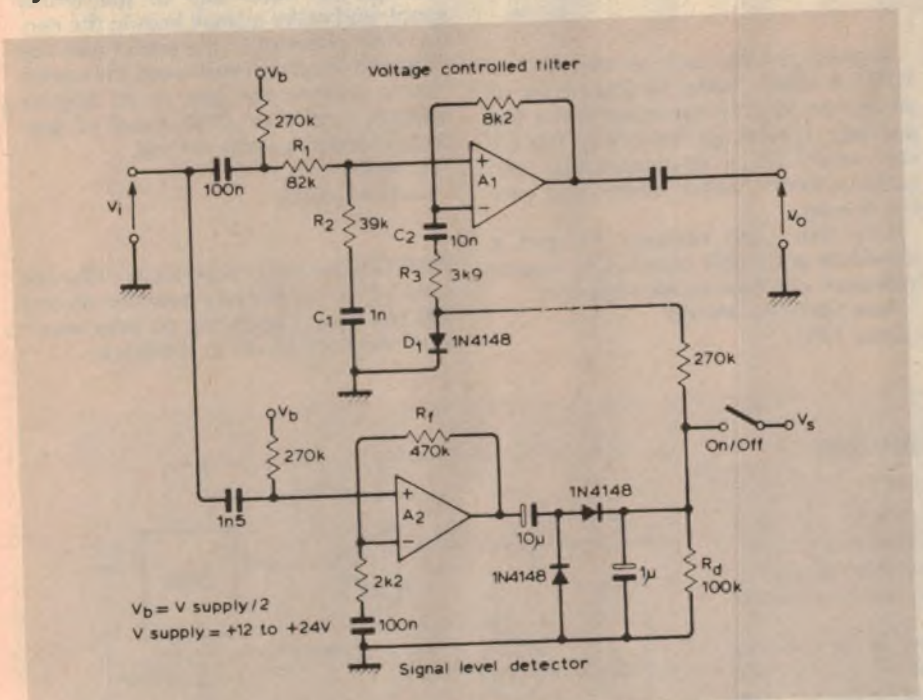
To understand the operation of this circuit, assume that the Q output (pin 1) of the 4013 D-type flip-flop is initially low. When S receives a pulse (at time t1), the D flip-flop is set, with the Q output changing to high. At the end of the input pulse, Q remains high until the state of the astable multivibrator (4049) changes from 0 to 1; at which instant (t2) the Q output of the D flip-flop returns to low. The duration (width) of the output pulse is thus t2 – t1.

Note that whilst the duration of the output pulse is random, it is confined within minimum/maximum limits. The minimum is set by the finite width of the input pulse; the maximum by the sum of the input pulse width and the period (one cycle) of the astable multivibrator. For maximum variation it is thus desirable that the input pulse width be as narrow as practicable. It may therefore be beneficial to reshape (differentiation, one-shot multi, etc) the input pulse prior to application to this device.



J S. Li,
Wollongong, NSW.

Dynamic Noise Reducer for Audio Systems



This circuit reduces the background noise of audio programs in the low-level sections. It may be applied to cassette, tape or disc sources, as it applies a progressive treble cut to signals which fall below about –35dB relative to the nominal 0dB level.

It is especially applicable to cassette tape reproduction, where the added expense and complexity of a Dolby-B decoder is not justified, such as in cassette players installed in motor vehicles.

A high frequency de-emphasis network, consisting of C1, R1 and R2 is in the circuit between the input and op amp A1, whilst a complementary pre-emphasis network (consisting of C2, R3 and an 8.2kΩ resistor) is arranged in A1's negative feedback loop. Assuming that D1 is conducting, the responses of the two networks cancel out, providing a flat frequency response between Vi and Vo. If D1 is in the non-conducting mode, then the pre-emphasis network is disabled, which results in a drooping high frequency response between Vi and Vo. In use, the diode is used as a variable resistance element to constantly vary the HF attenuation according to the signal level.

Bridged across the input is another op amp, A2, which raises the level for signal rectification. Output of this signal rectifier is applied to D1 via a 270kΩ isolating resistor. The level detector decay time and sensitivity are determined by Rd and Rf respectively. An on/off switch is connected between the rectifier output and Vs so that the noise reduction facility may be disabled where desired.

A stereo noise reducer could be built around one TL074 or similar quad op-amp. If desired, a complementary dynamic characteristic (say for encoding recordings) can be obtained by connecting D1 in series with C1 and R2 instead of C2 and R3 (with R3 being taken direct to ground).

From "Wireless World",
January, 1981.

Increased Sensitivity for Infrared Relay

The Infrared Light Beam Relay described in the April, 1981 issue of "Electronics Australia" consists of a simple transmitter operating at a nominal 10kHz, in conjunction with a receiver tuned to a nominal 10kHz. Whilst the bandwidth of the receiver is 1kHz, response is down 3dB at the band limits. Thus it would be possible, due to component tolerance

Continued on p92

spread, for the system response to be down 2 or 3dB. And in extreme circumstances the response could be down even further.

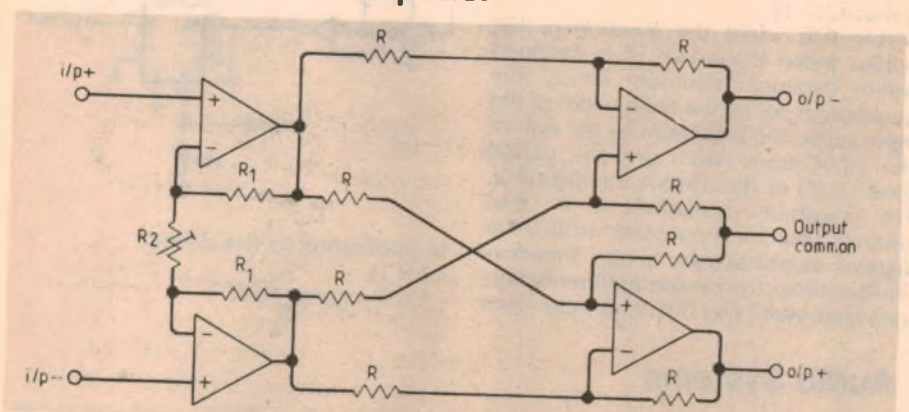
In such cases this could create problems, as the potential range of the system would be seriously reduced. What is required is a method of tuning the receiver to the transmitter (or vice versa). This can be most simply achieved by varying the transmitter oscillator frequency, as only one component requires removal.

Referring to the original circuit diagram, it will be seen that the oscillator is of standard CMOS three-inverter configuration. Frequency is determined by the 4.7kΩ resistor and 6800pF capacitor combination.

By removing the 4.7kΩ resistor, and replacing it with a series-connected 2.7kΩ resistor and 5kΩ trimpot (wired as a rheostat), frequency of oscillation may be preset to match the resonant frequency of the receiver and thus increase the sensitivity of the Infrared Relay system.

W. Pearce,
Croydon, NSW.

Balanced Isolation Amplifier



This circuit results in an amplifier block which features a high impedance differential input, and a low impedance differential output which is balanced about a third terminal. Overall gain is set by R2 which, with an open-circuit, is unity. Maximum gain is limited by performance requirements, but gains of 30 to 40dB should still provide satisfactory AF performance. If usage is to be restricted to very low frequencies, higher gain settings can be chosen with safety.

A quad op-amp such as an LF347 or TL074 is ideally suited to this circuit, as all four devices are contained in the one package. Typical applications of this circuit would be in instrumentation and audio systems, where earth loop problems exist.

Note that both resistors R1 and R should be accurately matched to ensure maximum common-mode rejection.

From "Wireless World",
June, 1981.

A Use for Your Empty Desoldering Wick Spool

Carrying a heavy carton of solder does not appeal to many of the servicemen and technicians who are engaged in making outside calls. But a one or two-metre length of uncovered solder is not only clumsy to use, but also picks up impurities which do not help in making good-quality joints and connections. However, an empty desoldering wick spool serves as an excellent container for storing a small length of solder.

To stop the solder from unwinding, fold up the outer flap of the empty spool, and make a small hole in the centre. Push one end of the solder into this hole and wind the rest onto the spool. Finally, restore the flap to its original position, and your small spool of protected solder is ready for use.

A. Stewart,
Gumdale, Qld.

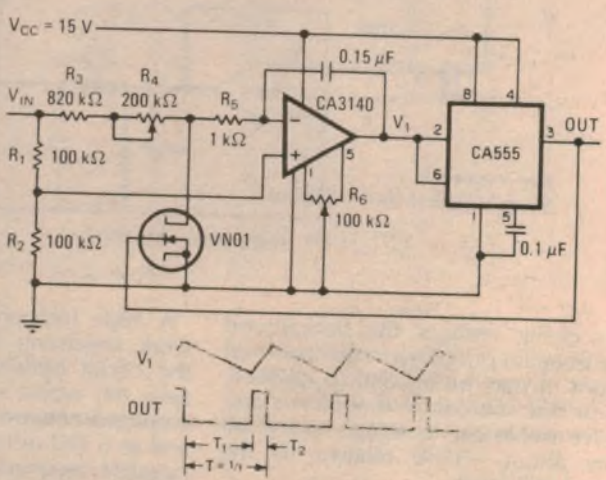
PSST! Got any neat circuit ideas? Why not send 'em to us? We pay between $5 and $20 per item, depending on how much work we have to do to publish it.

Voltage-to-Frequency Converter

With excellent linearity over the range 0 to 10V, this voltage-to-frequency converter functions with a conversion factor of 1Hz per volt. It would be suitable for control applications where the output frequency must correspond directly to the DC input potential.

Referring to the diagram it will be seen that the CA3140 op amp and 555 timer are wired together as a simple oscillator. Half the input voltage is applied to the op amp integrator over time interval T1, and the 555 timer is switched on when the falling edge of V1 goes below ⅓Vcc. During all of interval T2, the VN01 field-effect transistor is switched on to permit the integration of +½Vin, so that voltage V1 will rise. When V1 exceeds ⅔Vcc, the 555 is switched off and the cycle of this operation is directly proportional to the magnitude of the op amp's output, V1.

Trimpot R4 sets the voltage-to-frequency conversion factor at 1, and R6 is used to null the op amp's offset. The VFET (VN01) may be replaced by an inexpensive NPN bipolar transistor if two 10kΩ current-limiting resistors are added – one in the line connecting the output of the 555 to the transistor's base, the other between the transistor's base and emitter (ground). With this configuratioon, the lower limit of the voltage-to-frequency conversion will be 10 millivolts.



From "Electronics",
January 27, 1981.

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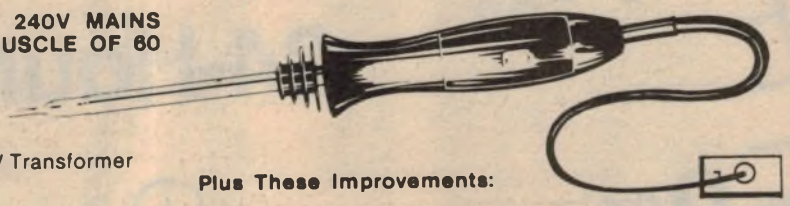

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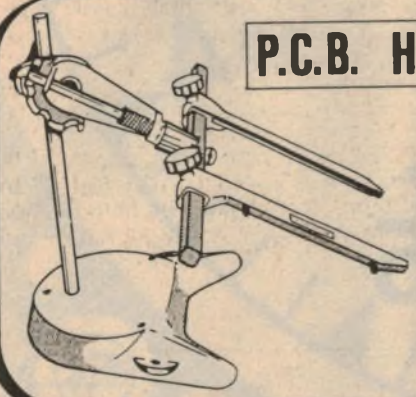

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Electronics for the handyman:

24-Hour Crystal Clock

In response to requests from amateurs and shortwave listeners (SWLs), we've redesigned the dial of our latest quartz crystal clock to provide 24-hour readout. Set either to UTC or local time, it will make a useful addition to the radio shack.

Last August, we described a crystal clock based on a newly available quartz crystal clock module from Amtex Electronics. The project proved immensely popular, with most readers purchasing the module to substitute for the mechanism in an otherwise defunct antique clock. There must have been many antique dealers bewildered by the sudden demand for old clocks!

Of course there were some readers who took up the other options suggested in the article, including mounting the module on a dial etched onto a printed circuit board (PCB). This latter approach was the one that appealed most to many amateurs and SWLs except for one problem: there was no 24-hour readout.

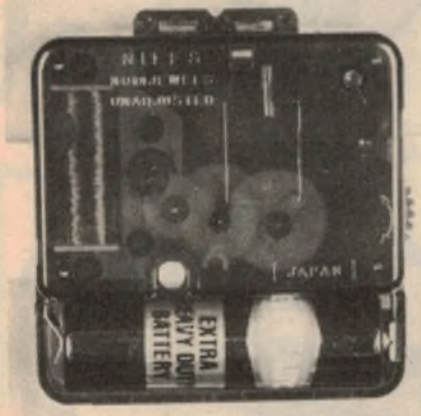
Unfortunately, modifying the clock module to operate as a 24-hour movement is out of the question. Our approach, therefore, was to modify the dial face by adding the numbers 13 to 24

as shown. All the user has to do now is remember which half of the 24-hour cycle is displayed.

The big advantage of our new dial is that you no longer have to mentally add 12 to all readings after twelve midday. You now simply read the correct time in the 24-hour cycle straight from the dial (assuming of course that you know whether it is morning or afternoon).

Naturally things become a bit more complicated if you set the clock to a time standard other than local time; eg, to UTC. It is now no longer obvious whether the reading should be, say, 0600 or 1800. The best way around this problem is to use the clock together with a chart that converts local standard time to UTC or whatever.

Pricing and availability of the clock module are as for the August issue. To recap briefly, the module is available for $13 post paid from Amtex Electronics, Suite 104, 11 Spring St, Chatswood, NSW 2067 [telephone (02) 411 1323]. Alternatively, it can be purchased direct



Close-up view of the clock mechanism. Unit runs from a single 1.5V dry cell.

from a number of retailers for around $11.50 including sales tax.

As mentioned in the August article, the clock comes supplied with two pairs of hands. The larger, plain hands suit the PCB dial face and measure 80mm from spindle to tip for the minute and sweep second hands, and 58mm for the hour hand. The more ornate set are suitable for smaller, old-style clocks and measure 54mm for the minute hand and 37mm for the hour hand.

The module is easy to use and is intended for single hole mounting. It is mounted directly behind the clock face, and packed as necessary to achieve a suitable spacing between hands and face.

The hour hand supplied with the movement is a push fit. The minute hand then slides over two tiny flats on its collar and is held by a small brass locking nut. Use the ring locking nut if you intend to fit the second hand. If you do not intend to fit the second hand, use the dome nut to ensure a neat finish.

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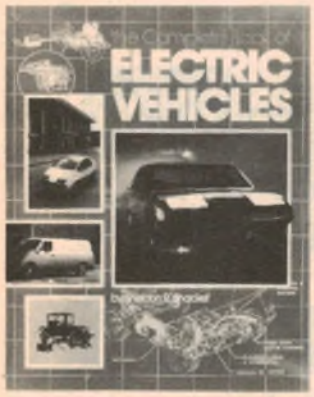
Books & Literature

Electric Vehicles

THE COMPLETE BOOK OF ELECTRIC VEHICLES, by Sheldon Shacket. Soft covers, 168 pages, 215 x 278mm, illustrated with many photographs. Published 1979 by Domus Books, USA. Price $8.95.



Anyone who has an interest in electric vehicles should regard this well-presented book as worthwhile reading even though there have been quite a few recent developments since its publication in 1979.

The book begins with quite a long review of the history of electric vehicles which is complete with many photos of electric cars and trucks from around the turn of the century. The next two chapters are devoted to the fundamentals of electricity and electric motors. This is kept to a quite basic level but the reader is told of the mechanical differences between shunt, series, compound and induction motors and so on. This latter chapter would have been improved with the illustration and explanation of torque/speed curves of these various motors without it becoming too technical.

Chapter four discusses batteries and energy systems but again on a very basic level. But chapter five, on electric vehicle controls, is the biggest disappointment since it gives none of the circuitry used in modern electric vehicles and it is fairly clear from the text of the chapter that the author does not have a clue in this regard. He even seems to have the idea that thyristors and SCRs are different types of devices.

Chapter six is a comprehensive catalogue of electric vehicles which are (or were) currently in production at the time of publication of the book. Included are some vehicles which have featured in the pages of Electronics Australia in recent years. The chapter includes forklift trucks and some of the futuristic mass-transport systems currently being researched. Not included is the Daihatsu Charade which is currently available on the Australian market.

Chapter seven is given over to examples of home-built electrics, both cars and bicycles while chapter eight discusses contemporary American legislation which is designed to promote electric vehicle research. Finally, chapter nine talks about the future.

While clearly enthusiastic about his subject, the author recognises that electric vehicles have a long way to go before they match the economy, reliability and convenience of modern four- cylinder designs such as the VW Golf, Mazda 323 and Honda Civic. In short, this book is a good record of the present state of electric vehicles although it does not explain or discuss the technology involved at any depth. Our review copy came from Dick Smith Electronics (L.D.S.).

Video Display

SON OF CHEAP VIDEO, Don Lancaster. Paper covers, 221 pages, 136mm x 216mm, illustrated with charts, tables and circuit diagrams. Published by Howard W Sams & Co Inc USA 1980. Price $11.95.

This is a sequel to the author's previous publication "The Cheap Video Cookbook". Together, the two books show low cost techniques for displaying computer graphics and alphanumeric characters on an ordinary television set. A feature of "Son of Cheap Video" is a series of video display circuits which Don Lancaster calls "cheaper than cheap" or "scungy video".

Chapter one describes the first such project, a video display system that can be built from standard parts for around $US7.

Briefly, the techniques described use a minimum of special purpose display hardware, relying on the microprocessor itself to generate all the required video timing signals. The simplest display project uses only five integrated circuits, and puts one line of 32 characters on the TV screen, reading directly from the computer's memory.

Because of the method used to generate the video timing signals, the circuits described here are very much dependent on the capabilities of a particular microprocessor, in this case the 6502, as used in the KIM-1 and Apple II. Two later chapters describe the application of the same ideas to the 8080 processor, used in the Heathkit computer, but these sections are not as detailed as other parts of the book.

Further chapters in the book expand on the "scungy video circuit" and present other useful techniques, including the use of EPROMs as character generators. A description of the hardware and software for a "chunky graphics" display is given, and Chapter four gives details of a music display system suitable for creating and displaying music notation on a video display.

Two final chapters provide a circuit for adding lower case capability to the Apple II computer and describe the software needed to use the modification. Three appendices are provided, covering further details of the use of the 2716 EPROM and Motorola's 6674 character generator, pin-outs of ICs used in the circuits described and two small circuit board patterns for the EPROM and character generator display modules.

"Son of Cheap Video" is an interesting book, covering a wide range of circuits and ideas for simple video displays. Having said that, it should be pointed out that the book really is a sequel. For full understanding of the circuits described it is necessary to read "The Cheap Video Cookbook" in conjunction with this volume. All the techniques described are designed to US video standards, of course, so modifications will be necessary to use the same ideas with video displays of the Australian PAL standard.

Our review copy came from McGill's Authorised Newsagency, 187-193 Elizabeth St, Melbourne, 3000. (PV).

Basic Electronics

ELEMENTS OF ELECTRONICS 5: Communication. By F. A. Wilson. Stiff paper covers, 248 pages, 180mm x 108mm, illustrated by line drawings. Published by Bernard Babani (Publishing) Ltd, London. Price in Australia $8.85.

Although compiled in the modest paperback format favoured by Babani Publishing, this book is not short on content. The author – a writer with a string of qualifications and affiliations, – assumes that the reader has a basic knowledge of electronics, such as might be gathered from the first four volumes in the "Elements of Electronics" series.

His initial concern is to look at the way information is conveyed through elec-

tronic systems – the form it takes, (Information Theory), bandwidth, attenuation, noise, AF and HF cables, and transducers. It is useful supplementary information.

But that is only the beginning. There are chapters on Transmission quality assessment; Networks, with reference to theorems, pads and filters; Transmission systems, wired AF and RF, carrier and digital; Signal Processing, with special emphasis on modulation systems; Electromagnetic waves in communication, including transmission lines, radiating systems and waveguides; Optical transmission.

Appendices add another 15 pages and include wavelength/frequency conversion, the geometry of electromagnetic rays and trigonometry.

Spot reading served to confirm that the material had been carefully planned and presented and time spent in absorbing the contents of this book should nicely round out the thinking of anyone with a working knowledge of electronics. Our copy came from the Technical Book & Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne, 3000 (W.N.W.).

Amateur Call Book

AUSTRALIAN RADIO AMATEUR CALL BOOK: Published by the Wireless Institute of Australia. Stiff paper covers, 269mm x 210mm, including directory, maps, tables and procedures. Recommended price $3.95.

The 1981–1982 issue contains a far wider range of information for amateurs and short-wave listeners than previous issues, together with information about amateur radio in general, 46 pages in all, plus a segregated eight-page traders' advertising section.

The Australian amateur call sign list is published by the WIA under licence from the Australian Government publishing service, using material supplied by the Department of Communications. Details include all state call sign lists up to and including June, 1981, addresses of Department of Communications (Operations Branch) throughout Australia, and WIA in all states.

Several pages are devoted to information concerning the operation of amateur stations in Australia, frequency bands, licensing regulations, reciprocal licensing, third party traffic, distress calls, WICEN, education facilities, Australian television, broadcasting and FM stations and frequencies, world time zones etc. These are also of value to non-amateurs.

Of special interest to amateurs and swl's, apart from the call signs listed, are the Australian DXCC countries list which can be removed from the centre of the book as a quick reference sheet. There is a full listing of VHF, UHF, ATV, RTTY and WICEN repeaters, including call sign, location and frequencies, amateur band

(continued on page 131)

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Electronic Data Book	$ 7.20
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Electronic Projects for Musicians — Anderton (Guitar Player Pubs)	$ 9.95
Ham & CB Antenna Dimension Charts Noll	$ 3.20
Practical Transformer Design Handbook- Lowdon	$29.75
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AMATEUR RADIO

by Pierce Healy, VK2APQ

Department of Communications upgrades services

Recently, when making the annual pilgrimage to renew my station licence, VK2APQ, the opportunity was taken to seek out acquaintances among the Frequency and Regulatory Section staff and look over the new Sydney office of the Department of Communication.

Since July 27, 1981, the Sydney headquarters of the DOC have been located in the MLC Building, 105-153 Miller Street, North Sydney – a prestige business area of the city.

The offices are now in keeping with what you would expect for such an important government department. The whole area is tastefully carpeted and furnished, providing pleasant conditions for both the staff and public.

The improvement over the multi-floor, rabbit-warren, congested premises in Berry Street, North Sydney, vacated by the Regulatory and Licensing Section, is most marked.

The public now has easy, convenient, and comfortable access to the Department and this is no doubt appreciated by both staff and public. It is conceivable that financial savings will result from the move, with all Department sections in one location.

On the upper ground floor adjacent to the main entrance is the inquiry desk, licensing section, and cashier, together with records, and a private interviewing room.

Licences are now issued over the counter on payment of fees by candidates successful in all amateur examinations. Requests to select a station call sign from those available are also acceded to.

Almost the whole of the second floor of the MLC Building is occupied by various sections within the DOC, including the ministerial office, broadcasting policy and operation department, radio inspectors, type testing laboratory, station monitoring equipment transferred from Middle Head, confiscated equipment store, conference and training rooms, general administration offices, and individual offices for senior staff.

During the course of general conversation, I was assured that every effort is being made to speed up answers to amateur examination inquiries, examination results, and associated matters.

There are no doubt problems arising from government financial policies and staff ceilings. This is a point I sensed as being of great concern to senior officers and is the major factor which causes delays in services, such as checking complaints of RF interference, and finalising examination results.

All in all, the relocation to a central point, with more comfortable working conditions, should noticeably improve the Department's image.

The postal address is: Box 970, PO, North Sydney, 2060. Telephone: (02) 922 9111.

IMPOSITION OF EXAMINATION

Federal police have been investigating cases of forgery, misconduct and imposition, under the Crimes Act, in relation to amateur examination certificates issued to applicants.

Recently an amateur was apprehended in north Queensland for false representation in obtaining a certificate. He was taken to court and fined. No doubt this will results in cancellation of his licence certificate.

It is believed that other cases are pending.

IARU NEWS

The fifth conference of the International Amateur Radio Union, Region III Association, will be held at Manila in the Philippines. Amateur radio societies in the area, which includes Japan, Southeast Asia, India, Australia, New Zealand and Oceanic countries, who are members of the IARU, will meet to discuss and plan future policies to further the status of amateur radio within their own countries, as well as on the international scene.

The WIA is the internationally recognised body representing all Australian amateurs.

The twelfth triennial conference of the IARU Region I Division was held at Brighton, England, during April/May, 1981. Thirty-eight of the 51 member societies of the division were represented by delegates or proxy. There are just on 127,300 amateurs in the region.

Among those present were N. B. Eaton, VE3CJ, president of the IARU, R. L. Baldwin, W1RU, secretary IARU, H. J. Dannals, W2HD, president ARRL, P. Seidmann, YV5BPG, secretary Region II, and D. Rankin, 9V1RH (VK3QV), secretary Region III.

The agenda covered many subjects relating to local and international amateur radio, among which were: an international beacon project, electro magnetic compatibility, IARU monitoring system, band plan for new frequency allocations, data transmission, etc.

The special conference station GB1IARU made more than 5000 contacts.

A lengthy report on the conference appears in the July, 1981, issue of "Radio Communication", the Radio Society of Great Britain monthly journal.

REPEATER CALL SIGNS

The Department of Communications has reviewed the allocation of call signs for beacons and repeaters. Previously, certain alphabetical segments were allocated to different States or areas. It has now been decided to make the full series, VK RTA to VK RTZ and VK RSA to VK RSZ available to all States for amateur beacon/repeater stations. The applicable State prefix number will be inserted after the "VK".

NEWS FROM USA

A bill introduced by Senator Barry Goldwater, K7UGA, has been approved by the United States Senate. The bill, among other things, gives the Federal Communication Commission authority to establish minimum radio frequency rejection standards for electronic equipment. This action should result in less interference being caused to home entertainment units such as radiograms, electronic organs, TV sets and the like.

The FCC will also introduce facilities for selected amateurs to assist in radio monitoring and in the preparation and administration of examinations.

The term for an amateur licence has been extended from five to 10 years, and 10 metre repeaters are now permitted.

AMATEUR RADIO

ASSISTANCE FOR DISABLED

Last month's lead story was on amateur radio and the disabled. Here is a report from the July 1981 issue of "Radio Communication", the RSGB monthly journal.

The Radio Amateur Invalid & Blind Club: The aim of the RAIBC is to enable blind and disabled short-wave listeners and amateurs to pool their knowledge and experience and, with the assistance of representatives and supporters, enjoy the hobby of amateur radio.

At the annual general meeting held at the end of May, 1981, at the Alexandra Palace, the secretary reported that during the year, 12 high frequency or very high frequency transceivers and 14 receivers had been added to the considerable number already on loan to members.

A total of 154 new members had joined, bringing the total to nearly 7000.

The treasurer reported that $A6350 had been spent on aid to members, ie, purchase and repair of equipment, and recording the RAE course on cassette.

Here in NSW the co-ordinator for the disabled is Jim Saunders, VK2BNY, 19 Wallis Avenue, Toukley 2263, or telephone (043) 96 4718 during business hours. Jim will be interested to hear from those interested in the project.

UOSAT LAUNCHED

As these notes were being completed it was learned that UOSAT, Great Britain's first amateur satellite, had been successfully launched at 1127UTC on the 6th October, 1981.

Preliminary orbital parameters were given as: orbit period 95.45 minutes, height 550km, beacon frequencies 145.825MHz and 435.825MHz.

Several weeks of engineering and performance testing are planned before any schedules are announced in the ARRL W1AW news broadcasts.

RNARS ANNIVERSARY AWARD

The Royal Naval Amateur Radio Society was formed on June 20, 1960. To celebrate its 21st anniversary the society has instituted an award to encourage contacts between society "special callsign" stations, RNARS members, and all amateurs.

The award is available to all amateurs or SWLs for contacts/reports between June 1, 1981 and May 31, 1982. For those outside the British Isles and Europe six contacts – one with a special call sign and five with ANARS members – are needed to qualify for the award.

Special call signs which will be active during the period are: GB2RN, GB3RN, GB4RN, GB3RNR, GB4RM, GB8RM, GB2MN, GB3CRS, VK3RAN and ZL2RN. Frequencies to monitor are: 1820, 1860. 3520, 3660, 7020, 7090, 14,052, 14,140, 14,340, 21,052, 21,190, 28,052, 28,400 and 28,933kHz.

Applications giving certified log data, together with 10 IRC's, should be forwarded to: T. McCrimmond, G4LQM, 6 York and Albany Close, Walmer, Deal, Kent, England.

RADIO CLUB NEWS

CENTRAL COAST AMATEUR RADIO CLUB: Preparations are already advanced for the 25th annual field day on Sunday, February 21, 1982, at the Showground, Showground Road, Gosford, NSW.

For those who have not attended this annual get-together a special invitation is extended. There will be plenty of events and entertainment for the whole family.

Any telephone inquiries relating to the field day may be made to Ray Wells, VK2BVO on (043) 24 1592 between 7.30am and 3.30pm weekdays only.

Why not make it a family weekend and book early for accommodation either at a motel or caravan park to suit your particular needs.

Further details in February issue of these notes.

MOORABBIN AND DISTRICT RADIO CLUB: Here is an item in a lighter vein taken from the August 1981 club newsletter "APC".

"A seminar will shortly be held in Melbourne to examine the effects of Murphy's Law upon amateur activities. As the air-conditioning system at the venue has broken down, the date has yet to be announced. In any case, it cannot be held until the fire damage repairs are completed. This may take a while, since the builder concerned has had a car accident.

"The lecturer, now fully recovered from his confrontation with a semi-trailer, would like anyone who knows the whereabouts of his lecture notes to contact him as soon as possible. As there is a problem with the telephone connection, please address information and donations to: The Murphy Foundation, Stuffup Lane, Mount Disappointment, NSW."

(As the address is not shown in NSW postcode listings it seems that for relief from those frustations it may be necessary to resort to further "APC's" – VK2APQ).

SAINT GEORGE AMATEUR RADIO SOCIETY: Here is a snippet from "Dragnet", July 1981, the quarterly SGARS bulletin, which may have those who participated in the disposals era after WWII hunting through their junk boxes.

"The December 1980 issue of Electronics News reports that in the current catalogue of the Fordham Radio Supply Company of New York the advertised prices for a number of older type valves seem to be reaching an all time high.

"The all-metal 6AC7 is advertised at $US20. It is outclassed by the metal 6H6 at $US30. However, the metal 6J7 is an all time winner at $US40."

SGARS meets at 7.30pm on the first Wednesday of each month at the First Allawah Scout Hall, corner Blakesley Road and Bellevue Parade, South Hurstville. Visitors are always welcome.

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.

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The Australian CB SCENE

CBRS for 1982: A 40-channel system?

All being well, January 1, 1982, should see the introduction in Australia of a 40-channel CBRS, hopefully identical to the FCC system in the USA. This would be the logical outcome of the Committee of Inquiry Report, as set out on page 9 of the October issue.

I certainly hope that a goodly number of CBers from among EA readers accepted the Department of Communications' invitation to comment on the recommendations. If it all works out as I hope, '81 will go down as a year in which notable advances were made. And I, for one, will be looking forward to celebrating the new year with the right to operate on 40 channels.

Conformity to the 40-channel FCC system would mean that the channel numbering system would revert to the way it used to be (prior to the 18-channel system) but with channels 24-40 added. It would look like the tabulation as follows:

FREQUENCY	CHANNEL NUMBER	NORMAL USAGE
26.965	1	General AM
26.975	2	General AM
26.985	3	General AM
27.005	4	General AM
27.015	5	General AM
27.025	6	General AM
27.035	7	General AM
27.055	8	Road Channel (1)
27.065	9	Emergency Ch. (2)
27.075	10	General AM
27.085	11	AM Call Ch. (2)
27.105	12	General AM
27.115	13	General AM
27.125	14	General AM
27.135	15	General AM
27.155	16	SSB Call Ch. (2)
27.165	17	General SSB
27.175	18	General SSB
27.185	19	General SSB
27.205	20	General SSB
27.215	21	General SSB
27.225	22	General SSB
27.255	23	General SSB
27.235	24	General SSB
27.245	25	General SSB
27.265	26	General SSB
27.275	27	Generel SSB
27.285	28	General SSB
27.295	29	General SSB
27.305	30	General SSB
27.315	31	General SSB
27.325	32	General SSB
27.335	33	General SSB
27.345	34	General SSB
27.355	35	General SSB (3)
27.365	36	General SSB
27.375	37	General SSB
27.385	38	General SSB
27.395	39	General SSB
27.405	40	General SSB

NOTES: (1) Recommended only. (2) Legally designated. (3) Suggested as a second SSB call channel.

Channel 35 seems to be used at present by "pirate" operators as an international call channel. Whether the NCRA is willing to back it as a second SSB call channel remains to be seen. At best, it would probably end up as such by a "gentlemen's agreement" only.

Once again, on behalf of the NCRA, I would call on all operators to take out licences if they do not already have them. The Department has come our way on quite a number of issues, in the update of the CBRS, and it is therefore to be hoped that CB operators will show their good faith by becoming legal.

It has long been our argument that an expansion of the HF channels would encourage a lot of former operators back on to the air, and would also help persuade non-licenced operators to do the right thing. Please don't let us down.

The Department relies on the number of licences issued to determine the number of operators on the air. It is reasonable to assume that the larger the number of licences, the more pressure we can exert on the Department for consideration in the future.

Problems in NZ

When our Prime Minister uttered those memorable words "Life wasn't meant to be easy", he might well have had in mind the New Zealand CB operators. From what I have been reading, New Zealand's name should be changed to the "Land of the Long Black Cloud". My good friend and erstwhile reporter, Ken Upton, has sent me copies of pages from one of New Zealand's newspapers, the "Truth".

Without getting bogged down with the moralities involved, it would appear that Radio Inspectors across the Tasman are getting a bit too keen in the areas of operating out of band and overseas communications, primarily with Australia.

There have allegedly been cases where peoples' homes have been broken into, even though the people were on their way there to open the house for the inspectors, after having been contacted at work and asked to do so. And there are the all-too-familiar allegations of ill-mannered inspectors "coming the heavy" on wives and the elderly; of entry without search warrants; of failure to produce ID cards and so on.

Thank goodness those days belong to the past here in Australia. I can honestly say that most of our local RI's nowadays are just average guys doing a messy job as best they can, and are as well mannered as they are permitted to be by the circumstances. Not so in New Zealand, apparently.

One of the most startling comments contained in the newspaper clippings, which Ken sent me on the subject, is one

made by Mr Dave Williams, president of the CB Radio Association. He is quoted as saying "The law is the law and it must be upheld. If you have something to be afraid of, that's your problem"; and "If you want to talk overseas, then the Post Office has the answer – get yourself an amateur radio licence."

Those of you who are familiar with the NCRA, our Australian CB organisation, will know that our attitude has been quite different. We have always said, in relation to Mr William's first comment, "If the law is wrong, don't break it, change it"; and, in relation to the second of his comments, "Make it legal for Aussie CBers to communicate overseas."

If the attitude of all New Zealand CBers is the same as Mr Williams', the licenced CB over there will stagnate. Indeed, had the NCRA's attitude been the same as his, we would still be operating under the conditions which were set up in 1977.

Perhaps our progress has been slower than we would like, but at least we have made progress.

I would like to hear comments from New Zealand readers on the subject, but would also like to leave them with this thought . . . "The people do have the power to change the law . . . if they really want it changed".

There must surely be some kind of a lesson in what has been achieved here by sitting down with Ministers and their top administrators, and seeking an answer for what are difficulties for them – as well as for those who are motivated to defy them!

In the meantime, I would like to ask Australian operators who exploit the 26MHz band to New Zealand to cool it. Apparently, our signals are causing real problems for the Kiwi operators who wish to stay within the law as it is. If a Kiwi wishes to take the chance and operate on the 27MHz band, that's their choice. After all we are permitted to acknowledge overseas "breakers" in our QSOs.

And in the UK . . .

The November issue of the English journal "Practical Electronics" carries a large news item headed "Citizens Band in Chaos?"

Written in mid-September, they complain that no one had been able to obtain a firm starting date even through the paperwork was complete. Manufacturers were holding up production and there could be a shortage of legal equipment on the starting date, as a result.

Well that seems to be it for this year, so I shall close off for 1981 in the hope that you will all join me in 1982. May we all have a happy and prosperous New Year. Jan Christensen, PO Box 406, Fortitude Valley, 4006.

Jan Christensen

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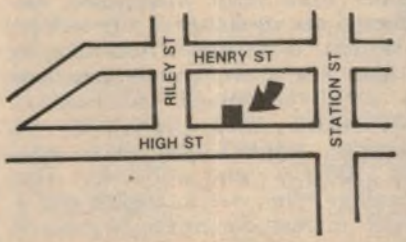

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SHORTWAVE SCENE

by Arthur Cushen, MBE

FCC approves four new shortwave stations

The United States Federal Communications Commission recently approved the operation of four new shortwave stations, two in the United States and the other two on Saipan in the Western Pacific, while the Voice of America plans to operate a program service for listeners in Cuba.

The first United States based station is WRNO, New Orleans, which has been under construction for some time and is expected to commence operation this month. The tentative schedule is 1800-2000 UTC on 17895kHz, 2000-2200 on 15355, 2200-2400 on 11890, 0000-0200 on 11965 and 0200-0700 UTC on 6155kHz, according to the WRH Newsletter. Transmitter power is 100kW. This is the first new shortwave station to be licenced in the United States for more than 40 years. Using the slogan "Radio New Orleans", broadcasts will be directed mainly to Europe and Canada.

The second station, Radio Miami in Florida, using the call sign WRMF (Radio Miami Florida), is expected to commence operation in about a year's time. WRMF is being built by medium-wave outlet WQBA and the short-wave transmitter will use 50,000W and a curtain antenna to beam the program south into Central and South America. Radio Miami will be a commercial station and will mainly broadcast in Spanish, reflecting the operation of the medium-wave station which caters for the more than 700,000 Cuban exiles in Florida. The medium-wave station WQBA operates on 1140kHz and is to increase power from 10kW to 50kW shortly.

Two stations on Saipan in the Western Pacific, in the Mariannas group, a United States trust territory, have been licenced by the FCC. A gospel station using 100kW will be operated by the Far East Broadcasting Company and has been assigned the call KFBS. Their gospel programs will be mainly beamed to Japan and parts of Asia.

The second station for Saipan is to be a commercial broadcaster and will be operated by Marcon. This station plans to provide Japanese language programming into Japan and will use a 100kW transmitter with a curtain antenna. According to information from Radio Netherland's Media Network program, these two stations in Saipan should be operational towards the end of 1982.

THE VOICE OF FREE CUBA

The United States Government has announced the setting up of a high powered station to broadcast from the Florida area for reception in Cuba. The Voice of Free Cuba will be similar to Radio Free Europe and Radio Liberty which have broadcast to Eastern Europe and the Soviet Union for more than 30 years. The station plans to commence operation in January but it will not be the first with a transmission beamed to Cuba. For many years the Voice of America operated two medium-wave stations, Marathon and Sugar Loaf, from southern Florida and earlier this year opened a relay base on Antigua. One of the famous anti-Cuban stations which was heard in this area was Radio Swan broadcasting from a small island in the Caribbean with transmission on medium and shortwave. This new station beamed at Cuba is to call itself Radio Marti, after Jose Marti, a hero of Cuba's war for independence against Spain in the last century.

LOW POWERED STATION

There are several low powered stations operated by the Broadcasting Corporation of Japan which relay the Home Service NHK programs. One of these which carries the NHK second program from JOZK Matsuyama has confirmed our reception of a broadcast on 3970kHz using 600W. According to the letter the shortwave transmissions are 2040-0100UTC 6005kHz; 0100-0130UTC 9535; 0230-0425 on 6005kHz; 0600-1100 3970 and 1200-1500UTC on 3970kHz. The verification letter was in English and a booklet commemorating the 40 years of JOZK was included.

There are several low powered stations which relay the NHK program on shortwave and as well as Matsuyama on 3970kHz there is a relay on this same frequency from Sapporo and Nagoya. It is therefore necessary to get the closing announcement of the station when the call sign is given following the national anthem at 1500UTC, as the program content from the three stations is the same. The transmitter is classed as an emergency facility, but seems to provide shortwave coverage for a part of Japan where medium-wave reception is not satisfactory.

INDONESIAN VERIFICATION

After listening to Radio Republik Indonesia station Tanjungkarang with a late broadcast on July 31 it was interesting to receive details on the reasons for the extended broadcast. In a long letter in English, the Director explained that during the month of Ramadan Moslems fast between 4.40am and 6.05pm. He commented that July 31 was the last day of fasting and since they had finished their duty it was their happiest time. Instead of closing at 11pm local time 1600UTC, they broadcast for a further hour with a special program called "Stage of Joy".

The station operates on 1031kHz medium-wave and 3956kHz though the schedule shows their frequency as 3995kHz. The schedule is 2150-1600UTC with some short breaks during lunch and early evening transmission. Our verification was signed by Mr Hamdan Syahbeni.

SERVICE FROM URUGUAY

The only station in Uruguay with an External Service is SODRE (Servicio Official de Difusion Radio Electrica) which broadcasts from Montevideo using two 10kW transmitters. Both these transmitters are used in parallel for a service from 0100-0400UTC on 9515kHz with English at 0145 and 0315UTC. According to the Nagoya DX Circle the transmissions open at 0850 and continue to 2200 on 9620 and 15275kHz. The International Service commences at 2200 through to 0100 on 11855kHz before moving to 9515kHz for the balance of the transmission. Broadcasts on 11855kHz include English at 2245 and 0015UTC, while Spanish is heard at 2200, 2330, 0100 and 0230UTC.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.

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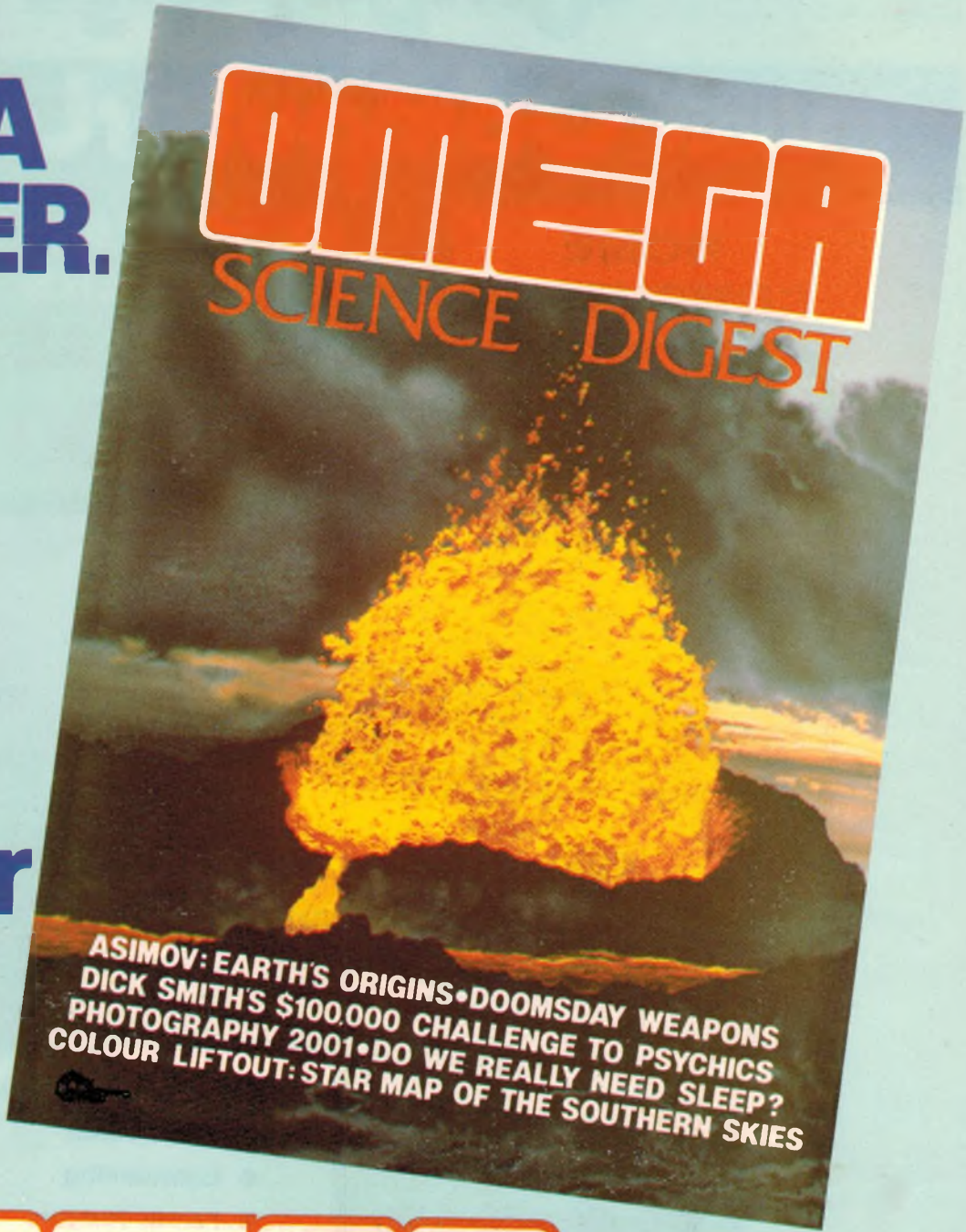

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December, 1931

2SM opens on Christmas Eve: The Catholic Broadcasting Company has chosen Christmas Eve for the opening of its new B-class station, 2SM, when the occasion will be celebrated by the broadcasting of High Mass from St Mary's Basilica.

The policy of the station will be to transmit high-class programs during week-days and religious services from St Mary's Basilica or other Roman Catholic churches on Sundays. The religious transmissions, which have been going through 2UE in the past, will be transferred to 2SM.

Two announcers have been appointed: Mr John Dunne and Miss Zara Gaden, both of whom have had considerable theatrical experience.

Miss Zara Gaden, who is an ex-student of St Vincent's College, Potts Point, Sydney, has a striking personality and unusual charm, which should win her many friends over the air.

☆ ☆ ☆

Electrolytic condensers: Introduced to the Australian market a few months ago, the electrolytic condenser has taken the trade's fancy, and today practically every set manufacturer in Sydney uses electrolytic condensers in the filter circuits of his sets. Naturally enthusiasts are interested in the change over from paper to electrolytic condensers, and some pretty fierce debates on their merits have taken place between members of one radio club and probably in others. To show that the subject has many points to be considered, it is only necessary to notice that technical journals from both England and America are divided on the subject, some supporting the electrolytic, whilst others say they are a failure and will soon become discarded.

☆ ☆ ☆

When the Southern Sun, with passengers and air mail for London, crashed at Alor Star as a result of overloading recently, many were disposed to blame the radio installation, without the added weight of which, it was said, the plane could have got away.

The plane had been elaborately equipped by Amalgamated Wireless with a transmitter for short and long wave communication with commercial stations, and a receiver adapted both to long and short wave reception.

Japs building seven new stations: Plans for the construction of seven new broadcasting stations to widen the service being furnished by the 15 existing stations of the Japan Central Broadcasting Corporation, have been approved by the Japanese Department of Communications.

Most of Japan's radio manufacturing industry consists of the assembly of sets from imported parts. Valves also are largely imported, though there are several tube manufacturers, the largest an American subsidiary. There are at least 100 makes of radio sets, including American, British, German and Dutch, manufactured or assembled and sold in Japan.

☆ ☆ ☆

Beyond The Ultra Highs: Going beyond even the so-called ultra-high frequencies, the International Communications Laboratories, Hollsborough, NJ, unit of the I.T. and T. Co, has asked the Federal Radio Commission for authority to erect two transmitters to operate between 1,000,000 and 3,000,000 kilocycles — small fractions of one metre. A European subsidiary of I.T. and T. recently conducted tests with high frequency voice transmission across the English Channel with favourable results, but these are the shortest wave lengths ever sought from the authorities.

RADIO TELEVISION AND HOBBIES 1/6

December, 1956

Outsize in radar: The United States Navy Department has recently announced the most powerful, longest-range shipborne radar set ever put in service and installed on the cruiser Northampton.

The heart of this most powerful radar set is a Westinghouse-designed magnetron, known as "Big Maggie", which delivers to the radar antenna the powerful pulses of energy which can search out enemy planes over 400 miles away.

☆ ☆ ☆

Television is here at last! After so many years of being "just around the corner", TV this month at last comes officially into Australian homes. From now on life will be different, spiced with a new adventure, filled with a new interest, enlightened, we hope, with a new and powerful influence for the community's good.

This fine picture, taken in the studios of the BBC, vividly illustrates the alert action that goes to make a first-class studio program of the type we soon hope to see in Australia.

☆ ☆ ☆

Cinerama at sea: Conversion of an obsolete aircraft carrier into a floating movie theatre is contemplated by the US Information Service. Its purpose would be to visit ports all around the world, where Russian propaganda is busy.

Columnist Roscoe Drummond says, "Criticism may be expected from some of the sophisticated experts on US propaganda, jeering at anyone thinking he could sell America with cinerama.

"Nobody is proposing any such thing.

"Those who are drawn to cinerama will see much else — an atoms-for-peace exhibit, displays of how the American economy works for its people and enables US to help others."

Flight deck of the carrier will provide space for a cinerama theatre seating 2000 persons and leave room for other exhibits.

The cinerama suggestion, says the columnist, "springs from the notable success which US had in using widescreen films in exhibits at Damascus and Bangkok".

☆ ☆ ☆

Underground TV: French television teams recently descended 2300 feet below the surface of the earth to produce a "live" television show on the miner at work.

Three hundred feet of new shafts were dug for the broadcast, and 1000 tons of ore were knocked down. The television teams lowered 5500lb of equipment into the mine, and laid almost two miles of cables and wires.

One of the greatest difficulties encountered was the temperature in the mine (108°F). Some of the equipment contains material which will evaporate at a temperature only a few degrees higher.

☆ ☆ ☆

TV in Ark Royal: Ark Royal, Britain's biggest aircraft carrier, has its own TV station. The Ark Royal, which is now re-commissioned, has 50 17 inch model receivers.

The TV studio aboard the ship has a camera, control unit, amplifying equipment, monitor sets and a cine projector.

Whenever the ship is at sea and far from home waters, sailors off watch will be able to sit in their mess decks and recreation rooms watching tele-films or "live shows" put on by the ship's company.

When the Ark Royal is within reception distance of British TV transmitting stations, or "swinging around the buoy" in harbour, the crews will see both the ITA and BBC programs.

New Products

30MHz storage 'scope from BWD Instruments

BWD Instruments Pty Ltd are going from strength to strength, increasing production of their wide range of oscilloscopes. Interest is particularly strong in the BWD 945 Storage Oscilloscope, which combines a range of storage modes with 1mV per division sensitivity, 30MHz bandwidth, a wide range delayed or mixed time base and comprehensive trigger facilities. With the addition of an optional battery pack, the unit is also completely portable.

Storage may be either in a normal mode or a special fast mode. By writing in the fast mode then switching to normal, storage times of up to 50 minutes are available. The maximum writing speed is specified as 1μs/div, but speeds of up to five divisions per microsecond can be achieved over most of the screen.

In addition to selectable storage, the oscilloscope also features an automatic storage facility which holds the CRT erased, extending the waiting period for signals to several hours. A signal will be immediately written in response to a trigger and then automatically stored.

BWD is also expanding into the OEM market with a recent contract with Radionics Pty Ltd, a Canadian firm specialising in the design and manufacture of medical monitoring instruments.

Radionics approached BWD to develop a special oscilloscope to be used in conjunction with their "echo-occulometer", used for measuring the parameters of the human eye prior to fitting plastic prosthetic lenses. A digital read-out from the occulometer and the BWD oscilloscope are used to obtain essential information prior to surgery.

A first order for 50 of the specialised oscilloscopes in the Radionics house colours has been placed with BWD. The oscilloscopes will be manufactured at BWD's recently expanded plant at Mulgrave, Victoria.

Further information on BWD Instrument's oscilloscopes and other test equipment can be obtained by writing to the company, at PO Box 325, Springvale, Vic 3171.

Keithley Instruments digital multimeter

Keithley Instruments recently introduced their new Model 128 Handheld "beeper" digital multimeter, developed primarily for the industrial and consumer service and repair markets. The Model 128 offers 0.5% accuracy, 3½ digit resolution (1mV), maximum current readings of 10A and resistance measurements to 20 megohms. Five testing functions are also included.

A beeper feature is incorporated, operating on all measurement ranges. Audible feedback indicates levels above the pre-set threshold when measuring voltage and current, and levels below the threshold when measuring resistance. In all cases the display remains active so that a precise measurement can be made. A side-mounted switch disables the beeper when audible feedback is not required.

Threshold for the beeper can be set as required, and high input impedance (10 megohms) is maintained with the beeper activated, making the Model 128 useful for sensing CMOS and other logic levels.

Also provided is a diode test range with a 1mA source current. Indication is by a LED in addition to the scale reading. Other features of the instrument include a rugged case with the circuit board cushioned against shock, 15mm high LCD display, full overload protection, rotary switches for range and function selection and a colour coded faceplate. Battery life is around 200 hours with carbon-zinc batteries, rising to 300 hours with alkaline types.

Keithley Instruments products are distributed in Australia by Scientific Devices Australia Pty Ltd, 2 Jacks Rd, South Oakleigh, Vic 3167, and 31 Halsey Rd, Elizabeth East, SA 5112.

Utilux connectors

New from Utilux Pty Ltd is a range of precision screw terminal blocks for printed circuit board mounting. The H1700 series terminal blocks are available in three basic styles with terminal spacings of 5mm and 10mm. Available sizes are different for each style of terminal block, but blocks of any size can be obtained by butting two or more blocks end-on, retaining the same terminal spacing.

Terminal blocks are a versatile solution to the problem of terminating leads to printed circuit boards. Further details are available from Utilux, Pty Ltd, 14 Commercial Rd, Kingsgrove, NSW, 2208. The postal address is PO Box 68, Kingsgrove.

Products continued p108

The amazing ATARI 400
Personal Computer

The great thing about the Atari 400 Personal Computer is that you don't have to be a computer whizz kid to use one!

The Atari 400 is both highly educational and highly entertaining and offers an amazing range of functions ..... with learning programs available to teach you touch typing and fun programs that let you pitch your skills against Space Invaders — in colour and complete with sound effects!

Take your family into the space age with the Atari 400 Personal Computer — you don't have to be a genius to use one but it would be a smart idea to order your Atari *now*.

Features/Specifications

CPU: 6502 Microprocessor. 0.56 microsecond cycle. 1.8 MHz
Colour: 16 colours, each with 8 intensities
Sound: Four independent sound synthesizers. Variable volume and tone. Internal speaker (in addition to audio through T.V.)
Memory: 16K bytes of Random Access Memory (RAM) included. 10K ROM fitted. Accepts cassettes or ROM cartridges. Utilises full range of peripherals & accessories.
Keyboard: 57 key monopanel alphanumeric keyboard plus 4 function keys. Upper/lower case. Inverse video. Full screen editing. Four-way cursor control. 29 graphics keys.
Language: ATARI BASIC cartridge is included.
DISPLAY: 24 lines of 40 characters. Three text modes. T.V. interface provided (for channel 3).

ALSO AVAILABLE!

Atari 800
Personal Computer System
WITH 16K BYTES OF RAM FITTED — EXPANDABLE TO 48K 10K OF ROM

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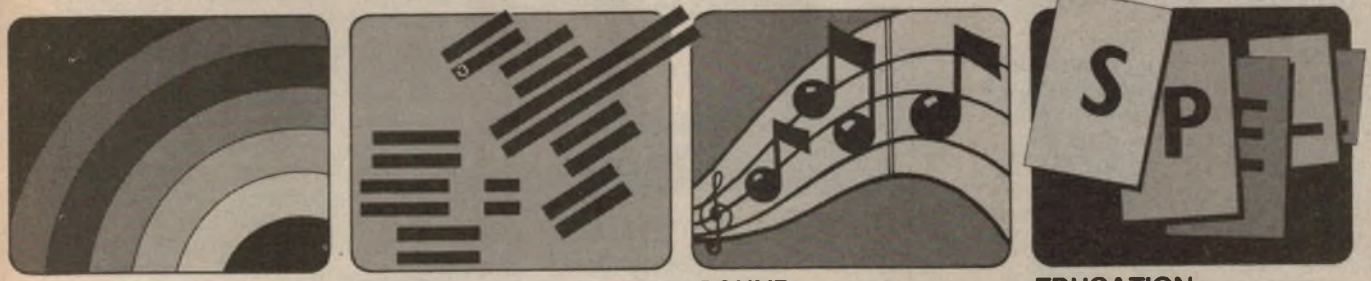

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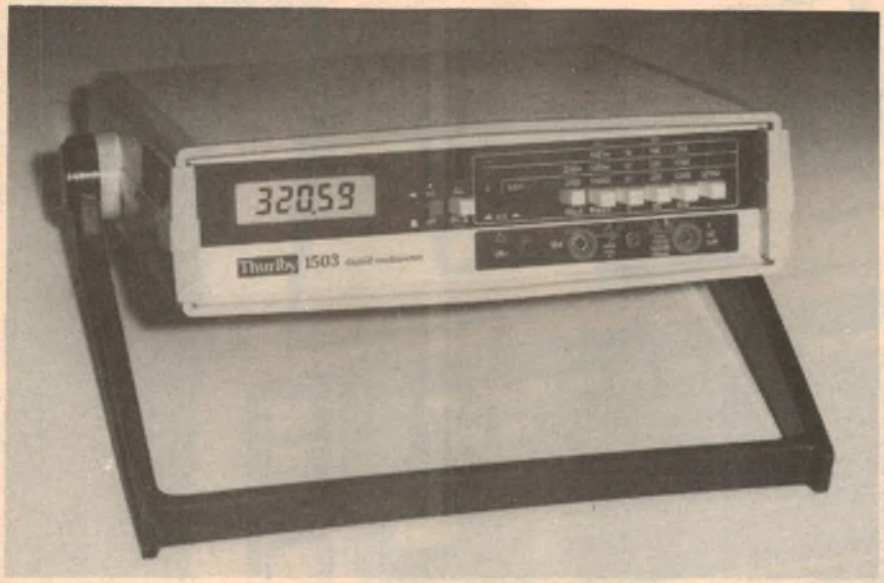
New Products



Parameters Pty Ltd is now distributing the new Thurlby 1503 LCD multimeter, a 4¾-digit device. The extra resolution of the 1503 allows it to monitor, for example, a 1mV change in a 30V power supply rail. A 4½-digit meter would be limited to a change of 10mV, and a 3½-digit meter limited to a change of 100mV on this range.

In addition, the extra resolution virtually eliminates inaccuracies due to digitising error, resulting in accuracy figures for the DC voltage ranges at least five times better than 3½-digit meters.

Thirty measuring ranges are provided, covering the five basic functions of DC and AC voltage measurement, DC and AC current measurement and resistance measurements. Diode test and frequency measurement functions are also included. Frequency measurement is achieved with a crystal controlled timebase, and maximum reading is 3.999MHz.

Readings can be made down to 10 microvolts, 10 milliohms and 1 nanoamp. Maximum input voltage is 1200V and current readings of 10A continuous can be made.

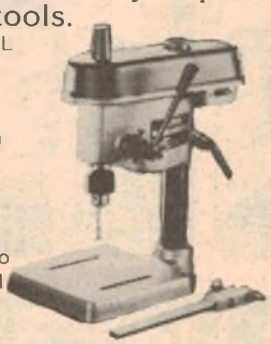
For further information contact Parameters Pty Ltd, PO Box 573, Artarmon, NSW, 2064.

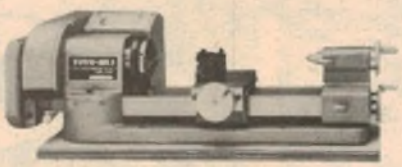
TOYO

PRECISION EQUIPMENT FOR THE ELECTRONICS INDUSTRY

The TOYO MINI DRILL and TOYO MINI LATHE afford complete accuracy equal to the standard of larger machine tools.

The MINI DRILL (as illus) offers 6 speeds from 850-31,000 RPM and has a drilling capacity from 0.0135mm to 6.5mm. Machine vice to suit if required. Weighs only 5.4kg.





The MINI LATHE (as illus) is fitted with a 240 volt motor, speed range from 250-3000 RPM. It has a swing of 100mm and is 250mm between centres. Weighs 15kg.

For brochures, prices and information contact

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Service manual for JIL-SX200 receiver

GFS Electronic Imports, Australian distributors of the JIL SX-200 HF/VHF/UHF programmable scanning receiver recently announced the availability of a comprehensive service manual for the unit.

The SX-200, a scanning receiver programmed from a front panel keypad, covers frequency ranges of 26-88MHz, 108-180MHz and 380 to 514MHz, and uses a 4-bit microprocessor with its own on-chip 2K ROM and 96 bytes of RAM. Extensive use is also made of LS1 Phase Locked Loops, shift registers, counters, pre-scalers and a 1K static RAM. JIL recognised that the advanced design made it mandatory for servicemen to have available a comprehensive service manual.

Included in the service manual are a block diagram, circuit diagrams, circuit and wiring diagrams, PCB layouts, a list of components, alignment procedures and a list of voltages for each IC and transistor.

The manual is available either directly from GFS Electronic Imports; 15 McKeon Road, Mitcham, Vic. 3121, or their distributors in other states. Price is $10 plus $2 for post and packing.

More Heathkit/Zenith electronics education kits

The range of electronics education courses from Heathkit/Zenith has been expanded with the addition of two new series, one covering linear circuits and the other digital. According to a spokesman from Warburton Franki, who distribute the Heathkit/Zenith systems in Australia, the abbreviated circuit descriptions of the series are ideal for the person who would rather learn by doing than by reading masses of theory.

Each course consists of a series of circuit "files" arranged in order of increasing complexity. Each file contains a brief description of the circuit, its operation, a circuit diagram and modifications to the basic circuit. Students learn how each circuit operates by building the circuit and observing its performance. When the course is finished the user has a handy circuit file for future reference.

The linear circuits course contains 86 components which can be built into more than 30 circuits, covering bipolar transistor applications, field effect transistors, the 555 timer and 741 operational amplifier. Students can construct various amplifiers, oscillators, multivibrators and active filters, among others, and then observe their performance with a voltmeter and an oscilloscope (both are necessary for the course).

Digital circuits are covered by the new

Products continued p111

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BELT DRIVE STEREO RECORD PLAYER MODULE

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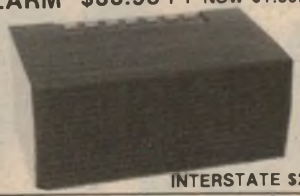

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MODEL C129R ● 240VAC 50Hz ● AUTO/MANUAL OPERATON ● 3 SPEEDS, 33, 45, 78rpm ● BIG 28cm PLATTER ● CUE-PAUSE CONTROL ● 2 SPINDLES ● CERAMIC CARTRIDGE ● TEMPLATE, INSTRUCTIONS ●

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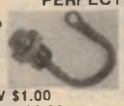

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55 watt for 36" blades
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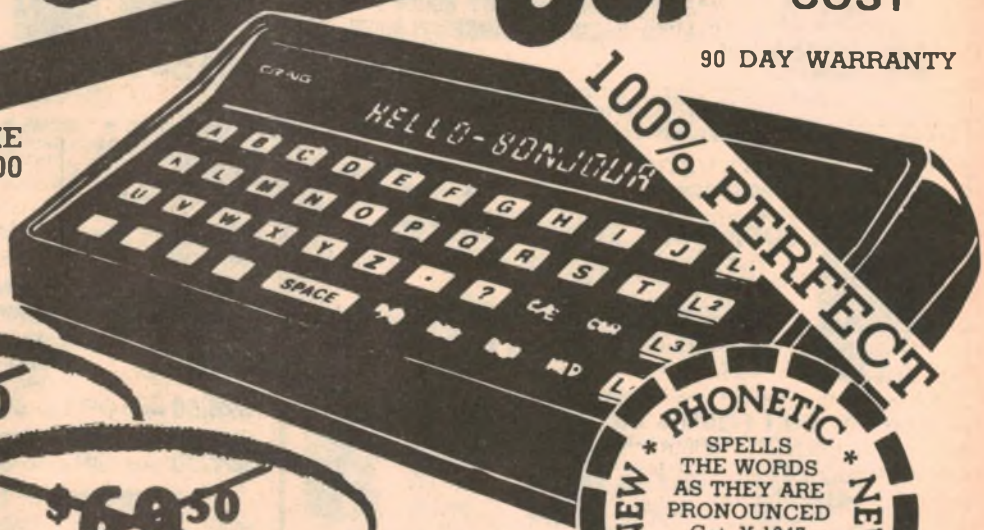

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Heathkit/Zenith

TTL and CMOS Circuits series. Examples of circuits covered include seven segment displays, flip-flops, clock generators, data multiplexers and comparators. Sixty-five components are included in the course, building up into 50 circuits.

Each of the educational courses are distributed in a vinyl binder containing circuit files and components. Circuits can be built up on the Heathkit/Zenith ET-3300 trainer, or the student can supply his own breadboard and power supplies.

For more details of the EH-702 TTL and CMOS Circuits course or the EH-701 Linear Circuits course contact Warburton Franki. The latest Heathkit catalogue is also available, free of charge, from Warburton Franki offices.

Toyo Mini Lathe, bench drill for the workshop

Two new products from Melbourne Machinery Co (Sales) Pty Ltd will be of interest to hobbyists. The first is the Toyo-ML1 Mini Lathe, a full-featured lathe suitable for modelling and small scale manufacturing. Also available is the Toyo-Mini Drill-1, a miniature bench drill.

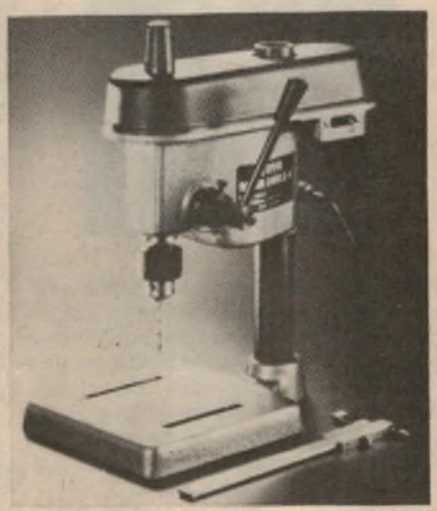
Toyo's lathe measures 250mm between centres and can turn work up to 68mm in diameter, or 80mm diameter with the optional 4-jaw chuck. A 145W motor is fitted, with reduction gears providing ratios of 250,1000, 2000 and 3000 rpm. An extensive array of accessories is available for use with the lathe, including a drill chuck, automatic feed gear and screw cutting tools, a 90mm diameter

ctd from p108

face-plate (needed for turning long work pieces) and a variety of cutting and finishing tools.

Price of the lathe is $425 plus sales tax.

The MD-1 bench drill is a table-top model, capable of taking drill-bits up to 6.5mm diameter. Maximum distance from between the cast-iron drilling table and the end of the drill chuck is 180mm, and the drill spindle can move a maximum of 45mm down onto the work. Six speeds are available by changing the driving belts to a different set of pulleys inside the detachable head cover.



Sakai Special Camera Mfg Co Ltd of Japan manufacture both Toyo products, placing special emphasis on precision and performance. Distributors of the tools, Melbourne Machinery Co (Sales) Pty Ltd, are at 51-61 Queensbridge St, South Melbourne, 3205.

Two colour Light Bars from Hewlett-Packard

Hewlett-Packard has added two innovative products to its family of LED Light Bars with the release of their new 8.89mm x 8.89mm Bicolour Light Bars. The Light Bars are composed of eight light emitting diodes; four high efficiency red and four that are either yellow (HLMP-2950) or green (HMLP-2965). Light from each LED is optically scattered to form an evenly illuminated light emitting surface.

Applications for the Light Bars include front panel indicators, back-lighted front panels, two-function lighted switches and illuminated labelling on control labels. Each of the four bicolour LED pairs can be controlled separately, giving three possible states (red, green or off). By using pulse width modulation techniques a range of colours can be obtained from the device.

Each Bicolour Light Bar is rated for total light output and dominant green/yellow wavelength, so that a uniform front panel appearance can be achieved.

The Light Bars are in stock at all authorised Hewlett-Packard distributors.

Single device has bargraph display and driver

National Semiconductor has introduced a series of integrated bargraph displays that save space when used in analog instruments such as panel meters, thermometers and speedometers. Due to their single unit construction, the NSM3900 LEDs are said to be considerably more reliable and resistant to shock than the conventional separate driver/display combinations.

For more information contact National Semiconductor, Cnr Stud Road and Mountain Highway, Bayswater, Vic 3153.

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REVIEWS OF RECENT

Records & Tapes

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BERLIOZ/COLIN DAVIS — A first-rate performance

BERLIOZ — L' Enfance du Christ. Sacred Trilogy. Janet Baker (Mary); Thomas Allen (Joseph); Eric Tappy (Narrator); Jules Bastin (Herod); Joseph Rouleau (Father of the Family) and others with the London Symphony Orchestra and John Alldis Choir conducted by Colin Davis. World Record Club stereo discs (two) R06217/8.

It is now 20 years since Colin Davis first recorded this work and I still have that set. It was therefore possible for me to make a comparison between the 1961 version and this one, first issued four years ago. I have enjoyed playing the earlier one so often that I know it well enough to recall the main points — and some of the details — without reference.

Leaving aside the improved sound of the new one, the main differences are only in details. Davis has remained true to his original conception. Even back in those days, he was well on the way to establishing himself as a true disciple of Beecham, when it came to playing Berlioz.

On a level of realism there is a point I would like to make: the tempo of the march of the Roman patrol at the beginning of the work goes a bit fast when the slowish, distance consuming stride of the Roman legions is recalled. But, on the level of musical effectiveness, Davis' present tempo is unquestionably better.

Janet Baker starts with a slight pulse in her lovely voice at the beginning of the stable scene but loses little time in correcting it. The chorus of invisible angels is at times almost inaudible but, otherwise, the choir makes a superb contribution. Listen especially to the entrancing singing in the Shepherds' chorus.

Davis is careful to maintain a modest and serene atmosphere throughout the cantata although, when necessary, he adds dramatic emphasis whenever it is needed. But there are no inappropriate gestures and posturings. The music remains reverent as well as sensitive.

Taking the new production all round, the analog recording is absolutely first rate, although one or two blemishes in the balance might be spotted by the hypercritical.

Among the principals, only one calls for any really critical remarks — Joseph Rouleau; but much can be ignored since his part is, after all, supposed to be that of a modest family man. He almost disappears behind the orchestra in his solo as The Father. The Narrator, Eric Tappy, tells the story simply and with the utmost clarity. In Davis' original recording Rouleau sang the part of Herod with keen perception of that king's agonising dilemma. Jules Bastin, in the performance under review, sings a heroic Herod always sure of himself and his authority.

Finally, memorable performances come from Janet Baker (Mary) and Thomas Allen (Joseph). While his Joseph is always practical yet warm hearted, her Mary has a carefully calculated remoteness. A moments' thought will establish its authenticity.

The orchestra is consistently splendid and the little trio for flutes and harp ravishing. Both Davis' sets are fine and I would be loath to part with either but there is always the improved engineering in the new issue. (J.R.)

MENDELSSOHN/HAITINK "Sorry to write so tepidly"

MENDELSSOHN — Symphony No. 1 and Symphony No. 4 (Italian). London Philharmonic Orchestra conducted by Bernard Haitink. Philips Stereo Cassette 7300 803.

Haitink can always be relied upon to give a sound performance of everything he plays. Sometimes he moves into a rank far above this standard. Take his superb Mahler series for instance; and, although I have no love for the composer, his Bruckner Symphonies as well.

These Mendelssohn works, however, find him in the first category. For instance, in the first movement of the Fourth (Italian) Symphony, his speed is up to tempo but, somehow, the movement seems to lack the sunny temperament expected of it. Bar by bar, you will find it difficult to fault but my impression was that everyone was pleased to be playing it for what they thought was the last time ever. Moreover, the sound on this Dolby cassette is not always up to Philips' best.

The second movement, a sort of pilgrims' march, goes nice and briskly but has much of the nonchalance of the first.

The Third movement is graceful but, after having said that, I find nothing of importance to add. There is commendable accuracy of attack at brave speed in the final Salterello, a pace that here, at all events, keeps everyone on their toes.

In Symphony No. 1 the sound is a bit congested, so that some detail is missing in the early part of the first movement. It shows a bit more spirit than the first movement of the Fourth, although not done full justice by the recording.

The second movement (andante) is pleasant but of no great emotional import and Haitink's tempo is more often moderato than andante. The attractive syncopations of the third are not always completely without the occasional unen-

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.).

thusiastic bar. I am afraid I didn't find the Finale exciting, although the voices in the fugal part were always nice and distinct. Elsewhere it lacked pointed accenting. I am sorry to have to write so tepidly about a conductor I admire so much, but there it is. (J.R.)

DELIUS: "given a little patience . . ."

DELIUS — Violin Concerto. Double Concerto. Yehudi Menuhin (violin) and Paul Tortelier (cello) with the Royal Philharmonic Orchestra conducted by Meredith Davis. World Record Club Quadraphonic OR06186.

You'll have to be a dedicated Delius lover to get full enjoyment out of these two works, for here is no Delius splashing about sensuously among gently modulating chords but two pieces with bones in them! You will find none of the Delian atmosphere of "'Twas brillig, and the slivy tove did gry and gimbal in the wabe" (I quote from memory, so may not have it quite right). Instead you are offered logic instead of rhapsody.

This is especially evident in The Double Concerto, when the recording engineer caught the nowadays sometimes disappointing Menuhin on one of his best days. Yet even here he is not at his one time best; not the old Menuhin who always hits the note bang in the middle.

Tortelier plays beautifully, with obvious understanding of this alien idiom, but is placed just a tiny bit too far behind the violin. This however is not as important as it might read, because both players treat the two works not as great occasions but rather as delicious examples of pure sound woven into slender but sturdy material.

That Menuhin's tone tends sometimes to harden might be due to the recording although, at other times, the old warmth for which he was famous is unmistakeably still evident. There are also moments when he sounds a wee bit too busy although, at all times, he maintains a flowing melodic line.

I realise that this may all sound a little contradictory but, if you hear it, you'll know instantly what I mean. And although the disc is only about five years old, it cannot be said to be one of the period's best examples of reproduction.

Both works tend to be of chamber music stature and although characteristically Delian, might well have sounded better under the baton of Beecham. It is difficult to win the "blending" atmosphere that distinguished Beecham's magical performances although Meredith Davis makes a brave stab at it.

While on the subject of Beecham's Delius, I might point out that I have heard the late Sir Thomas rehearse a Delius work assiduously for a very long time, before finally expressing his approval of its sound. But at the concert performance that night, he might play it quite differently, yet with the same magical effect. Please don't ask me how he did it!

I think that, given a little patience, even strongly anti-Delians will come to enjoy these concertos.

And aren't we about due for a new recording of Sea Drift and Appalachia, preferably by Beecham's true successor, Colin Davis? They would, I am sure, receive an enthusiastic welcome. (J.R.)

ORGAN SPECTACULAR

"flamboyant but capable"

CARLO CURLEY GOES DIGITAL — The Allen Digital Computer Organ in the Great Hall, Alexandra Palace, London. Stereo, digital master, Chalfont SDG-303A. (From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.)

In January last, I reviewed this performance, as recorded from a normal analog master tape, but I also mentioned the existence of a digitally mastered version. Well, here it is, through the auspices of PC stereo, who are now carrying the Chalfont label, along with a number of others.

I commended the analog version warmly because, amongst other things, it emphasised that a big digital electronic organ was fully competitive with a big pipe instrument in a comparable acoustic environment.

I would have liked to compare the analog with the digital version in a true, blind A-B situation but that was not practical. I therefore had to play the albums in tandem, well knowing which was which. Given that limitation, I soon developed a preference for the digital sound, because of what I believe to be lower intermodulation. There was less "snarl" in the big bass and the smaller high frequency sounds emerged more distinctly. In short, the digital had that certain "effortless" quality that I have referred to on other occasions.

As for the recital itself, it is a collection of organ "chestnuts", played by an organist who is often criticised as being flamboyant. He also happens to be an extremely capable musician! The one track about which I had reservations was Widor's Toccata from Symphony No. 5. In both versions, the bass sounds uncharacteristically lumpy.

The track titles: Toccata and Fugue in D Minor (Bach); Fantasia in F Minor (W.A. Mozart); Toccata from Symphony No. 5 (Widor); Fugue a la Gigue (Bach); Trumpet Voluntary in D Major (Clarke); Scherzando (Pierne); Finale from Symphony No. 6 (Widor).

Recorded on a Sounstream digital deck, it has the audio spectacular qualities that are usually associated with Telarc. I doubt that you'll hear a bigger organ sound anywhere, particularly in the bass end. For other observations, see "Forum" elsewhere in this issue. (W.N.W.).

MOZART: A contrast in emotions

MOZART — Piano Concertos Nos. 12 and 27. (K414 and K595.) Murray Perahia (piano) with the English Chamber Orchestra conducted by Perahia. CBS. Masterworks Stereo Disc SBR236008.

The first movement of Mozart's 12th Piano Concerto reflects Mozart's gaiety during his early stay in Vienna, following the annoyance he suffered in Saltzburg under the "patronage" of the odious Archbishop of that diocese.

Perahia captures this happiness and carefree mood beguilingly in the first movement which has, for an early work, a few interesting and strange syncopations in the middle. They provide an example of certain daringly original touches in an otherwise fairly conventional work. It is almost as if the composer was trying to discover how far he could go with his new audience.

Perahia gives us no tick-tock or tinkling Mozart. He builts on a delicate though sturdy frame, with a discreetly full-toned contribution beautifully balanced against the orchestra which, incidentally, he conducts while playing the piano part!

The Andante, a movement of serene elegiacal musings, might well have been religious in origin — a thought promoted by the long solo passage early in the structure. On the other hand, there are loud stretches later that reveal a mood much more fleshy than holy. But, whatever its meaning or temper, it is an enchanting movement, enchantingly played.

Though tending to length, one is still reluctant to leave it, even for the gay Finale, especially after its passionate ending. And just when you think the Finale itself is getting a bit dead-pan, Perahia enlivens it all again with a general lightening of spirit.

Nine years stretched between the 12th and 27th concertos, during which Mozart's pleasure at being in Vienna had suffered a sad blow. Things had not gone well. Viennese interest in his work had

waned and his wife had constantly nagged him about their poverty.

But, despite all this discouragement, which might well have led a lesser man to thoughts of suicide, we have glorious, mature Mozart in this, the last of his piano concertos. It is technically different from any piano concertos that had preceded it.

The solo part is not composed to advertise the soloist's virtuosity. Instead, piano and orchestra are one unit but, in a marvellous way, the piano part leaves an abiding memory in the listener's mind. The slow movement is in solemn mood, one almost of farewell. There is pain in plenty; resignation too.

Anything less virtuoso-like in a piano concerto is hard to imagine. Yet everything is on a sublime plane of emotion which makes the triviality of the opening of the Finale theme sound all the more startling in its mediocrity – this, despite the pseudo jauntiness designed to emphasise its dubious "charm".

Yet Mozart goes on to do quite wonderful things with a theme that sounds a bit like an errand boy's whistle! Here the piano part is more showy, admirably dealt with by Perahia. Everything is beautifully fluent and the engineering fine. (J.R.)

☆ ☆ ☆

GREAT MARCHES FOR ORCHESTRAS. EMI SMP 0020. World Record Club Release.

The Queensland Symphony Orchestra does a stirling job of playing for us, twelve marches from the classical repertoire, most of them qualifying as "favourites".

The performance, under the baton of Patrick Thomas, is of a high standard but the overall enjoyment of the record is somewhat marred by a very low recording level, to the point that surface noise sometimes intrudes. This reservation aside, I found the contents quite enjoyable.

The titles: Grand March From "Aida" – March Of The Little Leaden Soldiers – March Heroique – Turkish March From "The Ruins Of Athens" – Pomp And Circumstance No. 3 – Hungarian March From "The Damnation Of Faust" – Alla Marcia From "Karelia Suite" – War March of The Priests, from "Athelie" – March From "The Love Of Three Oranges" – March From "Algerian Suite" – March From The "Trojans" – Pomp And Circumstance No. 1. (N.J.M.).

☆ ☆ ☆

ARIE ITALIANE BAROCCHE (Italian Baroque Songs) – 14 songs by Caldara, Cavalli, Carissimi, Pergolesi, A. Scarlatti, Vivaldi; Teresa Berganza, mezzo-soprano and Cicardo Requejo, piano. DG Stereo disc 2531 192.

This record is a joy to listen to, from

CBS from Concept Audio

BARBRA STREISAND'S GREATEST HITS, Volume 2. Audophile stereo, CBS Mastersound 86079. (From Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale, NSW 2100. Tel (02) 938 3700.

Audiophile records and cassettes seem to be coming from all directions, these days, with Concept Audio being the latest source. I understand from Managing Director Derek Pugh that Concept is distributing a range of titles additional to that being handled in Australia by, CBS itself. At the time of writing, Concept have 10 titles in stock, with another 12 to folow.

According to the jacket sleeve, the Mastersound series contains a mix of pressings from digital master tapes and analog tapes, handpicked for their technical and musical excellence. They are transferred to disc at half speed and pressed in special quality vinyl in West Germany. That they are intended for the international market is evidenced by the fact that the jacket notes are in English, French and German.

After all that, it is not surprising to find that the sound quality is extremely good, even though it has probably been compiled from a number of source tapes. The frequency range is wide, the balance is good and the surface is dead quiet.

The track titles are: Love Theme from "A Star Is Born – Love Theme from "Eyes of Laura Mars" – My Heart Belongs To Me – Songbird – You Don't Bring Me Flowers – The Way We Were – Sweet Inspiration/Where You Lead – All In Love Is Fair – Superman – Stoney End.

The Barbra Streisand sound can – and does – range all the way from beguilingly gentle to brittle and, to the extent that that is her style, she does it well. Whether you appreciate and enjoy it is something on which you will already have made up your mind!

But you best be sure about it, because this series of audiophile discs is priced at $22.99. (W.N.W.)

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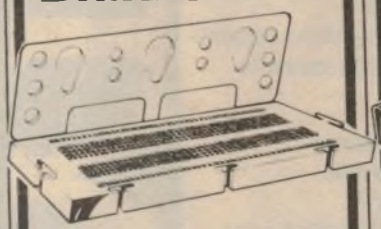

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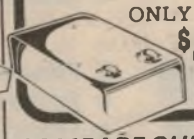

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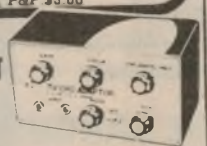

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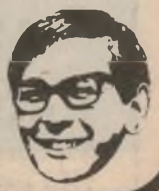

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RECORDS & TAPES — continued

beginning to end. The repertoire, with a few exceptions, is of almost unknown material, each work superbly sung, beautifully recorded and quite splendidly accompanied. Perhaps none of this should have surprised me, but I had feared some diminution of Berganza's vocal dexterity and was not familiar with her partner's artistry.

It would indeed be foolish to seek favourites in a program such as this one. There is a temptation, at first, to compare the disc with Janet Baker's "Arie Amorose"; although both are great singers and supreme artists, even though the period covered coincides, a comparison is pointless. Miss Berganza has been around for a bit longer than Janet Baker and no longer feels the need to express wild passions and moments of exalted drama; in their place she proffers a mellowness and a quiet pleasure in the beauty of her music. Mr Requejo, her regular accompanist, is quite a find and I should hope to hear more from him. The disc is likely to become quite a collector's piece! (P.F.)

☆ ☆ ☆

GOLDEN HAMMOND – Dirk Leonard, organ; Paul Jansen, percussion. Stereo, EMI Records, EMY-507.

After a string of records sponsored by Allen Organs, it is appropriate to have one sponsored by Hammond Organs Australia, which is now a Division of EMI Australia. It is also appropriate that the recording be by a one-time pupil of the late Wilbur Kentwell, who built his reputation on early model Hammonds.

But, while there is a connection in name, there is a world of difference between the tone-wheel Hammonds of the early Kentwell era and their modern electronic versions. They now have a full complement of bells and whistles!

Back in Australia after a couple of years on the American organ scene, Dirk Leonard puts them to good effect, with the help of Paul Jansen's percussion, in a program of 15 titles: Days Of Wine And Roses – The Hustle – I Only Have Eyes For You – The Restless Years – There Will Never Be Another You – Sometimes When We Touch – Can't Take My Eyes Off You – I Still Call Australia Home – You Are The Sunshine Of My Life – On The Inside – Copacabana – The Way We Were – As Times Goes By – More – Macarthur Park.

DEVOTIONAL – "Contemporary Gospel"

PRAISE THE LORD –Myrrh MSB 6638. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

"Praise The Lord" is described as contemporary choral settings of Gospel songs and this would be a fair summing up of the 10 tracks on this album.

With a good balance between the singers and the backing musicians, there is no problem hearing the message that each track bears. The titles are: One More Song For You – He Has Given Everything – Live For Jesus – I Am Ready For Your Love – Praise The Lord – All My Life – Oh So Wonderful – All Of Me – The Master's Love For You – Hallowed Be Thy Name.

The overall quality is the usual high standard in all areas that one has come to expect from "Word" productions. With vocal and music scores available from many Christian bookshops, these records can be a source material for youth groups. (N.J.M.)

Well played and well recorded, the album should have an automatic appeal to the many who are partial to the popular organ sound. (W.N.W.)

Audiophile cassette from Sound Lab

TEA FOR THE TILLE[illegible] Stevens. Stereo cassette, Dolby B, 02 tape and unity speed dubbing. Mobile Fidelity, Sound Lab MFSL C-035. (Distributed by BASF Aust Ltd.)

This Cat Stevens recording was part of a press kit distributed at a recent BASF symposium, which explains why it has fallen to me to mention it. As noted above, it is one of a series of audiophile cassettes produced by MFSL and distributed by BASF in Australia.

As you might imagine, I am not numbered amongst Cat Stevens' fans and I won't presume to comment on his performance here.

I have no doubt, however, that it is in line with what has built him a following and the titles are listed by way of further information:

Where Do The Children Play – Hard Headed Woman – Wild World – Sad Lisa – Miles For Nowhere – But I Might Die Tonight – Longer Boats – Into White – On The Road To Findout – Father And Son – Tea For The Tillerman.

Technically, the sound is excellent and, if Cat Stevens is your kind of music, you will be able to enjoy it while sampling the quality of an audiophile cassette. (W.N.W.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

OPENING NIGHT. Simon Gallaher. L 37580 Festival Records.

Simon Gallaher is being hailed as the Australian singer/songwriter find of the 80s.

This is his debut album which contains the following 10 tracks: Opening Night – All You Need Is The Music – I'm Already Falling – Sad Sad Story – Friday Night Masquerade – Love Songs And Beautiful Music – I Need To Know Right Now – I'm Really Only Singing For You – Solitaire and Australia Be Proud.

A fine Australian album with refreshing vocals and good musical arrangements. (D.H.)

A Christmas delight from Sweden

CANTATE DOMINO. Torsten Nilsson, conductor; Alf Linder, organ. Marianne Melnas, soprano; the Oscars Motet Choir. Stereo, Proprius, PROP 7862. (From M.R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone 07 48 7598.)

I put this one on the turntable shortly after having listened to the Carlo Curley recital reviewed elsewhere – and it made me wonder whether I should tone down my initial enthusiasm for that particular album. But I didn't, because both have their place.

Carlo Curley, on the big Allen in the Alexandra Palace, with its 7-second echo, epitomises the flamboyant romantic organ sound. It's one kind of listening experience, that many relish.

On this Album, the 75-year old Alf Linder, Sweden's leading organist, wins what can only be described as delicious sound from the relatively young but classical pipe instrument in the Parish of Oscars church, which I take to be in Stockholm. Built in 1949 to Linder's own specifications, it has 5000 pipes with 77 pitches.

However, while the organ is prominent, the music represents what is typically performed in the church on the first Sunday of Advent and the second day of Christmas. Without seeking to list the titles, it is a mix of organ, choir, and soprano solo, drawn from a variety of sources, and all performed with sensitivity and finesse.

Enclosed with the record is a 4-page folder explaining each track (in English), giving the lyrics variously in English, Latin and (I take it) Swedish. It also has something to say about the artists, the choir and the conductor, himself one of Sweden's best known musicians.

Surprisingly, after the familiar Christmas hymn and Stille Nacht (Silent Night), the program concludes with . . . Irving Berlin's "White Christmas". But, before you sniff slightly, this is White Christmas as you've never heard it before.

Alf Linder, age and tradition notwithstanding, exchanges his mantel as Sweden's leading classical organist, for his one-time role as a jazz pianist. Backing the choir, he turns on an up-tempo accompaniment that could be the envy of any professional pop organist. A final, delicious musical giggle!

Like the Proprius record that I reviewed in the October issue, this one is excellent – no special pretensions, just intrinsically good.

In fact, I thoroughly enjoyed the album, especially with Christmas in the offing. Recommended. (W.N.W.)

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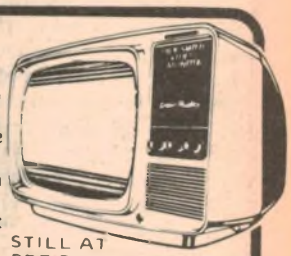

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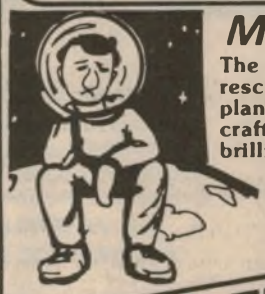

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Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

Just a matter of placing an order and sending the money — right?

Probably few customers realise the drama that can go on "behind the scenes" when a company like DSE arranges to stock a new product from overseas. Over the last couple of months I myself have had a graphic demonstration of how frustrating this can be, in an extreme case.

Superficially, you'd think it would be fairly simple for an Australian importing and distributing company like DSE to obtain and stock a new product from overseas, wouldn't you? That's what I used to think myself, when I worked at EA. With all the "real work" of designing and manufacturing the product already done, surely the rest should be quite straightforward – or so I thought.

When people like Dick Smith used to complain about all the hassles and frustrations involved, I really couldn't understand what they meant. For someone like myself, whose background was primarily derived from the engineering side of electronics, there didn't seem to be all that much involved in ordering, buying in and marketing. Over the last couple of years I've learnt (among quite a few other things) just how wrong I was!

Just lately I've had a dramatic demonstration of some of the frustrations that can occur in trying to get hold of a new product from overseas. The product involved was the Votrax "Type-'N-Talk" Speech Synthesiser, which should finally be available in our stores by the time you read this. Although this product involved a bit more trouble than usual, it should certainly give you a good idea of what I'm talking about.

If you read this column in the July issue, you may recall that I spotted the Type-'N-Talk unit at the US West Coast Computer Faire, back in March. The Votrax people had a couple of pre-production samples on display, and it took only a minute or two for me to realise that here was a most exciting product. Not only did it have a virtually unlimited vocabulary, but it would interface with almost any data terminal or computer, and could produce speech from a simple string of text in standard ASCII code. The applications seemed enormous – as they still do, I must hasten to add! But I'm jumping the gun.

The Votrax people made it clear that it would be some time before they had evaluation samples, let alone production units. And they didn't have 240V/50Hz power supplies, either. But yes, I could pay for an evaluation sample then, and they'd send one over when they were available. So I did.

Well, after I came back, weeks passed and nothing happened. So I tried sending a telex, asking how long it would be before an evaluation sample would be sent. A few days later there was a reply to the effect that a sample would be along in a few weeks, along with pricing schedules and other dealer information. Sure enough, a sample unit turned up about three weeks later.

Terrific! Now I could get stuck into trying it out with our computers, and arrange a suitable 240V power supply. Hopefully it wouldn't be long now before we could go ahead and place an order . . .

Checking the unit took a little longer than it might have done, as I was misled by a minor mistake in the user manual. However this was soon remedied, and before long all sorts of interesting sounds were emanating from my office. I quickly wrote a demo program, then called in Dick and some of the other executives to gauge their reactions.

Everyone was most impressed, so we immediately arranged for the Votrax to go on the next "Dick's Video" – a weekly in-house videocassette program which is distributed to all of our branches, presenting new products and involving all of our store staff in the decision-making process. There was only one minor problem – the Votrax people hadn't sent the dealer information package with the sample, so we didn't know the exact price of production units, or when they'd be available. Still, I sent off a telex, hoping to get a reply before the video would be shot.

The video came and went, with no reply to my telex. There was still no reply after 10 days or so, although by then we had the vote from our store people – a resounding "YES – STOCK IT!", despite the lack of information.

Another couple of weeks passed, during which I sent off further telexes. None of these was answered, either – not even a brief "SORRY – SNOWED UNDER" message. I advised that we were ready to place a firm order for a significant quantity, as soon as we could clarify the situation. Still no reply.

At this stage I hadn't tried ringing them up, because Votrax is in the American state of Michigan, and there is quite a big time difference between there and here. You can't really ring during our normal business hours, as they have normally "gone home" before we start work. Michigan is one of those places where communication is best done by telex! Still, by this stage I was starting to get desperate – here we were with money in our hot little hands, as it were, itching to place an order for a really exciting new product, and the supplier didn't seem to want to know us at all.

There was nothing for it but to set the alarm clock for 5am in the morning, and try to ring them from home. So the next morning I did, but the 'phone rang and rang without being answered. Hmmm . . . it was the middle of their summer (our winter), so perhaps they had closed down for a few weeks like some Australian firms. That might explain the lack of a telex reply, too. It didn't seem very likely, but I decided to wait another week or so, until the end of the month.

But there was still no telex reply, so I had another try with an early-morning phone call. This time I hit the jackpot – at least to a certain extent. After talking to a girl in the "domestic sales" department, I was transferred to the general manager, who apologised for the lack of any response and explained that they had indeed been overwhelmed with orders. He also apologised for the lack of dealer information, but explained that Votrax had received enquiries from a number of Australian firms, and wanted information regarding each company and its established suppliers, in order to make a decision as to the firm or firms most suitable for handling its product.

Needless to say we provided this information by telex, later the same day. Then followed a delay of some weeks, with telexes from us every few days and a by-now-familiar deafening silence from you-know-who. Most frustrating! All we could do in the meantime was to talk with a local transformer and power supply manufacturer, and arrange a sample

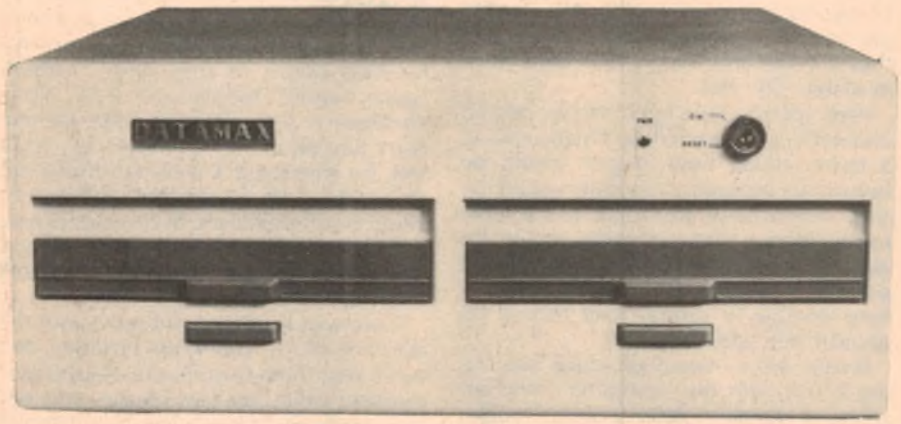
Continued on page 129

Microcomputer News & Products

Datamax 8000 — powerful new computer made in Australia

The Datamax 8000 computer is the first in a line of Datamax products designed and built in Australia for local conditions. It has been under development for the past two years and recently completed six months of successful field trials.

Key element of the design is a 400mm x 250mm single board containing a Z80A processor, 64K bytes of RAM, a double density floppy disk controller capable of handling up to four 20cm drives, and circuitry for two parallel ports, four serial ports, IEEE 488 instrumentation bus interface, floating point arithmetic processor, hard disk adapter and calendar clock with battery back-up. The board and its associated heavy-duty power supply is housed in a desk-top cabinet along with two double-sided floppy disk drives providing two megabytes of storage.



Using 64K bit RAM chips the on-board memory can be expanded to 256K bytes. Bank select circuitry is also provided on the board. As supplied, the board includes 2K bytes of EPROM, which can be expanded to 8K bytes.

Optional hardware features can be implemented by plugging chips into the sockets provided on the board. Currently available options include a dedicated arithmetic processor, EPROM programmer, S-100 bus adapter and calendar/clock.

System software consists of the CP/M operating system and a full range of high level languages. Extension to multi-user operation is possible through the use of the MP/M operating system. Programming languages available include ANSI-74 standard Cobol, Fortran IV, Basic interpreter and compiler, Pascal, a C-language compiler, APL and Forth.

The Datamax 8000 is being wholly manufactured at the company's plant in Manly, Sydney. It was designed by Mr Chin K. Kwong, a Chinese-born electronic engineer who has had extensive experience with real time computer systems used in radio astronomy. The Datamax 8000 is primarily intended for the OEM market, to be incorporated in complete computer systems by other manufacturers.

For further information contact Chin Kwong, Datamax Pty Ltd, 34-40 Central Ave, Manly, NSW 2095.

Price reductions on Ohio Scientific computers

Technical Computing and Graphics Pty Ltd (TCG), Australian distributors of Ohio Scientific equipment, has reduced the prices of its Superboard and CIP microcomputers. The Superboard has been reduced from $450 to $319, and the CIP from $750 to $499.

"Performance of the Superboard and CIP compares more than adequately with competitive products. Our pricing adjustment will enable us to make inroads into the volume markets currently dominated by Dick Smith, Tandy, Apple and Commodore," said Mr Mike Barraclough, a director of TCG.

When released in the late 1970s, the original CIP and the uncased version, the Superboard, were the first complete personal computer systems contained on a single board. The systems are based on the 6502 processor, and incorporate a standard 53-key keyboard with upper and lower case capability, a printer port and a cassette interface. The video display uses pre-defined graphics elements to give an effective resolution of 256 x 256 points. Standard units offer 8K of programmable memory, which may be expanded to 32K, and a Basic interpreter is resident in ROM on the board.

Enhanced versions of the CIP are also distributed in Australia by the TCG Group. For further information contact Mike Barraclough, TCG Ohio Scientific, 31-33 Hume Street, Crows Nest, NSW 2065.

The Source — BS Microcomp can put you in touch

BS Microcomp have announced that they have been appointed as a dealer for the "The Source", a US-based public access data base. Using a terminal or computer and a modem, users of "The Source" has access to a wide range of information including stock exchange data, commodity prices and news. A mail function also allows messages to be sent to and received from US correspondents.

BS Microcomp can make "The Source" available within 24 hours to customers who hold an account with Midas (the data transmission service of the Overseas Telecommunications Commission) and an internationally recognised credit card. For more information contact Bill Saunders at BS Microcomp, 4th Floor, 561 Bourke St, Melbourne 3000.

32K static RAM board from Bubble Electronics

Melbourne company Bubble Electronics has released a 32K byte static RAM board for use with all S-100 bus computers. The Australian designed and manufactured board is said to have features which have been previously unavailable on any single memory board.

The board uses the latest 2K x 8-bit static RAM chips, which combine high speed (200ns standard) with very low power consumption. Total current used by the board is less than 0.5A for a full

Micronews continued ►

PARIS RADIO ELECTRONICS

HARDWARE DESCRIPTION

S/09 6809 Computer w/128K Memory
/09 6809 Computer w/56K Memory
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8212 12" Terminal w/monitor
DMF 2 Disk System w/2.5m Capacity
CDS-1 Winchester Hard Disk System
MP-09A 6809 Process/Board (assem)
D5-2 double side/double density 720KB
3809 128K Memory Expansion for S/09
MP-LA Parallel Interface
MP-L2 Dual Parallel Interface
MP-N Calculator Interface
MP-R Eprom Programmer
MP-S Serial Interface
MP-64 Memory board 64K
MP-S2 Dual Serial Interface
MP-SX Serial Interface Expansion
MP-T Interrupt Timer
S-32 Universal Static Memory Card
MB 68XX 6809 Mother Board

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ASM09 Optimizing Assembler (5" or 8")
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SP-09-4 Basic
SP-09-5 Debug Package
SP-09-6 Extended Basic
SP-09-7 Standard Precompiler
SP-09-8 Extended Precompiler
UniFLEX Multi-tasking BASIC
SP-09-10 Sort/merge
SP-09-11 Utilities
Uniflex Operating System
Uniflex Basic
Uniflex Pascal
Pascal for Flex 09

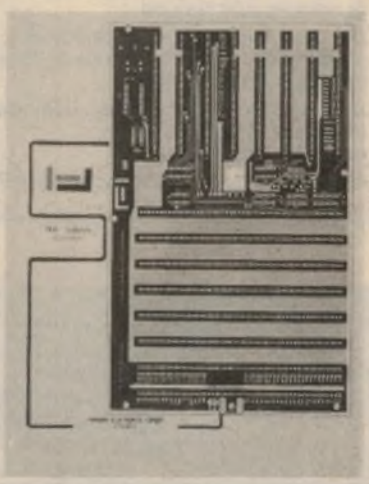
Microware Systems Corporation
OS9 Level I Operating System
OS9 Level II Operating System
Basic 09
Stylograph Word Processor
OS9 Macro Text Editor
OS9 Interactive Assembler
OS9 Interactive Debugger

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.

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.

DMF2

MB-68XX MOTHER BOARD
The MB-68XX Mother Board is an extremely versatile and universal mother board for SWTPC and similar SS-50 based systems. It provides 8 slots for full sized (SS-50) boards and 8 slots for I/O sized (SS-30) boards. Its main features are:
1. Switch selectable 6800/6809 I/O addressing.
2. Switch selectable 4/16 addresses per I/O slot.
3. Baud rate generator for SS-50C and S/09 compatability.
4. Schmitt trigger buffers on all data, address & control lines to I/O bus.
5. Physical size & mounting replaces existing SWTCP 6800/09 mother boards.
6. Extra thick 3/32" Epoxy board.
7. High quality double sided plated through holes.



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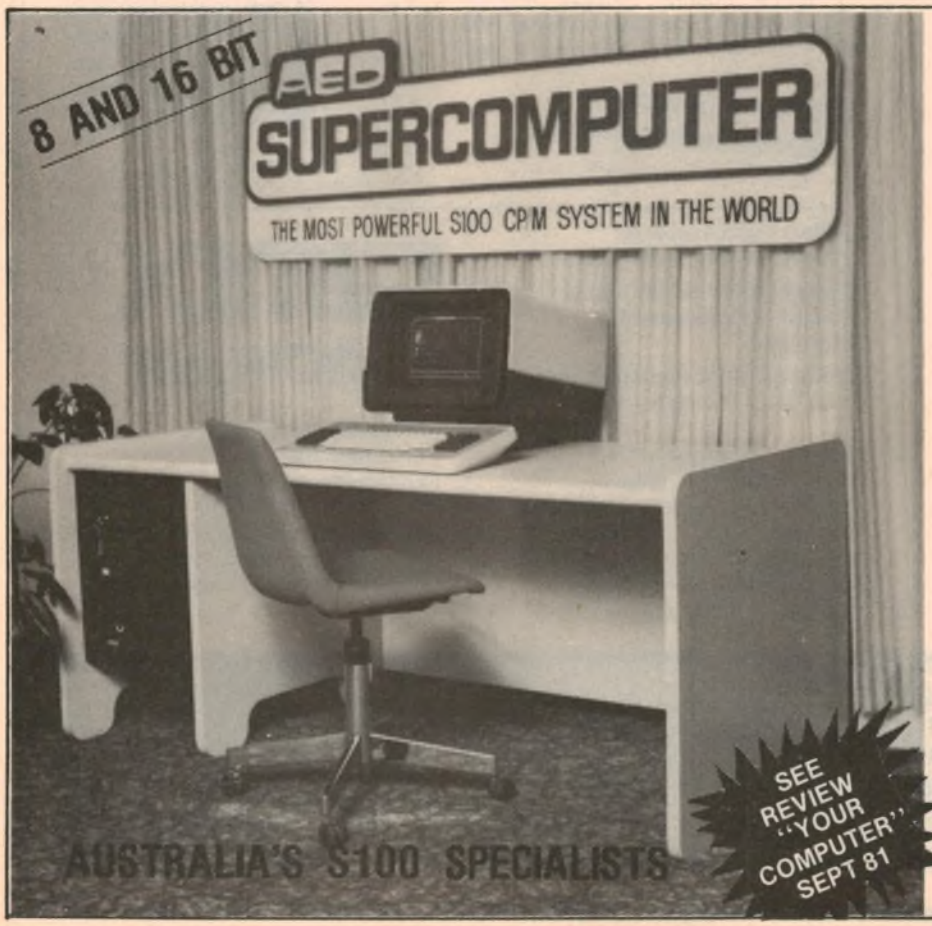

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Microcomputer News & Products

from p122

32K. Low power consumption avoids the problem of over-loading the existing power supply when a system is expanded.

A unique feature of the board is that any of the 16 RAM chips may be replaced by EPROMs, which are pin-compatible with the RAM chips. Appropriate wait states can be selected for any one or more of the 16 2K address spaces, allowing RAM and EPROM to be mixed in any configuration on the board – a definite advantage when developing programs, which can be programmed in RAM and then transferred to EPROM when perfected.

Further information on the new memory board is available from Bubble Electronics, 4-6 Bright St, Brighton, Vic.

Dindima has hand-held computer terminal

The Dindima Group Pty Ltd now has available the Pocket VDU, a portable data terminal which includes a 1600 character memory, 40 character liquid crystal display, full cursor control and editing facilities and eleven selectable data communication speeds (up to 2400 baud). The portable terminal is completely self-contained and is powered from a rechargeable NiCad battery pack which allows up to 24 hours continuous operation and retains data in memory for up to two months.

The complete 128 ASCII character set can be sent and received by the terminal, with control codes represented by special symbols. Two modes of operation are possible, either on-line to a host computer or an edit mode, which allows messages to be composed and revised before sending. Both RS232C and 20mA loop interfaces are provided with the terminal. Dimensions of the "Pocket VDU" are 215mm x 153mm x 45mm, and an optional carrying case is available.

For more information contact Mr Andrew Reid, Marketing Director of The Dindima Group Pty Ltd, PO Box 106, Vermont, Vic 3133.

From AED — a dual 8-bit, 16-bit CPU board

16-bit microprocessors have been available for some time now, but many users are reluctant to relinquish their familiar 8-bit software, which in some cases represents a sizeable investment. Relief is on the way however with systems which will run both 8-bit and 16-bit software. One such product is the S-100 8085/8088 board CPU board imported into Australia by AED Microcomputer Products Pty Ltd.

AED's new board consists of an 8-bit 8085 and a 16-bit 8088 microprocessor, both running at a clock speed of 5MHz. The board can run under current 8-bit CP/M systems and can also run the new CP/M-86 and other 16-bit software. 8-bit software can be run under the 16-bit operating system, and if required both 8-bit and 16-bit code can be used within the same program, so users can have the best of both worlds.

For more information on the 8085/8088 CPU board, contact AED Microcomputer Products, 130 Military Rd, Guildford, NSW 2161.

Ortex Pascal System 1 at Computerland

Computerland South Melbourne is currently giving top billing to the Ortex Pascal System 1, a computer system developed in Canberra and based around the Western Digital 16-bit Microengine, a microprocessor chip specially designed to run the Pascal programming language.

Bob Shattock, Manager of the South Melbourne store, says of the Ortex system "there are very few computers anywhere near its price which can match its Pascal handling features and with the enormous amount of software currently coming on the maket the Pascal System 1 will be one of the best supported units in this country".

In addition to the Pascal System 1, Computerland South Melbourne stocks Apple, North Star and Wangwriter, along with printers from NEC, MPI and Olivetti.

Computerland South Melbourne is located on the corner of Kingsway and Albert Rd, Melbourne, Vic 3004.

Micronews continued ►

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Microcomputer News & Products

This TRS-80 means business

One of Melbourne's newest microcomputer stores, Compak Computer Shop, specialises in TRS-80 based systems for the professional user who is interested in keeping costs down. Word processing, small business systems and education are the main areas catered for, and particular emphasis is placed on low cost quality printers.

Compak has released a TRS-80 system based on the Stringy Floppy, a digital cassette data storage system. They have built the Stringy Floppy into an expansion unit for the TRS-80 Model I and combined it with interfaces for electronic typewriters such as the Olympia ele ES100 and the IBM golfball. The unit is intended for low cost word processing and educational markets, but also has a range of general software available.

Also from Compak is a Z80-based single board computer for the do-it-yourself and OEM markets. The board runs CP/M version 2.2 and has an on-board disk controller for 13.3cm and 20cm floppy disks, an on-board programmer for 2716 EPROMs and parallel output and printer ports. It is fully assembled and tested, priced at $795 plus sales tax.

Compak is at 44 The Esplanade, Brighton Beach, Vic 3186.

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TSC 812/A

Keep your computer clean with Megabus

People can call computers by many strange names, but no-one should be able to say that they're dirty, and a new product from Megabus Microcomputers is designed to take the hassle out of computer cleaning. "Screen Kleen" is a detergent and solvent impregnated cloth packaged in a sealed sachet, just like those little cleaning tissues for people.

The sachets are said to be more effective than spray-can type cleaners, and more convenient to use. A box of 50 sachets costs $15, and will provide cleaning material for a year.

(Although designed for computers, the cleaning tissues have a wide range of uses, particularly in cleaning hard surfaces which must be left free of smears and scratches – eg, spectacles, TV screens and cameras.)

More information can be obtained from Megabus Microcomputers, 312 Hawthorn Rd, Caulfield, Vic 3162.

High resolution graphics for the Sorcerer

We recently had a chance to try out "Parsiplot", a program which should be familiar to all users of the Exidy Sorcerer. Parsiplot is a high resolution plotting system for the Sorcerer, written in machine code, which provides a screen resolution of 512 points across by 240 down.

Note that "Parsiplot" is the old name of this program, given on the instruction sheets and in the program itself. The distributors recently changed the name (on the cassette label only) to "Graphics", to give a better indication of what the program does.

The program can be called from Basic and allows the user to set and reset single points and to draw and erase lines on the screen. A special procedure clears the screen without resetting the graphics characters, and points can also be tested to check whether they are on or off. Points and lines are plotted by passing the co-ordinates as Basic variables (X1, Y1 for a point and X1, Y1, X2, Y2 for the beginning and end points of a line). A call to Parsiplot, by a statement such as Z = USR(S) will then turn on the point at X1, Y1. Z = USR(L) will draw a line between the two points.

Included with the program are three sheets of instructions and information, which are adequate although not outstanding. A valuable feature of these instructions is their explanation of how the program can be called from assembly language routines and other languages running on the Sorcerer.

Parsiplot was written by Geoffrey L. Cockhill and is distributed by the Global Software Network. Our copy came from City Personal Computers, 75 Castlereagh St, Sydney 2000. Price is $25.95.

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** One technical manual

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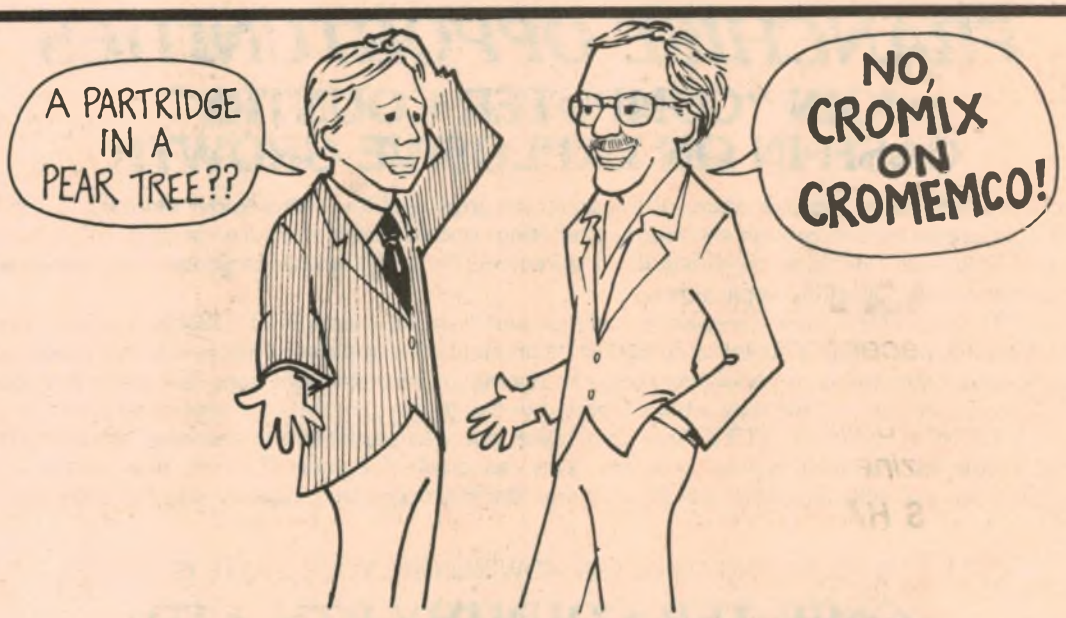

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Microcomputer News & Products

News from the clubs

● The Apple Users Group (Sydney) meets at the Sydney Grammar School Science Auditorium on the second Monday of each month at 6.30pm. Contact the Group at PO Box 505, Bankstown, NSW, 2200, or phone the secretary, Colin Rutherford on (02) 520 0926.

● The Western Australia Compucolor/Intercolor Users Group (CUWEST) can be contracted through The Logic Shop, 454 Williams St, Perth. The Group publishes a newsletter and has a library of books and software.

● The Commodore Computers Users Group of Queensland meets on the first Tuesday of each month at Construction House, 130 Petrie Terrace, Brisbane, at 7.00pm. For more information contact Bill Brown on (07) 397 0888.

● We have received a back issue of "Micro", the official publication of the NZ Computer Club, Inc. The Club serves to bring together users of all types of small computers and acts as a clearing house for information. Plans are now under way to establish a Computer Bulletin Board System using acoustic modems. A list of active computer user groups in New Zealand is also published. Contact the Club at PO Box 6210, Auckland, NZ.

Artificial Intelligence

. . . ctd from p27

machine's goal structure: if it cannot edit its high-level intentions, it may not be smart enough to be useful, but if it can, how can the designers anticipate the machine it evolves into? In a word, I would expect the first self-improving AI machines to become psychotic in many ways, and it may take generations . . . to stabilise them."

AI still in infancy

What worries some AI researchers more, however, is that industrial sponsors will give them too little time to produce anything that is useful. Though AI has existed for 30 years, it is still in its infancy.

Roger Schank warns the companies that are funding AI not to expect too much. "Industry needs to fund basic research. There still are not enough people in this subject and the theories aren't honed enough. I'm frightened that industrialists will want instant results and in four or five years decide that AI isn't that good after all."

This first appeared in "New Scientist", London, the weekly review of science and technology.

Column 80

. . . ctd from p121

240V power supply for testing with our evaluation unit.

To cut the story short, it took about six more weeks, seven or eight telexes and another couple of early-morning telephone calls before we finally received a long telex advising us of the pricing schedules, and inviting our order. Phew!

Mind you, that was by no means the end of the story. It took a couple more weeks to organise a bank draft, to actually get our order confirmed and arrange for Votrax to get the necessary US export licence. Then there were the usual things like arranging passage through customs, planning advertisements, getting artwork produced and making bookings, writing press releases and so on.

I didn't do all this myself, of course – we have a lot of very capable people who do most of these things. But it all has to be done, and it takes a lot of time and money. So when you walk into a store and see a product on the shelf, spare a thought now and again not just for those who designed and manufactured it, but for those who worked to bring it to you!

And if, by chance, the Votrax unit is not on the shelves in December, you'll know we are still having troubles!

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COMMODORE single disk drive units . . . $1250

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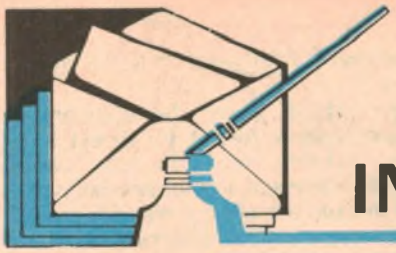

INFORMATION CENTRE

PLAYMASTER MOSFET STEREO AMPLIFIER: I am currently building the Playmaster Mosfet Amplifier using the C-core transformer and I have struck several problems which I cannot solve. Once the amplifier has warmed up a scratchy sound can be heard through both loudspeakers and the amplifier becomes extremely sensitive to power sockets and lights around being turned off. Massive bangs are produced which on several occasions have blown the fuses in my speakers.

Any suggestions as to the source and cure of these problems would be greatly appreciated. (M. S., NZ.)

● From your description we suspect that you have omitted to install bypass capacitors which are connected from the loudspeaker earth returns to the chassis, at the loudspeaker terminals. These capacitors are essential and the omission certainly will cause the amplifier to be sensitive to mains-radiated transients.

DF LOOP AERIALS: Many readers like myself have need for a reasonably compact loop aerial for direction finding purposes. In particular with respect to boats that may be fitted with CB on the normal channels or marine frequencies.

A loop that could be used ahead of these units, and switched also for use on the broadcast stations, and other beacons suitable for direction finding.

An aural and visual indication giving left or right indication of the heading required. A meter with needle indication in centre if on beam or turn to left or right to gain beam.

Anything published along this line, or would a project be forthcoming? (R.J.B., Burrendah, Q.)

● We have not published a design for a direction-finding antenna along the lines you suggest, but we will certainly consider it for a future project.

INFRARED REMOTE CONTROL: I have recently completed construction of the two-channel Infrared Remote Control (May 1981) and have come across a couple of problems.

The first problem is quite a major one, the channel using RL1 will not operate properly. When the associated button is pressed on the transmitter, nothing at all happens. Very occasionally this channel will work, I can make the relay and its LED operate maybe six or seven times but after that nothing. The other channel functions perfectly. I have both channels set up so that they switch the active line of separate surface-mounting mains sockets on the rear panel of the receiver.

As mentioned in the text a 0.1μF must be connected across the relay contacts when switching mains voltages. Firstly I tried using a 630 volt green cap (on the channel that works) but found that the unit could not switch off inductive loads such as a TV. Light globes work perfectly. Even when the receiver is turned off at SW1 (but still plugged in) inductive loads will still operate even if the relay is "off". After this I tried a blue coloured greencap rated at 250 VDC (not polarised) but the same problem remained. Without the capacitor the unit can turn off inductive loads but then the problem of triggering remains. When triggering occurs the channel that doesn't normally operate will be turned on; the only way I can turn it off is by turning the whole unit off as I have no control over it. I hope you can help me. (D. T., Doncaster, Vic.)

● There are a number of trouble-shooting steps that you can perform to determine where the trouble lies in your infrared remote control. First, you can determine whether the fault lies in the transmitter or the receiver, but we are betting that it is in the receiver. We assume that RL2 operates reliably. RL2 is operated by the 6ms pulse which is produced by the transmitter button associated with the .068μF capacitor. Try changing the other button's capacitor to .068μF and see if it will also operate RL2. If so, then the transmitter is okay and the fault lies in the receiver. Incidentally, there is a small mistake in the transmitter circuit in that the CH1 and CH2 designations should be swapped over.

RL1 is controlled by the 1ms pulse via IC3b and IC4a. You can check Q5, the driver for RL1 by disconnecting its 4.7kΩ base resistor from pin 1 of IC4a and connecting it to the positive supply. If RL1 now operates continuously, try connecting the base resistor to pin 13 of IC4b and see if RL1 and RL2 now operate simultaneously. If so, then the fault probably lies in the RC networks associated with IC1. These components should be carefully checked to see that they are of the correct value.

It is evident that the capacitor you are using to suppress turn-off spikes with mains operated inductive loads is too large. We suggest you reduce the capacitor across the relay contacts to .047μF/250VAC (or 630VW) and connect a 470Ω/1W resistor in series with each capacitor. If turn-off spikes are then a problem, you should reduce the value of the resistor until the problem is cured.

CAR BATTERY MONITOR: I've just completed two projects from your magazine: Car Battery Monitor, October 1980 and Guitar Fuzz Box, February 1981. With both of these projects I've found technical problems.

In the Car Battery Monitor when I applied 12 volts the green and yellow LEDs both lit up and on lower voltages the red LED didn't usually light and if it did, it didn't flash.

I then replaced the zener diode and IC (4136) and only the green LED lit at all voltages. Could you please send me details of how to fix the problems.

In the Distortion Box the "Fuzz on" mode is fine but in the "Fuzz off" mode there is leakage of fuzz. (G. H., East Doncaster, Vic.)

● We assume that you have adjusted the trimpot to obtain two voltages designated +6V and +6.6V. If this is the case we also assume that the yellow LED only comes on for battery voltages in excess of 13.35 volts or thereabouts. If this is the case, then the most likely reason for the green LED to also light up is that D2 is connected the wrong way around.

The red LED will only light for battery voltages of less than 12 volts. In this condition, the output of IC1b, pin 3, should be high. If not, check that the voltage at pin 1 (the inverting input) is actually lower than pin 2 (the reference input at +6V). If not, check the values of the 47kΩ voltage divider resistors. If the output of IC1b is high, IC1d should oscillate and flash the red LED. As noted in the Notes & Errata for October 1980, the 0.1μF capacitor in the oscillator should actually be .01μF.

Referring to the Fuzz Box, we assume that by "leakage of fuzz" you mean that the circuit is distorting when it should not. The most likely reason for this is an incorrect resistor value which would upset the bias conditions.

PLAYMATE: After having the "Playmate 3W+3W" amplifier given to me for my birthday, I got sick of the idea of a "cheap" tone control. Is there any way of integrating the BASS/TREBLE control circuit, as used in the "Playmasters", into the "Playmate" circuit.

I have worked out it would have to be inserted in between Q2 and Q3 but

Speed Record as Court Evidence

SPEED RECORD: Due to the experiences being reported in motoring magazines throughout the world, I have a suggestion for a project that I would like you to consider. Even if you decide the project is beyond your capabilities, then maybe some company may be able to take it up, as I consider the market potential is enormous.

As you are probably aware, when a motorist is booked for exceeding the speed limit, it is impossible for the motorist to offer any concrete evidence of the speed he was actually doing. In most cases, this probably does not matter but I believe there are sufficient cases being reported where the authorities claim the motorist was doing one speed and the motorist another, and that some means of recording speed is becoming essential. Of course, the current situation, it is always the word of the authorities that carries the day in court.

I envisage a device that continuously samples the car's speed (say every two seconds) and updates its memory so that enough readings are stored to show the car's speed for either the last two kilometres or the last two minutes. On demand, it would then be possible to dump these speeds on an inbuilt thermal printer, showing the time, date and the instantaneous speed readings at each sampling interval. The motorist would then be able to compare the printout with the data produced by the authorities and for the first time ever we would break away from the "your word against mine" situation.

Such a device would of course have to be tamperproof and therefore may only be able to be installed on new cars at the time of production. One less obvious advantage of this system is that it would tend to force people to drive within the speed limit at all times, as you would in fact be adding to the evidence against you automatically.

This letter has been prompted by the fact that several of my friends have been booked recently for speeds which they all claim were far in excess of what they were actually doing. One of them was a priest and even his word is not considered good enough to challenge that of the booking officer. If he had had such a device, the truth would have been known, regardless of who was right.

Many thanks for such an excellent magazine. (A. M., South Headland, WA.)

● A patented device along the lines you suggest probably would have a substantial market, provided that courts would accept it as evidence. This and the need for it to be tamperproof does put it beyond the scope of a magazine project, although it would not be particularly complicated. We understand that some interstate truckdrivers have used their engine recorder charts as evidence in speed offence cases.

where does the lead with the 0.47μF electro (on the Playmaster Twin Ten to a resistor divider on the emitter of Q5) have to go on the "Playmate"? All the extra components I intend to mount on a piece of Veroboard.

I have, sitting in my "bits" box, a transformer with the standard voltage and amperage, maximum stamped on it. But after the amperage it has the word "INTERMITTENT" stamped on it. Is this basically the same as saying it has a 900 mA peak? (A. R., Ermington, NSW.)

● In practice, it would be quite difficult to incorporate the tone control from the Playmaster amplifiers into the Playmate since the collector of Q2 established the bias for the amplifier output stage. You would have to provide a voltage divider to provide the bias and then interpose the three-transistor tone control network between Q2 and Q3.

The reason why the three-transistor tone needs to be incorporated in its entirety is that the feedback amplifier comprising Q4 and Q5 must be driven from a low source impedance and this is provided by the emitter-follower Q3 (these numbers refer to the Playmaster Twin Ten circuit described in June and May, 1979).

The intermittent rating of your transformer means that it can only be used at full power for say one minute in every ten.

Books. Contd from p99

beacons, and band plans. Also listed are WIA contests and awards, amateur satellites, radio club directory, great circle maps and regions, Papua New Guinea (P29) call signs, and many other informative notes concluding on the inside back cover, with notes on first aid in case of electric shock.

Apart from the listing of around 15,000 call signs the publication is worthy of a place in every amateur station and as a Christmas gift to overseas amateur friends.

Copies are available from all WIA Division offices, the WIA Federal Office, 3/105 Hawthorn Road, North Caulfield, Vic 3161 – PO Box 150, Toorak, Vic, 3142 (add $1.00 postage) or through major bookshops. (P.J.H.).

Notes & Errata

LOW DISTORTION AUDIO OSCILLATOR (June 1981, File No. 7/AO/33): The wiring of S2a shown on the wiring diagram on page 52 should be changed to agree with the circuit diagram on page 51.

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ASIO

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4000 ohm 10W	25c
220 ohm 5W	20c
5 ohm 5W	20c
220 ohm 10W	25c
950 ohm 3W	20c
115 ohm 5W	20c
10 ohm 5W	20c
1k ohm 5W	20c
5000 ohm 5W	20c
6.8k ohm 3W	20c
3300 ohm 10W	25c
6800 ohm 10W	25c
1500 ohm DUAL 21W	50c
50 ohm 5W	20c
1k ohm 5W	20c
820 ohm 5W	20c
12 ohm 10W	25c
470 ohm 7W	20c
4700 ohm 4.5W	20c
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3.3K	7W
27 ohm	5W
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2.2uF, 200V	10 for $1
0.047uF, 1500V	50c
47uF, 25V	4 for $1
680uF, 40V	50c
22K, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	50c
680uF, 35V	50c
0.015uF, 250V	25c
1uF, 100V	25c
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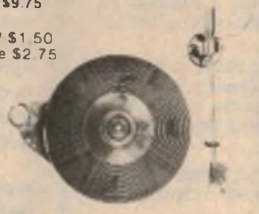

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ELECTRONICS AUSTRALIA

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MAG039

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JVC0058/EA/FMMH

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