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FEBRUARY, 1982

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LARGE SCREEN STORAGE CRO ADAPTER

AVIONICS FOR THE NEW JETLINERS

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The new Sony Walkman. It can make your experience of sound infinitely wondrous.

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WALKMAN

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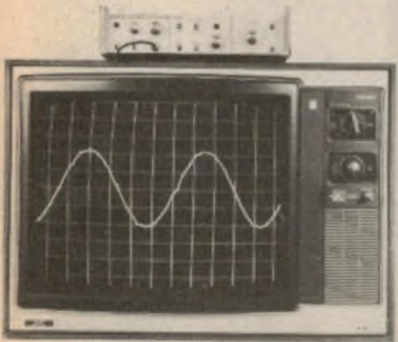
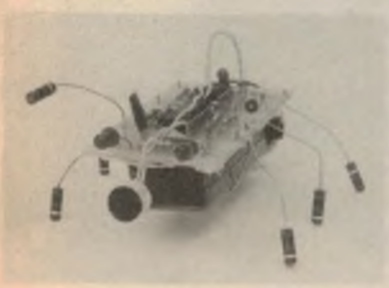
ELECTRONICS AUSTRALIA

Volume 44, No. 2
February, 1982

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE



For around $100 you can build an adapter to convert a normal TV into a storage CRO with electronic graticule, one-shot triggering and storage of up to four displays. The article starts on page 50.



This aggressive little beastie is really quite harmless but can make an incessant noise. He is called Cudlipp and you can have him for your very own, as shown on page 72.

NEXT MONTH

Some of next month's features are listed on page 61.

COVER PHOTO

This month we have a comprehensive review of Tandy's new colour computer, the TRS-80C, starting on page 66. The front cover photo is by Chris Vitek, of Tandy Corporation, Australia.

FEATURES

HIFI, VIDEO AND REVIEWS

PROJECTS AND CIRCUITS

PERSONAL COMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

Editorial Viewpoint

Hooray for Multicultural Television!

As I write this leader, we are in the lull between Christmas and New Year celebrations, when most of the population are enjoying good cheer and well-earned leisure. Much of that leisure will be spent watching a TV set which will be showing either a normal broadcast, or increasingly, a video game or program from a VCR.

As time goes on, these last-named options must constitute a considerable threat to conventional TV broadcasting, particularly the commercial networks. Advertisers may realise that more and more people are not watching and so turn to other media.

But as far as the television broadcasters are concerned, it would seem as though nothing has changed . . . They still act as though the average viewer will accept whatever is served up in that bane of the viewer's year, the Non-Rating Period. On any one day over the Christmas period, more than half the programs are likely to be repeats and many of these have been repeated numerous times before.

The remaining time is taken up with either news and current affairs or wall-to-wall sport. And as far as the number of repeats and amount of sport is concerned, there is little difference between the ABC and the commercial networks. No wonder people are turning to VCRs or those ultimate mental turnoffs: video games with their inane, incessant blurts, booms and whistles as rewards for victory in simulated conflict.

Happily, for people living in Sydney and Melbourne there is an alternative to turning the television set off altogether and that is Channel 0/28, multicultural television. Ever since this service began in late 1980 it has provided a vast range of program material from all over the world. While the foreign language films have been provided with English subtitles (sometimes rather loosely translated), many magnificently produced documentaries have been presented, with locally written narrations. At the same time, Channel 0/28 has an excellent worldwide news coverage, which is especially attractive if you do not like the emphasis on sport in other news telecasts. Finally, to cap it all, there is the award winning current affairs program, "Scoop". All of this has been achieved with a small and enthusiastic staff with a low budget.

So while many readers may have become disillusioned as Australia's first class television broadcast system fails to provide entertainment, Channel 0/28 is succeeding in its purpose. While Channel 0/28 entertains it is also informing Australians about other cultures.

Unfortunately, in Sydney at least, many viewers do not enjoy good reception of Channel 0/28 because they do not have a suitable antenna. But for readers of "Electronics Australia" that is not an insurmountable problem. To paraphrase a commercial TV announcer, "We'll bring you *that* story in a later issue."

Leo Simpson

Registered by Australia Post — publication No. NBP0240.

Printed by Magazine Printers Pty Ltd. of Regent Street, Sydney and Masterprint Pty Ltd of Dubbo, NSW, for Magazine Promotions, of Regent St, Sydney.

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Representative: Sandy Shaw (08) 267 4433.
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Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001.
Enquiries: Phone (02) 20944, ext 2589.

Circulation Office
21 Morley Ave, Rosebery, Sydney 2018.
Phone (02) 663 3911.

Distribution
Distributed in NSW by Magazine Promotions, 57 Regent St, Sydney; in Victoria by Magazine Promotions, 392 Little Collins Street, Melbourne; in South Australia by Magazine Promotions, 101-105 Waymouth St, Adelaide; in Western Australia by Magazine Promotions, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

News Highlights

Industry Association calls for go-ahead on Telecom's Videotext proposal

A multi-million dollar boost to manufacturing, employment and sales is being held in check because of a Federal Government decision over Videotex, according to the Vice President of the Australian Electronics Industry Association, Mr Bruce Goddard.

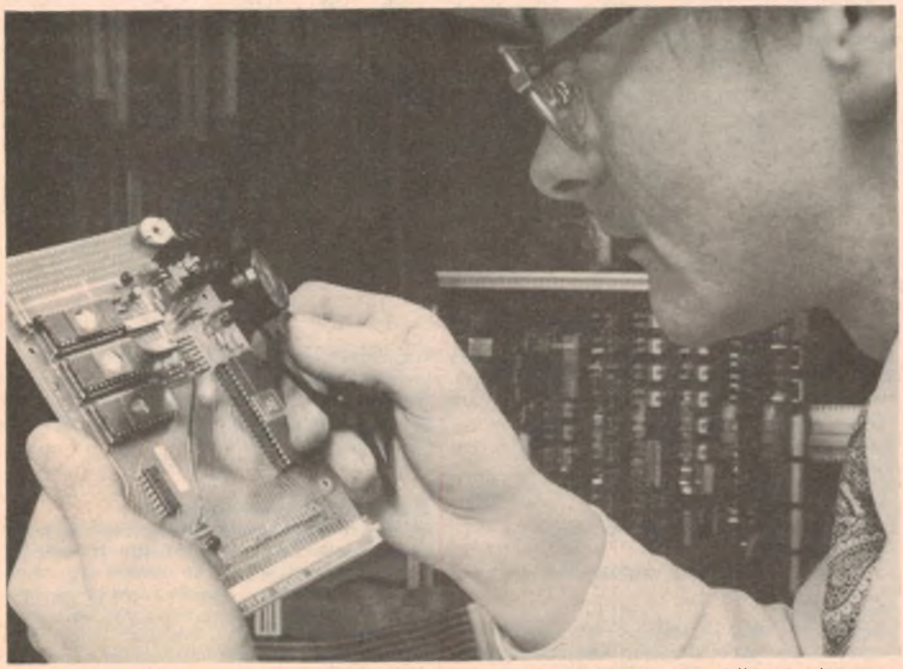
"Although the Government announced last October that Telecom Australia should not proceed, at that time, with its proposal to establish a national Videotex service, the practicalities of the situation are that no-one apart from Telecom can realistically establish and manage a national Videotex system," he said.

Telecom already has the carrier network in place and the vital management and administrative expertise to make a national Videotex system work. Private enterprise, touted by the Government, has not taken up the offer to develop a Videotex service, presumably because it would not be efficient or cost-efective to duplicate Telecom's existing facilities. Once established however, with the costly installation work done, Videotex would be very attractive to private enterprise.

The Minister for Communications, Mr Sinclair, announced last October that Telecom's future involvement in Videotex could be a matter for the enquiry into Telecom, headed by Mr Jim Davidson. Mr Goddard replies "We believe that it is undesirable to delay action until after the Davidson enquiry, as the entire electronics industry would benefit from the introduction of Videotex.

"The manufacturers of components, adapters, TV sets, terminals, data modems – there are millions of dollars worth of manufacturing boost to industry awaiting the Videotex decision. The electronics industry wants Videotex to proceed as soon as possible; the people who will provide information for Videotex want it to go ahead quickly and both business and domestic users want it now," Mr Goddard said.

"We believe the Government should reconsider the roe of Telecom in Videotex as a matter of urgency and either revise the earlier decision or at least encourage the early establishment of a joint venture between Telecom and private enterprise so that the system can be introduced quickly."



This stand alone speech synthesiser is said to be able to electronically simulate any language or dialect. It is shown above being examined by British designer Peter Rush who developed the board to allow the user to program it with any vocabulary.

Parkes to monitor Halley's Comet mission

The 64 metre radiotelescope at Parkes in New South Wales will play an important role in the European Space Agency's planned interception of Halley's Comet in 1986. Parkes will have the primary responsibility for receiving scientific data from the spacecraft as it flies through the head of the Comet, some time in March 1986.

Halley's Comet appears every 76 years, and is thought to consist of a mixture of ice and dust. As it approaches the Sun, particles are "boiled off" the head of the comet to create a long, highly visible tail.

CSIRO's Division of Radiophysics mans the radiotelescope and will support the space venture, code-named Project Giotto. A French Ariane rocket will be used to launch the spacecraft in July, 1985. Plans call for the craft to intercept the comet on either March 12 or 13, 1986, when it will be at the closest point to the Earth since 1910.

A wide range of scientific data related to the composition of the Comet will be collected by the intercepting craft and returned to Earth through the Parkes radiotelescope. From Parkes the information will be sent to the European Space Operations Centre in Darmstadt, West Germany.

The experiment in 1986 will coincide with the 25th year of operation of the Parkes facility.

Direct satellite broadcasting is on the way

Television broadcasting direct from satellites to home receivers will become a multi-million dollar business in the next 10 years, according to a new report from Mackintosh Consultants. Australia does not rate a mention in the report, but estimates are that sales of satellite receiving equipment for home users in North America and Western Europe will reach $2 billion a year by 1990.

Confirming some of the findings of the report is the news that Europe is to go ahead with a new satellite system which will handle business communications from rooftop dish antennas as well as direct television broadcasting. The satellite is expected to be launched in 1986.

Go-ahead for the scheme follows the decision by Britain and Italy to take major shares in the European Space Agency project. Other participants include the Netherlands, Switzerland, Austria, Belgium, Spain, Denmark and Canada.

Campbell House wants work

Campbell House is run by the Sydney City Mission and was opened in 1974 as a rehabilitation centre for alcoholic men. As part of the rehabilitation program the men are given tasks to perform in the modern, well-equipped workshop in the Centre.

Challenging long or short term work is needed for the men taking part in the Centre's rehabilitation program. The workshop holds up to 130 men who perform similar tasks to those of the outside workforce. There is a modern commercial laundry in the workshop which serves over 20 institutions and nursing homes. The men also perform light electronic assembly work, packaging, sorting and refurbishing.

In addition they carry out component packing and wiring of printed circuit boards, make telephone handsets and do other forms of assembly work. Campbell House has qualified supervisors to maintain quality control, and also maintains its own pick-up and delivery vans to service all areas of Sydney.

Campbell House needs work which is challenging, to enable the men to reach their full working potential. For many it has been several years since working and the workshop plays an important role in their rehabilitation.

Anyone who has work which may be suitable is invited to contact John Hemsley, the Director of Vocational Rehabilitation at Campbell House. The address is 103 Bathurst Street, Sydney, 2000 (02) 357 5055.

A view of one of the work areas at Campbell House.

BBC begins computer education broadcasts

"The single most important influence in bringing ordinary Britons face to face with the computer" – at least that's how one UK newspaper describes a revolutionary new concept in teaching about computers, courtesy of the BBC.

This month the BBC Computer Literacy Project goes to air, with ten television programs designed to introduce and teach about microcomputers. Not content with just TV programs however, the BBC has also commissioned Acorn Computers of Cambridge (makers of the Acorn Atom) to produce and distribute a computer to be used in the course.

Known as the BBC Microcomputer System (BBCMS), the computer is a full-fledged 6502-based device, featuring high resolution colour graphics, Teletext interface and room to grow as the BBC broadcast lessons become more advanced. Special procedures have been followed to make sure the computer is as reliable as possible because of the overtones the project has for national broadcasting. Acorn's 50 service centres around Britain are also gearing up to support the project.

Both Teletext and Prestel offer prospects of loading software into the computer direct from the BBC studios in conjunction with the educational TV broadcasts. TV programs scheduled include two introductory broadcasts dealing with the "what and why" of computers and courses of programming languages, storage, communications, graphics and use of D/A converters for appliance control, artificial intelligence and future developments.

With 40,000 applications arriving almost as soon as the project was announced, the BBC and Acorn Computers seem certain to bring microcomputers into the British home in a big way.

Electronics for self-help medicine

More and more people in the United States have taken to monitoring their own health using a range of electronic gadgets and computer programs. According to a report by International Resource Development Inc, home medical electronic devices are currently one of the "hottest" new markets, growing at more than 40% a year.

Within four years, according to the repot, more than one million people in the US will be using home computer software packages to watch their health, exercise and diet. Do-it-yourself blood pressure monitoring devices, pulse rate monitors, electronic thermometers and a host of other gadgets are expected to contribute to the boom.

The report from IRD points to a major trend towards preventative medicine, with people seeking to avoid rather than solve medical problems. In addition to electronic devices and home computer software, IRD expects that Videotex and home information services will also be used to provide medically oriented services. The trend is part of a wider move away from complete reliance on doctors and the health-care establishment towards more self-care and self-reliance.

The new electronic devices are said to provide completely automatic readings of vital functions, without the need for special skills or training.

Computers muster the sheep in CSIRO project

It seems that even sheep-dogs are in danger of being replaced by automation. When sheep are rounded up, for treatment such as dipping, a great deal of work is required to get them into the handling races and keep them moving. This effort could be saved if a self-feeding sheep run automatically presented the animals to the handler when he is ready for them. The need for a second person behind the sheep, moving them along, could be eliminated.

A research team at the CSIRO Division of Land Resources Management in Perth has designed such a system, consisting of a long curved approach race holding a large number of sheep and a "sheep shunt" which presents the sheep to the handler one by one.

A mechanical sweep helps keep the sheep moving around the approach race and the shunt uses a series of microprocessor controlled devices to encourage the animal to move at the appropriate time. Tilting floors, swinging gates and loudspeakers are used to move the sheep as required.

The equipment is designed to be portable, so that a farmer could link it to his standard handling equipment. The sweep glides along the dividing fence of the approach race, pushing the sheep forward with 100mm rubber flaps. A loudspeaker mounted on the sweep can be activated to further encourage the animals.

An AIM 65 microprocessor is used to run the system. It was selected because of its portability, relative cheapness and the convenience of its in-built printer for recording data. Power requirements can be provided by a 12V car battery.

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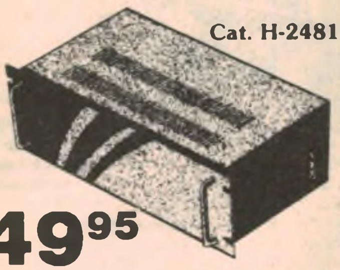
Cat. H-2481



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SINCLAIR ZX81

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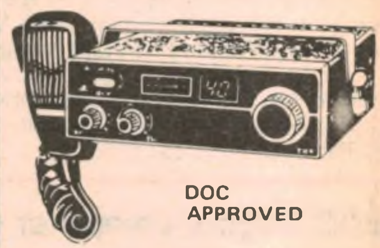
- Complete with all leads to connect up your TV and cassette recorder.
- Supplied comprehensive user manual.
- Amazing 8K BASIC ROM!

NOW LEGAL!

40 CHANNEL



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STALKER XIII 40 Ch AM/CB

An AM CB radio with a full 40 CHANNELS! Easy to install and pushes a clean signal through the air. Great in emergencies or for making new friends! So join the CB rush now!

Cat. D-1447

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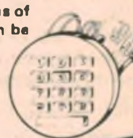
Converts rotary dial phones to push button type. Ideal for private phone systems. memory re-dial allows a previously engaged number to be re-called at the press of a button. Up to 16 digits can be retained in the memory.



NORMALLY $39.50

NOW ONLY **$27**

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This informative book features gambling games, educational programs, arcade games and utility programs. Challenge the ZX81! Cat. B-2357

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DON'T tells you how to care for your computer and its peripherals to save you time and money.

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Use your System 80 to talk with other computers use local or overseas data bases, etc. Cat. X-3766

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This program includes software and assembled hardware, allows you to play a four-part harmony on your Sorcerer. Comes complete with sample tunes. Cat. X-3603

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This is superb SSB (Single Sideband) set. It has up to 3 TIMES the range of AM!!! Great CB value!

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$199

Why buy a superseded 18 channel set?

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YOUR SYSTEM 80 CAN SPEAK!!!

VOTRAX Type-'N-Talk™

Exciting, new text-to-speech synthesizer Cat. X-3290

Type-'N-Talk™, an important technological advance from Votrax, enables your computer to talk to you simply and clearly — with an unlimited vocabulary.

You operate Type-'N-Talk™ by simply typing English text and a talk command. Your typewritten words are automatically translated into electronic speech by the system's microprocessor-based text-to-speech algorithm.

Type-'N-Talk™ adds a whole new world of speaking roles to your computer. You can program verbal reminders to prompt you through a complex routine and make your computer announce events. In teaching, the computer with Type-'N-Talk™, can actually tell students when they're right or wrong — even praise a correct answer.

Type-'N-Talk™ has its own built-in microprocessor and a 750 character buffer to hold the words you've typed. Type-'N-Talk™ doesn't have to use your host computer's memory, or tie it up with time-consuming text translation.

Type-'N-Talk™ can be interfaced in several ways using special control characters. Connect it directly to a computer's serial interface. Then a terminal, or line printer can be connected eliminating the need for additional RS-232C ports on your computer.

Type-'N-Talk™ uses the least amount of memory and gives you the most flexible vocabulary available anywhere.

ALSO SUITS MANY OTHER COMPUTERS INCLUDING TRS-80

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CUDLIPP

(The Electronic Cricket) This interesting novelty kit reacts to external sounds by chirping back. Amuse your friends — confound your neighbours! Cat K-3397

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$1.50 Z-4155

NOW COLOUR GRAPHICS FOR SYSTEM 80!

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You'll go a long way to find a case as good as this one. Ideal for a huge range of projects, extremely well made looks a million dollars! But our low, low price?

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Q-1270

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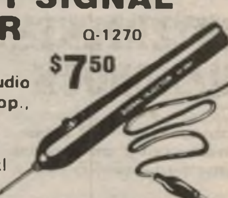

WATCH THIS SPACE

Did you miss out on our BELOW COST SPECIAL?

Last month . . . Kambrook 4 outlet power board (Cat P-5610)

Normally $21.50

Reduced to $11.35

SAVING $10.15!!

This month? Call in and find out for yourself!

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- LCD Display
- Compare elsewhere for $$$ more!

This superb new multimeter has just been added to our already large range. It has liquid crystal display and is auto ranging with a very low power consumption plus overload protection.

$49.50 Cat. Q-1446

DICK SMITH Electronics

You'll find all our stores and resellers listed on another page of this magazine!

DSE/A164/LM

NEWS HIGHLIGHTS

Teachers visit BWD Instruments

BWD Instruments Pty Ltd's plant in Mulgrave, Victoria, was the scene of a recent visit by two Indonesian teaching instructors, Mr Soebagio Basoeki and Mr Ahmad Rauf Effendi. Both men are from the Technical Teacher Upgrading Centre in Bundung, Java, the leading teacher training centre in Indonesia.

The two instructors have been in Australia since February, 1981, undergoing special training as Electronics Instructors at the State College of Victoria, Hawthorn, in conjunction with the Box Hill College of TAFE.

Braille terminal for Prestel shown in Britain

British Telecom last year demonstrated a Braille reader for use with Prestel.

Prestel is a combination of telephone and television that gives users at home and at work two-way access to a wide range of information stored in a computer data base. The information is called up over the phone line and normally displayed in as text and diagrams on a television screen.

In the Braille version, the TV screen is replaced by a flat box "about the size of an attache case". An array of tiny, flat-topped pins is set into the surface of the Braille terminal and raised and lowered under computer control to spell out information in Braille as it is called up from the Prestel computer.

Like a conventional Prestel set, the Braille version has a push-button control pad for selecting "pages" of information on different subjects.

Ultrasonic detector probes the Concorde

Shown here as it is prepared for work on a Concorde aircraft, the UFD-S flaw detector makes use of the "shadow system" of ultrasonic testing as well as more conventional pulse echo techniques. The shadow system uses a resonant frequency that is passed through a plastic tipped probe into the work under test. The ultrasonic sound waves are redirected by any flaw in the material and picked up by a second probe to be amplified and displayed on an oscilloscope screen. Changes between the intensity and position of the transmitted and received signals indicate flaws in the material being tested.

The ultrasonic materials tester was developed in Britain and detects flaws in honeycomb sections, composite materials and ceramics without the need for surface preparation or any special coupling material between the test probes and the work piece.

It is useful in confined spaces, since the transmitting and receiving probes can be as small as 5mm in diameter and can be used at any angle to each other. On large areas, other probes for the system can be used without the surface preparation required by previously available systems.

The UFD-S flaw detector is made by Balteau Sonatest Ltd, Dickens Rd, Old Wolverton Road Industrial Estate, Milton Keynes, North Bucks, MK12 5QQ, United Kingdom.

Consensus needed on Australia's technology

Wider agreement between industrialists, scientists and politicians was needed to plan Australia's technological future, the Chairman of the CSIRO, Dr J. Paul Wild, said recently. He stated that the CSIRO was developing plans for key technological areas, but a nationwide consensus was needed.

"Problems of fragmentation, the existence of competition rather than collaboration between firms and a lack of spirit of innovation in manufacturing industry all make the interaction between industry and the scientist difficult. For its part, CSIRO believes four areas at least can be identified as worthy of greater research and government support," he said.

"In this country I would think technologies such as biotechnology and microelectronics would qualify. Solar energy for industrial heat is a good example of an industry pioneered in Australia which has a slender presence but a great potential future."

Dr Wild said that in spite of its rejection of the key industry approach, the Federal Government did give special support to a small number of large industries through tariff protection. "But these are the well established conservative industries like motor cars, textiles and clothing, not associated with the new innovative technologies of local origin. It is significant that CSIRO has produced a succession of quite brilliant innovations in the textile industry – but they only seem to find their way into industry overseas."

Department of Communications steps up campaign agains unlicensed operators

The Department of Communications continues to carry out regular campaigns against unlicensed users of the radio frequency spectrum. During the 1981-82 summer, for example, inspectors in NSW concentrated heavily on checking out harbour mobiles and ship stations along the coastline.

This article was written in December, so it is not possible to summarise the success or otherwise of this campaign although initial results indicated that it would be highly successful. In the past, campaigns in many parts of Australia have resulted in hundreds of licences being renewed or taken out. Two unfortunate results have been court actions against some offenders and the forfeiture of expensive equipment to the Commonwealth.

I say "unfortunate" because the Department of Communications tries to avoid a cudgel-like approach in these campaigns. We prefer persuasion rather than prosecution, but some offenders are so recalcitrant that the only solution left to us is to go to court.

Most of these prosecutions are successful, as the following statistics show. In the 12-month period from April 1, 1980, to March 31, 1981, there were 210 actions through the courts and of these 203 succeeded. For the previous 12-month period the figures were 230 and 211 respectively.

About 300 radios worth approximately $100,000 were forfeited to the Commonwealth in the April 1, 1980-March 31, 1981 period. If it is the offender's first offence, and the equipment is licensable, it is sometimes returned on payment of a contribution (usually about $100) towards the cost of the investigation.

The additional fees revenue obtained through these campaigns is nice to get, but really this is a secondary consideration. We look upon the operation of unlicensed equipment as serious because:

- Unlicensed operators can, and in many cases do, cause interference to other and future legitimate users of the spectrum;
- Illegal modification of equipment to allow more channels or excessive power to be used can result in similar interference.

In regard to fees, it is fair to state that unlicensed operators throw a heavy burden onto legitimate operators who pay their dues. This is not an inconsiderable amount for in this financial year almost $15 million will be collected to enable the Department to cover the costs of managing the spectrum.

It is conceivable that if all operators paid fees there would be an easing in the annual increase in fees charged. The most recent campaigns — in Western Australia and Victoria, and random checks in Queensland — brought in almost $57,000 in additional licence fees, with the likelihood of subsequent renewals adding substantially to this figure.

Those breaching the Wireless Telegraphy Act and regulations are not always individuals although boatowners frequently fail to license their transceiving equipment and those wanting to use CB and amateur service equipment often buy it and operate it without a licence.

Companies often neglect to license additional land mobiles and several firms have been prosecuted for operating unlicensed equipment or making unauthorised transmissions. A bus company forfeited $15,000 in equipment while a taxi co-operative was found to have evaded annual licensing fees of $1700.

The NSW campaign began in August and has continued through the spring and summer months. Officials of fishing and boating clubs were interviewed and asked to encourage members to ensure their equipment was licensed and that they followed good operating practices. Advice was given that there would be a concentrated effort in NSW to inspect as many harbour mobiles and ship stations as possible in the peak summer period.

There are almost 5700 harbour mobiles and 2300 ship stations in NSW giving a total of about 8000. If the weather was fine this summer — and remember, this article was written in early December — then the Department's inspectors would have checked about 33% of this figure. If the summer was poor it would have dropped to about 25%.

Statistics from Queensland indicate the seriousness of unlicensed operations in Australia and their potential dangers. This threat applies in particular to fishing vessels where out of 25 inspected at random at Brisbane berths during October 1981, 92% had technical deficiencies in their radio communications equipment. The dangers of going out to sea with defective radios will be readily apparent. Almost half the 25 boats were unlicensed and the estimated loss in revenue to the Commonwealth was $75,000 a year.

Our Queensland colleagues also inspected 151 small boats from Cairns to Brisbane over a six-month period and found that 54% were unlicensed. The estimate is that there are 5000 unlicensed small craft in Queensland and the revenue loss is again $75,000 annually.

During this same six-month period our inspectors in Queensland found that 19% of land mobile units in the state were unlicensed, representing a loss of $317,600 annually. Obviously Queenslanders are not alone in their indifference to the licensing laws so it can be appreciated that Australia-wide the problem is quite a serious one.

Our officers in Queensland are so concerned at these figures that they too plan to mount a campaign early in 1982 after giving adequate warnings and publicity on unlicensed use.

The Department also intends running a trial campaign in the Yellow Pages of telephone directories in Newcastle and Canberra in 1982 in an attempt to bring the licensing laws to the buyers of radio communications equipment. One objective in this trial is to get buyers to approach the Department for free advice on the correct equipment to buy. Then they should not be tempted to modify their equipment illegally. This often happens when buyers find their gear cannot do the tasks they set it to do. If this trial is successful it may be extended to directories for other towns and cities.

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

New director of Institute of Industrial Technology

Dr W. J. Whitton has been appointed the new head of the CSIRO's Institute of Industrial Technology. Announcing the appointment, Dr J. Paul Wild, Chairman of the CSIRO, said "Dr Whitton, the Research and Technology Director of ICI Australia Ltd, has had wide experience in the application of research to industry in Australia". The appointment is for five years.

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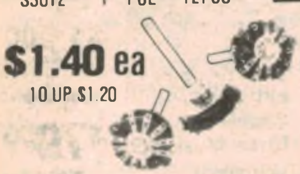

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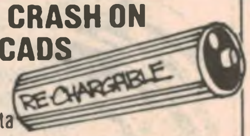

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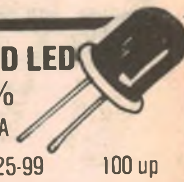

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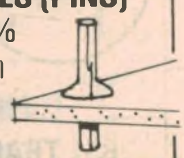

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Are automatic airliners ready to take off?

The next generation of airliners will largely be flown by computers, with TV display screens replacing conventional instruments. Such "TV cockpits" will greatly reduce the work-load of the plane's pilots, perhaps leading to two-man crews, even on large international jets.

by BILL SWEETMAN

The aerospace industry has always boasted that it is more technologically advanced than any other. Now, that very dominance of new technologies has forced it to be a pioneer in a less welcome area – labour relations. Computers and television screens in airline cockpits cut the number of pilots needed to fly the plane from three to two, creating a problem that is more difficult to solve than making the complex electronics work.

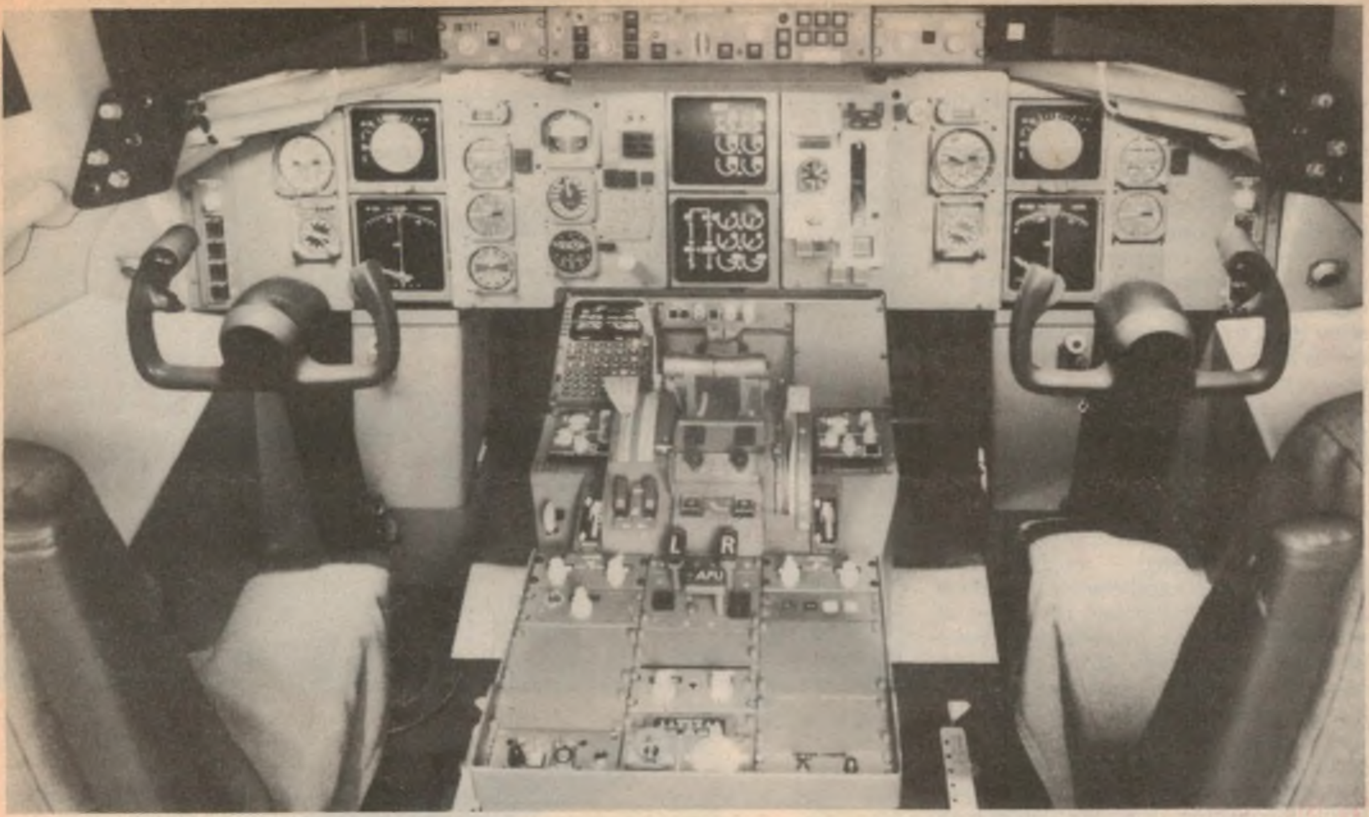
The focus of the industry's problem is the cockpits of three new jetliners, now being developed by Boeing in the US and the European consortium Airbus Industrie. Airlines have ordered the best part of a thousand of these new aircraft, to replace their fuel-thirsty predecessors. The first of these, Boeing's 210-seater 767 was rolled out of its hangar in August, and has started test flights. All three new aircraft will be in service by the beginning of 1983.

Above, the old style – the complex cockpit of the Concorde. Compare this with the "C-Cab" (facing page), to be used in later versions of Boeing's 757 and 767.

From the outside, the new aircraft – Boeing's 767 and 757, and the Airbus A310 – look very like today's models. Beneath their aluminium skins they incorporate no revolutionary advances in aerodynamics, structures or engines. But from the pilot's seat they bring about the biggest single change in design for half a century. The airlines and the pilots agree that the new designs of cockpits represent a great advance; it is the implication of new technology for the crews which have caused them to fall out. But what is the fuss all about?

The flight deck of a modern airliner concentrates the control and authority of a highly complex system in a miniscule volume; any comparable process or form of transport would require a control room the size of a small house. The pilots have several levels of task to perform and the designer of the cockpit has to make sure that they do them all efficiently. The crew's main task is simply to fly the aeroplane without exceeding the limits of the machine; this may seem obvious but the complexity of the other tasks tends to conceal its importance. Secondly, the crew is responsible for the relationship of the aircraft to the environment: avoiding other aircraft and the ground, planning and steering a correct course and ensuring that their actions fit in with the commands of air traffic controllers on the ground. The third task is to monitor the behaviour of the aircraft itself, making sure that the hundreds of electrical and hydraulic subsystems and components, on which the safety of the flight depends, are performing satisfactorily.

The three tasks make for a lot of work, and with new airlines, the load is increasing. The modern jet airliner is nearly 30 times larger than those of the early 1930s. Yet a DC-3 pilot of those days would find the cockpit of any airliner now in service somewhat familiar. The same basic dials and pointers are arrayed in identical layouts in front of each of the two pilots, showing height, speed,



altitude and course and allowing the pilots to fly the aeroplane within limits even at night or in bad weather. The number of gauges, warning lights and switches which indicate the health of systems and which can be used to isolate a faulty system has increased dramatically – but warning lights and gauges are not new. Where something completely new has been added to the flight deck since the 1930s – such as weather radar, autopilot or inertial navigation systems – it is now to be found on the edge of the pilot's area of attention. It has not displaced other indicators from their traditional positions. The DC-3 pilot might notice one definite, qualitative change – some of the gauges and switches have been transferred to a panel to the side and rear of the cockpit, and a third crew member in a seat facing sideways monitors them. DC-3s often had just two pilots.

But put the 1930s pilot in one of the three new jets and he is faced by a row of blank TV screens and no familiar instruments. The TV screens are the obvious difference in the new cockpits, but they are merely outward signs of a far more fundamental internal change. The old instruments were driven electrically or mechanically, responding directly to inputs from the extremities of the aircraft, or by gyroscopes driven by compressed air. Although the pictures on the TV screens used in the new cockpits can look like the old-style instruments, the similarity is as much an illusion as a Walt Disney animation. The images are generated directly by computers which interpret all the signals from the aircraft's sensors and turn them into visual form. It need hardly be said that the cheapness, small size and reliability of microprocessor technology has made these new cockpits possible.

But they do far more, far faster, than anyone imagined possible as little as five years ago. At the 1976 Farnborough air show, British Aircraft Corporation (now part of British Aerospace) demonstrated a mock-up of an "advanced flight-deck", in which black-and-white TV screens replaced some instruments; it might, it was suggested, be suitable for the generation of airliners after next. Now, the ones in the next generation have colour displays. The progress is so rapid that the new cockpits make that on the Shuttle look dated.

The TV cockpit significantly improves the performance of some basic cockpit instruments, extends the usefulness of some others and introduces some new functions. The instrument which is least changed is the "artificial horizon", that now includes the old "turn and slip" indicator, which shows the attitude of the aircraft. The colour TV version looks essentially the same, with a moving circle divided into blue and brown sectors to simulate the horizon.

But the new television instrument can add more information and – almost as important – can eliminate all data that are unnecessary at any given time. For example, the old mechanical instrument has small moveable metal bars linked to the radio landing-guidance system. They are needed only when the aircraft is landing, when they tell the pilot the angle and the course he needs to fly to reach the end of the runway at night or in bad weather; but through the rest of the flight the small bars continue to clutter the instrument. On the TV instrument, they can be switched off, making room for new images.

In Airbus Industrie's new cockpit, the screen which carries the artificial horizon also carries a vertical-strip that shows airspeed, replacing the old clock-type meter. Normally, vertical-strip instruments are too bulky for aircraft or their scales are too small to show the other important flight functions. With a TV version, the mechanical bulkiness is not a problem. It is also possible to add details to the display which would be impossible to introduce on a conventional instrument of adequate size, such as a small arrow which changes length and direction to indicate whether, and at what rate, the aircraft is accelerating or decelerating.

More radically changed is the instrument descended from the original compass, which in a conventional cockpit still resembles the traditional compass "rose" but can accept signals from ground beacons through the aircraft's navigational system. This type of display is available on the TV screen if the crew needs it, but the new systems can provide a completely different picture containing far more information. To start with, the TV screen can cut most of the compass arc, merely showing the sector around the actual track being flown, and at a much larger scale. It adds to that a picture of a simple navigation map showing the pilot his planned course, how far he has to fly to his next turning point and what height ar:d speed he should be making by the time he reaches it. Finally, it can add a full-colour radar picture of the surrounding weather to the map.

Radar is not new; nor are visual navigation displays of one kind or another, and, of course, the compass is the oldest navigation instrument known. What is new is that all the information that the crew used to have to assemble in their minds from three separate instruments is now combined on a single screen, on a constant scale, and — an important improvement for any map-reader — with the words all the right way up.

The aspect of the new cockpits which is arousing the greatest direct controversy, however, is the new approach to the monitoring systems — engines, fuel system, hydraulics and electrical — which are necessary for the safe operation of the aircraft. The two manufacturers have developed equipment along rather different lines. Boeing — for a long time the leading maker of airliners — started with the engines, and has gone over completely to TV for the instruments which show the pressures and temperatures within the engines. This information is so important that Boeing has to use a "belt, braces and safety-pin" approach to ensure that even if two of the TV screens fail the crew will be able to tell how well the engines are running. Half the area of one screen is permanently used for engine instruments, displaying images which appear similar to the traditional mechanical type but which carry much additional information. The "safety-pin" is a tiny liquid-crystal display which shows essential engine information in digital form.

Boeing has approached the way the TV cockpit works with two principles in mind. The first is that the picture on the TV screen should change automatically only when something has gone wrong, because the change in itself is a very useful warning. The second principle is that the same information is always displayed in the same position. This makes for the most effective possible Display of information about the performance of the engine; and after the primary flight and navigation data, this is probably the most important information for the crew.

The television screens in the Boeing cockpit can also display written warnings of faults in the aircraft and can be used as a check on its readiness for a flight. The computer's memory can also store the maintenance crew's list of any faults that occur in equipment.

Airbus Industrie, the European consortium which has risen in the past three years from the commercial doldrums to become second only to Boeing in the number of planes it sells, has taken a different approach. Airbus's engine instruments are conventional electromechanical types but, like the Boeing cockpit, the Airbus flight-deck has two TV screens. Because they do not have to carry the vital engine data, which have to be displayed continuously, the TV screens can be used to their full potential for monitoring other aspects of the plane's performance.

New generation airliners — the Airbus Industrie 310 (top) and the Boeing 757

The two television screens in the Airbus cockpit are driven by a sophisticated computer which receives inputs from sensors all over the aircraft — all the information which is usually displayed by warning lights or electromechanical gauges in the conventional cockpit. One of the TV screens warns the crew of any problem; the other gives further information. Both make full use of the processing power of the computer and the vast flexibility of computer-generated images, to give the crew information in a far more refined form than conventional instruments could ever achieve.

In the case of a failure, for example, the warning panel not only notifies the crew of a failure but tells it what corrective actions to take and in what sequence (the crew of today's airliners need a written check-list to do this). As the crew follows the computer's list and takes the right action, the visual warnings are cancelled. But if the corrective actions have some deleterious effect on the performance of the aircraft, that fact will be noted and displayed as a reminder to the crew. Meanwhile, the other screen, the one that gives information, displays diagrams of the affected system — something which, once again, would be found only in a written manual on a conventional flight-deck. The diagrams are animated, so that the image of the hydraulic system gives fluid levels and pressures, with symbols showing, in colour, whether a pump is switched off. Once the primary fault has been dealt with, the computer automatically displays the results the corrective action had had on other systems; if one of the three hydraulic systems is shut down, for instance, a diagram of the aircraft's control surfaces will appear, showing which of them have lost part of their power.

Both the Airbus and Boeing cockpits combine the TV screens with another new device, which sounds totally mundane but nevertheless is an important innovation — pushbuttons. The conventional cockpit has three control and display elements for every system (an oil pump or a valve, for example); an indicator that shows whether the system is switched on or off; a switch, and a fault-warning light. New solid-state switches mean that all these functions can be combined in a single pushbutton, saving a tremendous amount of panel space. Airbus has incorporated these pushbut-

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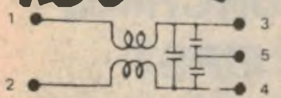

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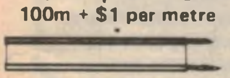

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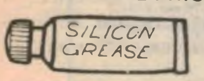

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4029	1.25	4518	1.50
4030	0.80	4520	1.50
4031	2.20	4528	1.25
4033AE	1.50	4538	2.65
4035AE	0.50	4543	1.95
4040	1.65	4553	6.50
4042	0.70	4572	1.75
		4584	1.65

74LS SCHOTTKY — TTL

00	0.35	73	0.95	175	1.65
01	0.40	74	0.75	221	2.25
02	0.40	75	0.65	240	3.50
03	0.60	85	1.25	241	3.50
04	0.40	86	0.50	244	3.55
05	0.60	90	0.75	245	2.95
08	0.40	92	1.25	259	2.50
09	0.50	93	0.85	266	1.25
10	0.40	95	0.75	273	2.95
11	0.40	109	0.75	367	1.25
12	0.60	122	0.75	373	2.95
13	0.60	123	1.10	374	2.50
14	0.85	126	0.75	393	3.50
20	0.40	138	0.92		
27	0.60	139	1.45		
30	0.50	147	2.95		
33	0.50	148	3.95		
42	0.95	157	1.50		
47	1.45	166	2.95		
48	2.95				

OTHERS

74C02	0.50	7484	1.00
74C14	1.50	7491	0.60
7404	0.40	74196	5.00
7410	0.40	Z-80 CPU	17.50
7420	0.40		
7450	0.40		
7460	1.00		
7472	0.80		
7476	0.60		

VOLTAGE REGULATORS

7805/LM340 T5+	1.05
7905/LM320 T5−	1.95
7812/LM340 T12+	1.05
7912/LM320 T12−	1.65
7815/LM340 T15+	1.05
7915/LM320 T15−	1.65
78L12	1.00
78L15	1.00
78H05/LM323	7.50

LINEARS

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TL071	0.98	723	1.25
TL072	1.45	741	0.40
TL075	3.50	747	1.95
TL081	0.65	TEA1002	17.50
TL084	2.95	TDA1022	29.50
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LM307	0.96	1496	1.98
LM308	1.25	EXAR2206	5.95
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LM317T	2.80	CA3046	1.45
LM319	3.50	CA3080E	1.30
LM324	1.20	CA3130	1.80
LM339	0.95	CA3140	1.45
LM348	2.25	LM3900	0.95
OM350	9.50	LM3915	4.50
LM380	1.48	CA4136	1.85
LM381N	3.95	5534	1.50
LM381AN	5.95	5534AN	1.98
LM382	2.60	MM5837	3.90
ZN414	2.50	TA7205	4.50
555	0.35	7555	6.59
NE556	1.10	SN76477NF	4.75
NE570	5.75	SN76488NF	5.95

TRANSISTORS

AC187/188 (matched pair)			1.66
AD161			1.70
AD162			2.00
BC337	0.25	BC557	0.18
BC547	0.15	BC558	0.18
BC548	0.15	BC559	0.18
BC449	0.15	BC639	0.34
BC550	0.65	BC640	0.34
BCY71			0.95
BD139 (NPN)			0.53
BD140 (PNP)			0.53
BD266A (PNP)			1.50
BD677 (NPN)			1.20
BF115			0.75
BF200			0.50
BF469 (NPN)			1.65
BF470 (PNP)			1.65
BUX80			9.50
MJ2955			1.50
MJ15003			4.75
MJ15004			4.75
MPF102			0.95
MPF105/2N5459			0.85
MPF106/2N5485			0.58
MPSA05			0.95
TIP31A	0.90	TIP2955	1.20
TIP32A	0.90	TIP3055	1.20
TT800			0.85
VN88AF			3.50
ZTX501			0.45
2N3055			0.85
2N3059 (Motorola)			1.50
2N3442	2.50	2N3773	5.00
2N3638	0.35	2N5087	0.65
2N3643	0.45	2N5210	0.50
2N3772	4.00	2N5245	0.90
2N5459/MPF105			0.85
2N5484			0.60
2N5485/MPF106			0.60
2N5589			8.50
2N5590			9.50
2N5591			12.50
2SJ-49			6.50
2SK-134			6.50

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tons into what it calls a "dark cockpit philosophy": if no lights show, the aircraft is working normally; blue lights indicate components in temporary use, green lights show where back-up machinery has been brought in to rectify a fault, while amber and red lights indicate faults that are developing.

There are two important implications of the new technology for the airline industry, and in particular for airline pilots. The manufacturers claim that the "smartness" of the new displays — the way the computers can constantly scan the instruments for signs of a fault before it achieves dangerous proportions — considerably reduces the pilot's workload. At the same time, the new pushbuttons allow all the controls and instruments to be on the front face of the cockpit, instead of being hidden away on side panels. The airlines say that these new aircraft will be so much easier to fly that the third crew member, now needed to help with the complex controls and to monitor the side panels, becomes redundant. The pilots' unions — traditionally representing both technical people as well as the pilots — strongly disagree.

Airbus Industrie has tried not to become embroiled in the conflict, saying simply that its new flight-deck is equally suited to a two-man or three-man crew. In the latter case, the third man sits between, behind and slightly above the two pilots, where he can help to monitor the systems and at the same time keep a look-out in front, something the engineer in today's jets cannot do. Boeing has been more vocal, suggesting that two-man crews — common on smaller and simpler jets — are safer than three-man crews.

There are a number of arguments behind this apparent paradox. One is that pilots who have to work hard are safer because their attention is never allowed to wander. Also, as there are two "channels of communication" instead of six, there is less chance of a message going astray between two of the three members of the crew. For example, in the DC10 that crashed in Antarctica in late 1979 the third crewman kept warning that the aircraft was too low, in poor visibility and uncertain terrain, but he was ignored by the other two. Or there was the jet in the US that collided fatally with a light aircraft with five crewmen either working or riding in the cockpit.

These arguments do not impress the crews. Boeing's statistics do not stand up to analysis, according to the pilots and in any event are based on a small sample of accidents. They have three basic arguments. First, although the crews concede that in some ways, the new jets may be easier to fly, they maintain that they will present new challenges. It will be the crew's job to ensure that the new system is working correctly and it may

The Boeing 767. Later versions will be fitted with a "TV cockpit".

be necessary to reprogram the systems to accommodate a change of flight plan. Crews are already under increasing pressure to plan their flight, so as to conserve fuel, adding to their workload.

The sheer novelty of the system also worries some crews. Total failure, they say, is not the problem; but advanced electronics have a habit of generating strange failure modes in flight, and the "gremlins" that occur can disappear when the aircraft is on the ground. One example being cited is a new computer system on one airliner which erases the entire flight plan as soon as the wheels retract after take-off. The computerised cockpits are very new: neither Boeing, nor Airbus has yet flown a complete new technology cockpit; full-scale trials being due to start later this year.

The pilots' third point is more general: it is that operations with two-man crews are less safe than operations with three crew, and is a problem that is tending to increase. Although the workload on a three-man crew, taken as an average across the flight, is relatively light, the pilots argue that this statistic is meaningless. The workload is not an average, but inevitably peaks sharply at take-off and even more dramatically on landing. With the increasing density of air traffic, a two-man crew can become seriously overloaded during a difficult night or bad-weather approach, and the crews cite accidents to two-man aircraft which support this view.

European pilot unions want the third, sideways-facing, crew member to be retained, at least on the Airbus A310, saying that in some ways the new cockpits are being designed to do too much. They suggest that an alternative layout, with three crew and a separate panel for the third man, provides a more reasonable workload, and a more logical split of responsibility, particularly in the event of a failure or failures in the automatic system, while the design could still allow the third man to help keep a lookout. Air France has already conceded the case to its pilots, and the crews of Lufthansa — the second biggest Airbus customer — are also preparing a detailed case for a similar flight-deck.

Ultimately, neither airline nor union can be considered the arbitrator of air safety: both are too deeply involved commercially and industrially to be regarded as unbiased. Perhaps the shape of things to come is revealed by an imminent report commissioned by the White House, which is expected to point the way to a settlement of the two-versus-three argument in the United States. Whatever the outcome of the present dispute, the shape of the airliner cockpit is about to change drastically.

This article first appeared in "New Scientist", October 29, 1981, and is reproduced here by permission of the publishers.

Austr radio

Realising the strategic value of radio, and as a direct result of the First World War, Australia entered the early 1920s determined to build up an independent radio communications industry. Here the author examines the role played by Australia's radio industry during and after the First World War.

by PHILIP GEEVES

Fellow of the Royal Australian Historical Society.

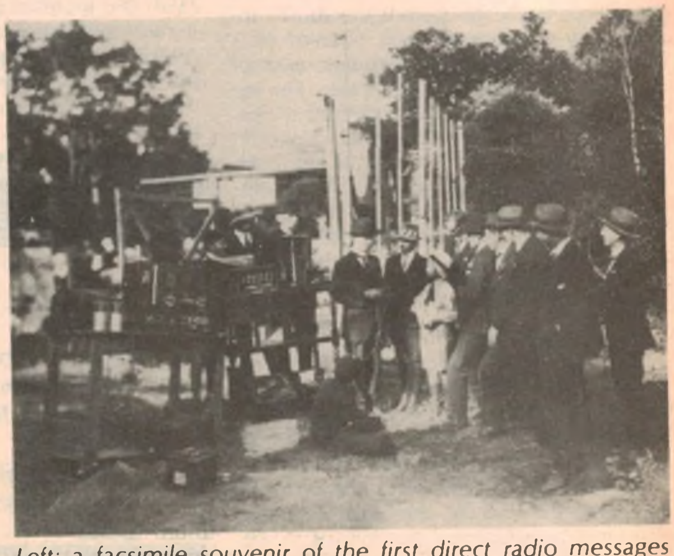
Australia had enjoyed her newly-won nationhood for little more than a decade when, in August 1914, she was suddenly plunged into war. Among the "urgent imperial services" asked of Australia by Great Britain was the task of silencing the powerful radio stations in Germany's Pacific colonies, including New Guinea, which were capable of relaying instructions to naval raiders. At minimal notice, Australia mustered wireless operators and equipment for island outposts, installed a station at Sydney's Garden Island naval base in four days, and set up monitoring posts. This proud chapter of our wireless history deserves to be better known.

At the outbreak of war the Postmaster-General's Department was operating some 20 coastal wireless telegraphy stations around Australia. Apart from the two 25kW quenched spark Telefunken stations at Pennant Hills and Applecross, all the others were 5kW transmitters designed by the Commonwealth "wireless expert", J. G. Balsillie, and manufactured by the Maritime Wireless Company, the corporate offspring of Father Shaw's Randwick workshop. A special feature of Balsillie's spark discharger was that one electrode was shaped like a nozzle, through which air under pressure was blown. By preventing arcing at the spark gap, the system produced clear and easily readable Morse.

At that time most radio amateurs – officially "experimenters" – maintained receiving stations. Only a minority had the requisite knowledge and affluence to own a transmitter, as wireless components were both scarce and expensive. Indeed, most of the advanced amateurs lived in what were then the "establishment" suburbs. The first impact of the war on the experimental fraternity was a directive to dismantle their equipment and deliver it to the nearest post office for impounding. By May 1915 more than 400 licensed and 200 unlicensed experimental stations had been dismantled. It was not until long after the Armistice that amateurs were belatedly freed from wartime restrictions and again permitted to pursue their hobby. By that time radio telephony was already well advanced and, consequently, its novelty soon captivated Australia's experimenters whose ranks had been swollen by an influx of ex-servicemen with wireless experience.

Quite early in the war it became apparent that the management of radio was creating intense rivalry in official circles. The Navy considered that it should have overall control of wartime wireless and when a Post Office operator unwittingly transmitted an uncoded message concerning a troop convoy, this security breach became a cause celebre. During the latter half of 1915, following Australia's numbing losses at Gallipoli, control of wireless telegraphy throughout the nation passed progressively to the Navy. A year later, with the intention of giving governmental wireless its own manufacturing facilities, the Commonwealth purchased Father Shaw's enterprise, the Maritime Wireless Company, for £55,000. Father Shaw died suddenly in curious circumstances shortly after the money was paid over. A subsequent Royal Commission was extremely critical of the whole transaction and resulted in the dismissal of a former Navy Minister and the resignation of a senator, who admitted receiving money from Father Shaw. The Navy's venture into wireless administration had been something less than auspicious.

Australia's only direct links with the great centres of world power were submarine cables, and destruction of these cables by an enemy raider could have isolated the Australian continent. The Marconi Company had proposed the establishment of an "Empire Wireless Chain" before the war but indecision on the part of the British Government had caused the scheme to lapse. During the early part of the war. Australia's coastal stations at Pennant Hills, Applecross and



Left: a facsimile souvenir of the first direct radio messages from Britain in September 1918. Above, the ten valve set used to receive the first messages, at Wahroonga, NSW.

alia's pioneers — 2

Townsville were equipped with valve receivers for the first time, thus making possible the interception of European transmissions, especially from the powerful German station at Nauen, near Berlin. German propaganda messages were copied daily in Australia.

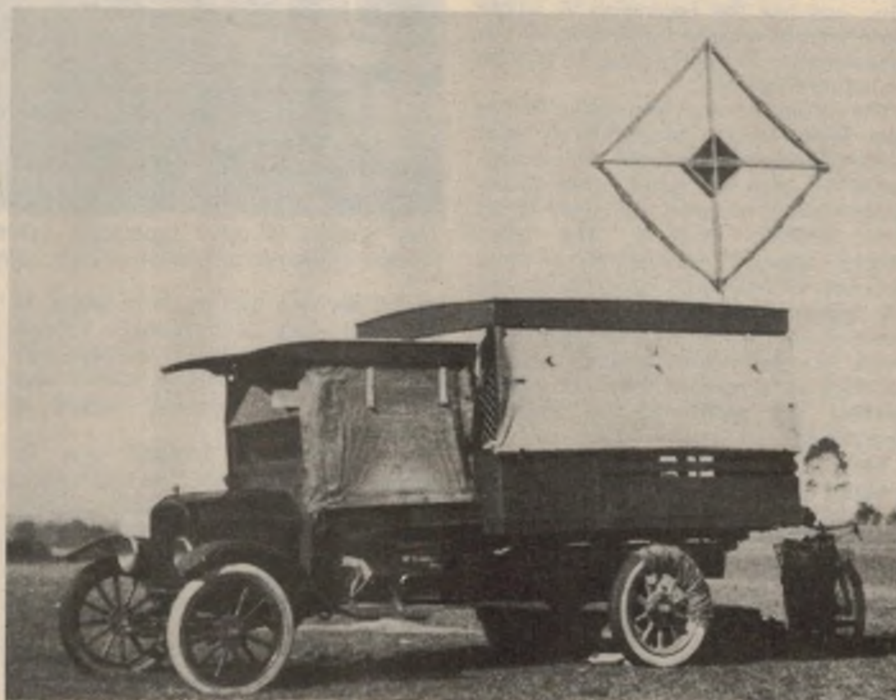
In 1916, while on a visit to England, Ernest Fisk arranged for a series of test transmissions from the Marconi long wave (14,000 metres) transatlantic station at Caernarvon, Wales. Returning to Australia, Fisk obtained official sanction to use a receiver at his Pymble, NSW, residence, and subsequently at his Wahroonga residence. He succeeded in receiving Caernarvon with a 10 valve set employing plate potentials in excess of 300 volts although, as he later wrote, "at that time it was generally considered that no more than three valves could be used in cascade."

After months of experiments, with increasingly better results, Fisk arranged for Caernarvon to transmit special messages addressed to Australia by Prime Minister "Billy" Hughes and Navy Minister Sir Joseph Cook, who had just returned to London from the battlefront. That historic exchange of messages in September 1918 established the practicability of direct wireless communication between Australia and Britain. The achievement also made a profound impression on Hughes, who was later responsible for Australia's decision to create her own global communications links.

At the Imperial Conference of 1921 Hughes informed Britain with characteristic vigour that Australia was not prepared to settle for anything less than a direct wireless link with England. Rejecting a plan submitted by a prestigious British committee for a relay scheme, which would have left Australia dangling at the end of a fragile radio chain passing through countries of dubious stability, the Commonwealth Government commissioned Amalgamated Wireless to set up a direct service to England and, as an expression of faith in the future of radio, acquired a major equity in the company, a partnership that endured for almost 30 years. That same 1922 agreement empowered AWA to take over the operation of coastal radio stations.

At that time, the prevailing technique for long distance transmission was essentially a combination of high power and long wavelengths. The super station planned for Australia's transocean service was to have been of 1000 kilowatts, with a huge antenna system supported on 20 steel masts, 240m high. The capital cost of such a station was considerable and, as Marconi veterans still recall, the atmosphere around these stations was rather eerie; birds or cats seldom ventured near a high power station, where the air fairly crackled with radio frequency during transmission.

To obtain reliable data on reception from Europe, AWA established an experimental monitoring station at Koo-wee-rup, Victoria, in 1921. A puzzling phenomenon soon became apparent. Two daily reception peaks were noted, but the reason was not understood until a rotatable loop aerial revealed that signals from European stations were following the great circle route of maximum darkness. This was confirmed independently by two Marconi engineers who visited Koo-wee-rup in 1922. Later that year, AWA outfitted a Ford van as a mobile laboratory to explore possible sites in New South Wales for the proposed high power station. Locations examined included Campbelltown, Mulgoa, Mount Victoria, Richmond, Singleton and Maitland. Results obtained were very similar, but slightly inferior, to those at Koo-wee-rup.



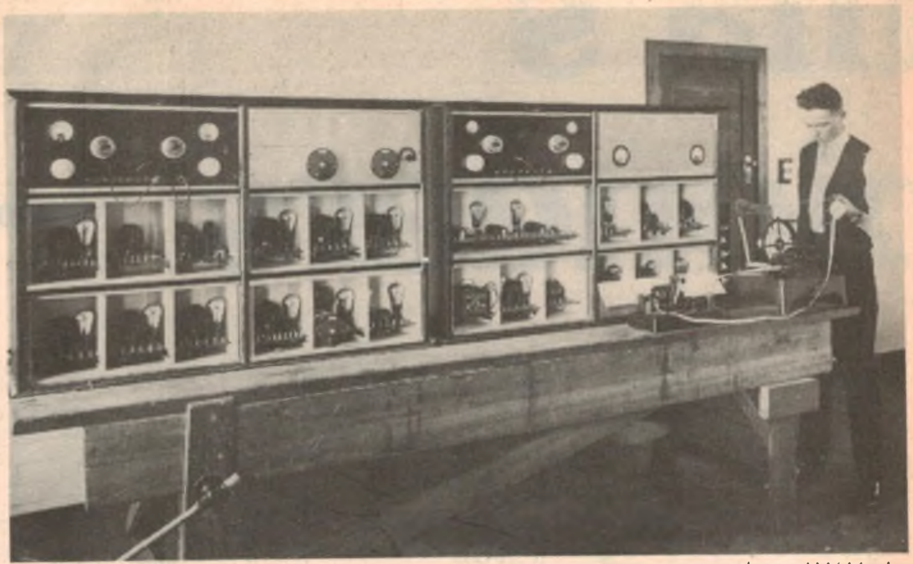
Ford van out-fitted by AWA as a mobile radio laboratory, used for testing reception at various sites considered for the long wave transocean service.

At these field investigations were proceeding, no one in Australia suspected that the future course of global communication would soon be decided by Marconi's renewed interest in the behaviour of short waves. Marconi himself was surprised at the distances achieved by short wave transmissions when his principal assistants, Franklin and Round, succeeded in designing transmitters using thermionic valves and special reflector antennas at wavelengths below 100 metres. For obvious reasons, these Marconi discoveries were kept "under wraps", so it was with considerable astonishment that in February 1924 AWA engineers read a cable from Marconi asking them to listen on 90 metres for a station in Cornwall, call sign 2YT. That message was to become the death sentence of Australia's planned transocean wireless service and of Britain's entire scheme for a long wave relay chain.

There was not a set in Australia capable of receiving 90 metres, so AWA built two immediately, installing them at Willoughby and Vaucluse. One of the engineers involved, Eric Burbury, recalls . . . "to our surprise, at 5.30 the following morning signals were received at good strength and reported by telegram to the Marconi Company". That was just the beginning. A whole series of tests ensued, employing various wavelengths: 25 metres gave the best all round performance.

The results were so impressive that in May 1924, Marconi decided to try short wave telephony to Australia. This experiment was also successful, good quality speech being received at Sydney direct from Poldhu, Cornwall. The word "beam" appeared increasingly in press accounts of Marconi's experiments and the bemused public sensed the attainment of yet another technological landmark. Popular writers described beam wireless as "a narrow ribbon of energy girdling the earth like an invisible searchlight".

Yet the discovery of beam propagation created a fine dilemma for the Marconi Company, as well as for the governments with which it was dealing. The beam was still experimental, so no one could really be sure that the results obtained were not merely freakish propagation effects. In Australia, a veteran Marconi engineer, Harold Drake Richmond, was already busy on preparatory work for the long wave station, but the beam breakthrough put the expensive high power scheme into abeyance. After some agonising soul-searching, the crucial decision was made in favour of the short wave beam system. Victoria became Australia's beam wireless centre, with the transmitting station near Ballan and the receiving station at Rockbank.



This "special 16 valve supersonic heterodyne receiver" was used at AWA's La Perouse station for reception of high speed morse code from Melbourne in the '20s.

The service to England was inaugurated in April 1927. The result was a triumph and the beam rapidly became the world's trusted messenger. Indeed, its speed and economy soon created a serious situation for the cable companies, but that is another story altogether.

The year 1927 proved to be a vintage year for Australia's growing international outreach. In September, AWA's 20kW experimental short wave (28.5 metres) transmitter at Pennant Hills launched Empire broadcasting with an ambitious presentation by Australian artists and notables. The program was intercepted by the BBC and re-broadcast to millions throughout Britain. Before the year ended, a total of five global programs had been transmitted in this way, and Australia's characteristic accent, as well as the kookaburra's laugh, were familiar in many countries long before the BBC established Empire broadcasting. Much of the credit for VK2ME's successes belongs to veteran AWA engineer, S. M. Newman.

AWA engineer Sydney Newman with the company's experimental 20kW shortwave transmitter, Pennant Hills, 1928.

Following the spectacular success of beam wireless, it was inevitable that international duplex telephony would be the next refinement, and after considerable experimentation it became a reality for Australia in 1928. VK2ME, the powerful "maid-of-all work", was again pressed into service. On October 31, 1928, a select group of VIPs and pressmen gathered at AWA's Sydney office to exchange greetings with confreres in other countries, merely by speaking into a domestic telephone. And although male voices dominated those tests, it should be mentioned that Mrs Albert Deane, the American wife of an Australian-born film executive, had the distinction of being the first woman in the United States to converse with Australia by radio telephone. The regular radiophone service to England was opened with due ceremony on April 30, 1930.

The next logical step was a facsimile service, a facility with many applications, including news photographs, cartoons, fashion sketches and fingerprints. The first experimental essays in the genre shuttled between England and Australia in 1929, but it was not until October 1934 that AWA opened a fully-fledged

continued on p126

FORUM

Conducted by Neville Williams

VCRs present real problems in remote areas

In our editorial in the September '81 issue, we referred to the obvious boom in home video and to the technology which has reduced colour/sound video recording to an exercise in button pushing. But a correspondent from Western Australia suggests that the situation, as he sees it, is much less rosy than we appear to have painted it. Indeed, he's downright sour about it!

Perhaps such a reaction should not be surprising, for the truth is that we in the urban areas do tend to forget the remoteness of country homes from back-up technical service. And, even if there's a serviceman in the area, any spare parts that are needed may well have to come from a source hundreds of kilometres away or even, ultimately, from interstate.

Here's the position as our correspondent sees it, warts and all!

BITTER COMPLAINT

Dear Sir,

I would like to comment on your article "Video is on the boil" (Sept '81).

We are a small service centre and service a relatively small community, but spread over a huge area between Broome and Darwin. Our problems can be said to be unique in Australia and would make a good "outback" book of the serviceman on the track.

In regard to VCRs, there seems to be a great problem of obtaining spare parts and service manuals. Mainly for this reason, we do not service these ourselves, except for minor problems, but send them to Perth for major repairs.

Unfortunately, it would appear that models over 12 months old are obsolete. We now have several models in Perth that have been there for the last nine months. Other brands may take up to six months and no amount of jumping up and down can make the spare parts arrive any sooner.

The domestic VCR is not an item that gives years of trouble-free service. Out of 2000 VCRs sold in this area, being assorted brands, more than half have broken down with major problems within three months.

From the public backlash in this area, which is as large as the whole of NSW, one could be led to believe that the VCR domestic setup is a ripoff!

As far as I am concerned, personally, I cannot agree that the VCR works well. We have been called, according to the records, 27 times to inspect VCRs brand new out of the box, that did not even work, and that had to be sent back; this within the last six months!

Electronic magazines in the past used to be far more critical in regard to consumer products and were more concerned with long-term reliability than with initial and often temporary performance. The format of say 10 years ago was far more interesting and enlightening than it is today. Maybe it is all part of the changes that are all around us, but as an oldie I am concerned. So much so that, if it wasn't for "The Serviceman", your company would be a $1.80 poorer!

It seems that magazines are suffering from over-exposure to the dazzle of what a product will do, or rather what the manufacturer claims it will do. What it does not do properly is hidden under talking chips, clocks and gadgetry!

I may be biased and I may look at things only from a service point of view, but it seems a long time since a magazine mentioned the lousy wiring, the aluminium shavings, the loose screws and the multitude of dry joints that appear in brand new equipment.

I really would like to be able to say something nice about the consumer electronics industry but, with the spare parts situation the way it is, the industry is in poor shape, at least in this country.

M.B. (Derby, WA).

In a personal reply to our correspondent, I expressed some surprise at the contents of his letter, on the grounds that he is the first and only reader to have expressed himself in such strong terms about problems with present-day VCRs. We have seen and heard a few grumbles about obsolete European decks, a few criticisms of poor quality tape and a few complaints about individual modern VCRs but they have been the kind of complaint that one hears from time to time about almost any consumer item.

This is not to say that problems don't occur; it may simply mean that, for consumers in urban areas, the problems seldom get to the stage of public confrontation. If a new, off-the-shelf item proves to be faulty, most suppliers will try to rectify the fault immediately, or swap it for another unit in order to avoid any fuss.

But, even if a VCR or a hifi system is out of commission for a week or so in suburbia, there's still plenty of TV and radio entertainment to go on with.

In remote country areas, it's a quite different matter. As we have said, replacement units and/or spare parts may be hundreds, even thousands of kilometres away; likewise people with expertise in the particular item. Breakdowns are much more obvious, much more traumatic, and much more likely to be mentioned to other members of the community.

WE ASK QUESTIONS

However, motivated by M.B's letter, I began to ask deliberate questions around the industry about unit failures and possible delays in the supply of spare parts. And I got some interesting answers.

The failure rate, suggested by our correspondent, for VCRs straight out of the carton does seem to be way above normal expectations and may well have to do with the additional handling and transport between the supplier's bulk store and remote country destinations. Modern packaging can absorb a lot of punishment but long hours of shake and shock on a freight train or a truck can take its toll on high technology equipment, particularly equipment containing both electronic and mechanical components.

This is mere opinion, of course, but looking back over the years, I can recall a variety of radio gear that failed to make the journey from Sydney to the black stump!

I remember, in particular, a line of 6-inch hifi loudspeakers that was brought out by Rola in Melbourne, using a heavy magnet and a well finished aluminium housing. They performed very well and stood up to any amount of electrical punishment. We used them in a project and one of our then major advertisers began to sell them in made-up form. Imagine the surprise of all concerned when systems railed to country destinations began to arrive back at the shop with the magnet assembles rolling around on the bottom of the cabinets!

As for the scarcity of replacement parts, this was acknowledged as a real problem for some makes and models.

It would appear to have been largely the result of the explosion in demand which hit Japanese VCR manufacturers a year or more ago. Many produce components and models under different brand names for major companies around the world. In an effort to maintain production for these customers, I was told some of the manufacturers did not put aside enough components for replacement purposes. Hence the prolonged shortage, of which our correspondent complains, affecting certain makes and models.

Hopefully, the position will improve from here on but whether, in the meantime, country and interstate servicemen get equal access to what is available may be open to debate, especially by those who are at the far end of the supply chain!

DUST OR PERHAPS . . .

Dust was another problem mentioned in the conversations. As one company rep put it to me: people are people, and some of them, some of the time, are going to leave cassette doors open and the cassettes themselves lying around, out of their sleeves. That kind of thing is bad enough in the city, he said, but it's a positive liability in areas where there's a lot of airborne dust.

It is conventional wisdom, I agree, to warn users against this kind of carelessness but I do wonder whether it can contribute significantly to the frequency of breakdown that our correspondent talks about. Somebody out there may be able to offer the benefit of their experience.

However, talk of winds and dust did bring to light a rather fascinating proposition from one well informed sales engineer.

Some time ago, he said, his company had fitted out a new showroom, with all the usual trappings, including an impressive expanse of nylon carpet.

The first and obvious result was that, under conditions of low ambient humidity, when anyone walked across the aforesaid carpet, there was a splat – and a mild shock – when next they touched a metal object. (The same thing happens

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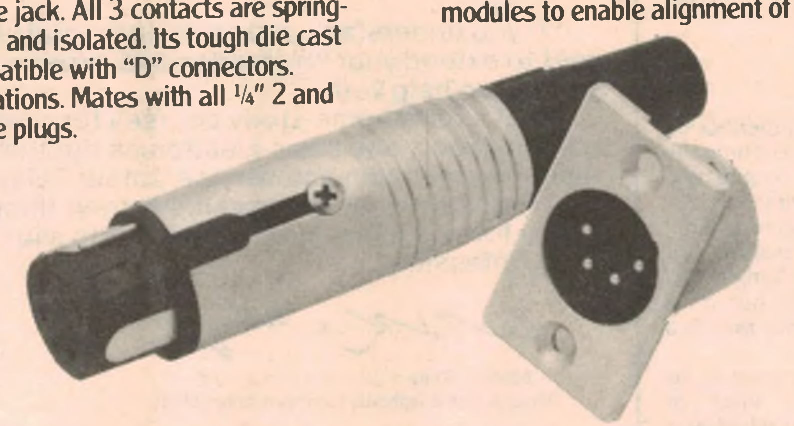

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RHC002

FORUM — continued

in our editorial office on occasions.)

The second — and more alarming — result was that the discharges proved capable of knocking out the control logic ICs in a then-new soft-touch VCR. Suitably alarmed, they notified their parent company in Japan and had the design modified to afford protection against this unexpected hazard. They were lucky but it led my informant to pose the question:

"I wonder if there are other soft-touch VCRs out there in the field which are still sensitive to static discharges?

"In fact, the problem could arise with a whole array of tuners and audio tape decks which use soft-touch logic."

I don't know the answer to his question but it certainly bears thinking about.

Then there's the matter of the tape being used. I have no apprehension about the well known brands but all of them appear to be in short supply, largely because of the heavy demands of software manufacturers. The situation provides the perfect incentive for importers to bring in whatever cassettes they can buy to fill the gap — with the strong chance that such cassettes, or the tape in them, will be of questionable quality, subject to dropouts, oxide shedding and even mechanical jamming.

Some examples of this have occurred already but the tip is that a lot more second-grade cassettes could find their way on to the market, with Western Australia being mentioned as a prime target. It prompts one to speculate whether some of the problems mentioned are being caused by inferior tape, including the tape used in "bootleg" copies of pre-recorded shows.

But, whatever the explanation, we certainly have one very unhappy serviceman/reader in Derby who feels strongly enough to brand the whole domestic VCR set-up as a ripoff. I wonder how many agree or disagree?

ABOUT MAGAZINES

In closing, M.B. has some strong words to say about technical magazines and their failure to be concerned with long-term reliability, rather than dazzling up-front technology.

The fact is that, faced with a new product, magazine reviewers are in no position to comment about long-term reliability. A unit may appear to be well made or it may appear to have some vulnerable features but reliability — or the lack of it — can only be demonstrated by experience in the field, long after the New Product review has been published.

This much I will admit — and it may have something to do with our correspondent's fond memories of an earlier decade: Ten years ago, one could pull the lid off a receiver, or amplifier and physically inspect physical components, to form an opinion, about their potential reliability. But how can you form opinions nowadays, about a whole mass of circuitry contained inside one or more integrated circuits?

You can't, because good, bad and indifferent chips all look the same from the outside; yet they have a profound effect on reliability.

One sentence in M.B's letter really intrigues me:

"*. . . it seems a long time since a magazine mentioned the lousy wiring, the aluminium shavings, the loose screws and the multitude of dry joints that appear in brand new equipment.*"

THE OLD DAYS!

I must admit that (in some senses) in the "bad old days" of local manufacture, a bit of filing and drilling was often just part of the assembly procedure — with a possible heritage of filings and shavings. These days, if we came across anything like that in a quality brand product — and of all things in a VCR — that would be news indeed! We could hardly miss it or ignore it.

Lousy wiring? If the implication of this is difficulty of access to some boards and some components, we would have to agree that we have often registered the reaction: "but who'd like to have to service it?"

Perhaps we've been guilty of the too-easy assumption that, if such equipment needs repair, it is best done in the service department of the distributor. Hopefully they will have manuals, replacement boards and service personnel who have been through a familiarisation course in the particular equipment.

Where does that leave a serviceman, out in the never never, and remote from such resources? In an awkward position, I must admit, particularly if there are hold-ups of 6 to 12 months, as per the letter. Yet the more complicated and specialised the equipment becomes, and the more unique the components to each manufacturer, the greater must be the dilemma of a back-country serviceman. He can hardly be expected to be an expert at everything.

Loose screws? Dry joints? Lousy wiring (if it means unreliable wiring)? The Serviceman has had quite a bit to say about dry joints, in particular, but these are all things that tend to show up in service, not when we first take equipment out of the carton for a product review.

And, significantly, they're the very things that might be revealed by prolonged vibration in a freight train or a truck.

But I wonder how representative M.B's experience is? Is it typical or was his letter written in the wake of a particularly nasty intermittent?

Audio-video Electronics

HIFI • HOME VIDEO • PROFESSIONAL AUDIO

MORTON GOULD — A noted conductor shares his ideas about high technology recording

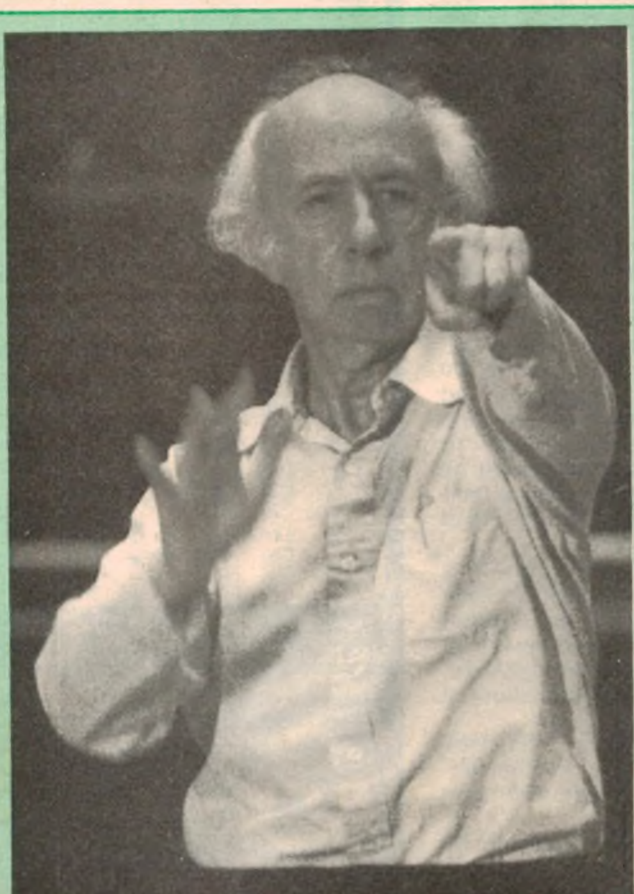
The following interview was conducted by Gary Stock on behalf of the US magazine "AUDIO". Reprinted by arrangement.

GS: *You've been exposed in the course of your career to many technical advances in sound. In fact, you've always been noted as a composer who has taken an interest in the technical side of broadcasting and recordings. Of all the incremental improvements in sound that came along during your career, which was the most dramatic and large-scale?*

MG: The biggest advance was the LP. For my kind of music — which I suppose might be called symphonic music for want of a better term — the ability to do a symphonic work without having to stop after four minutes or so was a major breakthrough. There used to be a 12-inch shellac, which ran four minutes and some seconds, and then a 10-inch shellac, which ran three minutes and something. Even if you did a movement that ran only eight minutes, you had to break it into two segments. If it ran 10 minutes; you had to decide what to do with the remainder of the record. To say nothing of the improvement in sound, the idea of a record that could contain as much music as an LP was a complete revelation.

GS: *How much music of the pre-LP era was composed specifically to fit the 78 format? Do you think the musical compositions were substantially affected by the time limitations?*

MG: In the commercial sphere, a lot of things were affected. When I was making so many recordings of my arrangements of popular show tunes, they were obviously made to fit on a record side; they just could not run more than one side and be effective. I did many, many years of radio broadcasting, and in radio you rarely ran a piece more than four minutes because, in a half-hour program, you wanted to do seven or eight numbers. The re-



To the student of contemporary American music, the name and works of Morton Gould need little introduction. He stands as one of the nation's foremost composers, not only because of his symphonic works, but also because of the eclectic body of popular music — pieces for film, ballet, Broadway, and television — which he has written.

From the first flush of national popularity, acquired through his Depression-era radio broadcasts, Gould has explored an ever-widening array of musical forms. He developed the concept of the "little symphony" in his well-known symphoniettes, examined jazz forms in "Interplay", contributed to what might be called American patriotic music with "American Ballads", "Columbia", and "American Salute", and composed ballet scores for artists like de Mille ("Fall River Legend"), Balanchine ("Clarinade"), and Eliot Feld ("Santa Fe Saga").

His film music includes scores for "Windjammer", "Holiday", and "Delightfully Dangerous", and his Broadway works include scores for "Billion Dollar Baby" and "Arms and the Girl". He composed the theme music for the NBC production "Holocaust" and for ABC's "F. Scott Fitzgerald in Hollywood", among other TV works.

As a conductor and recording artist, Gould has been no less active. His RCA recordings of the music of Ives and Nielsen were strong influences on the growing popularity of these composers in the US; he won a Grammy award for an RCA Red Seal recording of Ives' music with the Chicago Symphony in 1966.

In recent years, his intimate interest in recording with the highest possible sonic quality led him to both direct-disc and digitally based records with the London Symphony and London Philharmonic Orchestras. These recordings, on the Chalfont and Varese/Sarabande labels, have made him familiar with the new technologies of digital recording and dbx-encoded discs. We visited Gould in his home on Long Island to talk about his reactions to recent developments in recording techniques.

cording time affected many such things. What it did not affect was the serious composer who was going to write a symphony or symphonic work; however long it ran, that was it, because it was intended primarily for concert performance. The recording was simply an after-the-fact event. When you recorded it, it was your responsibility as conductor to look at the score and choose the first feasible break around the four-minute mark. Then you would attempt to stop, start again, and pick up the music.

GS: *What was the development that did the most to give music vibrance and "life", however?*

MG: That came with the whole era of high fidelity, the accent on an increased consciousness of sound, which again was tied strongly to the advent of the LP. This was coupled with the whole idea — also new at that time — of putting music on tape, as against the wax, and the idea that you could edit. When we did 78s, of course, that performance was it, and if there was a mistake there was no way of retrieving it.

GS: *How did the radical improvements in sound change the way you went about arranging music? For example, how did you react to the presence of wider dynamic range?*

MG: The wider dynamic range made possible what might be called an expanded palette of musical colours. People could go for effects, for impact, where before it had not been possible. In the performances of individual players, you could get a wider latitude of dynamics.

GS: *With tape, did you find that performers were generally willing to take more chances?*

MG: Yes, I think so. When we were doing the 78s, we all had to be careful, since there was no way to correct, while with tape you might try certain dynamics — play something louder than you were supposed to — and see if you got it on tape. You might have it on tape, too, but then not be able to make the transfer to the final disc; a certain amount of tempering was inevitable there. But at least you could try for the effect, and then, if the tape or the groove broke up, do it over again or temper the transfer.

GS: *Did most composers and conductors in the early days of high fidelity take advantage of this expanded dynamic palette fully, or was it left more less unused for a while?*

MG: It took some time for people to catch up to it. You have to remember that a lot of people who recorded in those days were not particularly sensitive to the recording medium. Many of my colleagues would make comments and even write articles about how terrible recorded music was — that it was all artificial, and presented an aesthetically distorted view of music. Many performing artists wanted nothing to do with recordings. Others were allergic to the recording environment, and had to be almost pulled forcibly into the studio. There were some clear exceptions to this of course; Stokowski was doing stereo back in the thirties. He was really a pioneer, very sound conscious.

GS: *That has also historically been said about you.*

DIGITAL RECORDING: Maybe we all have something to learn!

Along with many others, we have been trying to find some explanation for the strongly opposed reactions to modern record/replay technology and in particular to the digital system. In many ways, the situation is reminiscent of the controversy which accompanied the moves into wide-range (Decca ffrr, etc) and into stereo — a confused mix of technical and musical reactions.

The interview with Morton Gould sheds further light on the subject and tends to reinforce some of the things we have been thinking and saying. Let's sum them up under three headings:

PROGRAM CONTENT: Emerging technology ultimately has to display itself in actual performances, which will inevitably be compared with the best that already exists. If the comparison is unfavourable, and especially if the cost is greater, the resulting disillusionment can discredit the whole enterprise — including the technology. One has to be wary of this in seeking to evaluate such technology.

DYNAMIC RANGE: As Morton Gould observes, musicians as well as engineers can be involved in exploiting the wider dynamic range which is now possible with modern technology. But how much dynamic range is acceptable in the home is open to debate. It could well be that the limits imposed during the analog era are not too far from optimum for most homes and most listeners over 50, whose acuity to low-level sound is not quite what it was.

"CURTAIN" OR "FOG": The accepted way of listening to a large orchestra (or a large organ) is in an auditorium which envelops every individual sound in an ambient made up of reverberant energy, plus noise from the environment and the audience itself. It has been variously described as an acoustic "curtain", an acoustic "fog", or a lightly frosted acoustic "window" — terms intended to be descriptive rather than critical.

When a stereo microphone is positioned above and in front of the orchestra, it will pick up a more direct sound. However, en route to a listener via analog tape or a radio broadcast, electronic intermodulation will add its own supplement of "curtain" or "fog".

But what happens if the microphone feeds into a system which drastically reduces electronic intermodulation? Which strips away the curtain, or dispels the fog? Or, to quote Bill Andriesson of BASF, "which cleans the window"?

Engineers will almost certainly appreciate the result. Morton Gould seems to like it ("clearer sonic air") possibly because he does so much listening from the podium.

But, to concertgoers, the new sound may be unfamiliar, even unacceptable. And here I quote our own classical music reviewer, Julian Russell, in a recent conversation which partly prompted these remarks:

"I'm not completely sold on digital sound, you know, especially when they overdo the dynamic range. It's just too much for home listening.

"Digital may be fine for a small group but it doesn't always work for a big orchestra.

"In a way, it's TOO b . . . . good. It spotlights detail that should remain part of the total sound!

"You know, it reminds me of the Festival Hall in London, when it was first commissioned. It revealed every bit of orchestral texture, but the audience hated it. And they went on hating it until they rounded out the sound with artificial reverberation."

I must confess to finding Julian's observations intriguing. Critics of digital sound have been looking for mysterious faults in the face of state-of-the-art performance figures. Here's someone saying that digital is simply too good. Like too close a view of an oil painting, it emphasises texture rather than composition.

Maybe recording engineers will have to place their microphones with that thought more in mind. Maybe concertgoers will have to make their own adjustments as we move into the all-digital era.

FOOTNOTE: In a yet-to-be-published review, Julian Russell has criticised a recent CBS Audiophile analog release: too transparent, too much dynamic range — the same problems as digital!

MG: Well, I think I was among those aware of it, and therefore perhaps part of the process of development. The opposition of many early performers to recording stemmed from the distortion of musical values in their eyes, rather than the technical shortcomings — though the two are of course related. An artist used to playing a tremendous fortissimo would go into a recording studio and be told "Now look, don't play it too loud". And he would begin to play a real pianissimo and be told "No, that's too soft". There developed in the first years of sound recording a breed known as the "recording artist". I was one of them.

We were people who, because of our styles or our chemistry, could adapt to the peculiarities and tensions of recording without being too thrown. Many artists, unused to studios, would go to pieces when that red light went on. As nervous as one might get in a concert hall, it was in a sense transient. You would leave; the music would be gone — whereas, in a recording, an artist could put something down and for many years afterward somebody could listen to it and comment on its faults. There were all sorts of factors that stood in the way of the performing artist relating to the recording medium. Today every great artist is primarily a recording artist. We often know of artists long before we see them live, through their recordings. Long ago it was just the opposite.

The reason for this change is, of course, the whole technological area, and the constant striving for improvement, up to the digital and dbx recordings I've worked with recently — which are also radical breakthroughs.

Throughout my career, the problem with recording has been that it was always a mechanical medium, with its own noises, problems, and limitations. Bit by bit, the technology has widened the limits and slowly overcome the aesthetic frustrations that existed.

GS: *You're perhaps the ideal man to ask this of, Maestro Gould. There is a fair amount of debate now as to how much digital recording colours music. Some claim that it inherently sounds false; they say that the music world is having technology for technology's sake shoved down its throat. What is you view? Do you hear intrinsic faults in digital recordings?*

MG: Frankly, I wasn't aware that there was this sort of belligerence against digital recording. While I'm not fully up-to-date on all of the different techniques and processes used in recording, I think that digital recording is a very important breakthrough in expansion of recording possibilities.

GS: *As big as stereo, or the LP?*

MG: I would say so. In evaluating a recording's quality of sound, you must bear in mind that you have to start with what we might call a good set-up. The sound will depend on so many factors

SENNHEISER EXPLAIN: What is meant by open, closed phones

If you've taken any notice at all of headphone advertisements, there's a good chance that you've wondered about Sennheiser's frequent use of the term "Open Aire" to describe some of their models. They explain here what the term means and why it is seen by many of their supporters as a desirable feature.

Sennheiser's latest HD-40 phones, described as "super light and super inexpensive". Also, the driver system can be rotated to permit flat storage.

Headphones produced during the early days of radio, were normally intended to clamp tightly over the ears — in many cases too tightly! Perhaps it seemed the natural thing to do and, in a practical sense, there was probably good reason to shut out external noises and allow the user to concentrate on what were frequently very weak signals.

Since then, headphones have become rather more civilised — lighter in weight, with softer surfaces against the ears and, of course, offering of much improved audio fidelity. But the substantially airtight seal against or around the ears has generally been maintained for another reason — that to do with bass response.

As with a loudspeaker cone, the diaphragm in a headphone can beam middle and high frequency signals directly into the listener's ears but, at low frequencies, it has to rely on a "pumping" effect to activate the ear drum. Ideally, the air between the two should be sealed off, either by the way the phone rests against the pinna, or against the side of the head, encircling the pinna. Large, cushioned headphones exploiting the latter idea are common in the market.

Such headphones have their role where the listener wants to shut out extraneous noises and also prevent the sound from disturbing other people in the room. But against that, large headphones can be bulky, sometimes heavy, and oppressive in warm climates. What's more, they lose some of their efficiency in the bass register, if the seal is ineffective due to spectacles, hairdo or maladjustment of the headband.

"Open" headphones such as Sennheiser's "Open Aire" model HD 414 go to the other extreme. They are small, light in weight, and interpose an open cellular foam cushion between the diaphragm and the ears. The earphone housing itself is also acoustically transparent. Sennhieser's model HD 430 does use a cushion seal but the assembly is still acoustically transparent by reason of side and rear openings.

With such headphones, the user is not "shut in" with the music and is not isolated from the room environment. In this respect, Open Aire headphones have something in common with loudspeaker listening.

But what about the bass response in the absence of an airtight seal? In Sennheiser's Open Aire headphones, this is compensated by carefully guiding the low frequency resonance of the diaphragms and the damping effect of the foam cushion. The overall result is a more spacious sound with still-adequate response low down.

"Semi open" headphones are a compromise between these ideas, involving a closed or sealed zone between the front of the diaphragm and the ear, but an open housing behind the diaphragm. This ensures good pressure coupling at the bass end while permitting some environmental sound to reach the listener through the body of the headphone. The principle is seen to best advantage in electrostatic headphones where the diaphragm is normally very thin.

However, in the design of their well known Unipolar 2000 phones, Sennheiser opted for a genuinely open rather a semi-open design.

Mr Doug Thompson has been appointed as Product Manager for Sharp Corporation's audio division. Formerly South Australian Sales Manager, he is now at the Fairfield (NSW) Head Office of the Company.

related to the set-up, no matter what kind of recording mechanism is used. It depends on the studio; it depends on the conductor; it depends on the A&R (Artist and Repertoire) man; it depends on the engineer; it depends on the weather; it depends on so many, many factors. All recordings are affected by these things, and that includes digital as well.

There is no system that can automatically guarantee a first-rate recording and a good performance. You must have the appropriate ambience in the studio — especially when you're talking about big orchestra recording such as I've been involved in. You must have an engineer and technical staff who are sensitive enough to handle the orchestra's sound.

You have to have the right microphones, and the right microphone positioning. You have to have a balanced orchestra; you can have a brilliant recording but an orchestra that is imbalanced within itself, or even a good orchestra that just doesn't have a good whole sound. Or you can have a great orchestra and a conductor who is not sensitive and thus unable to project a performance in the studio with no audience. Assuming that all of these are pluses, and everybody knows what they are doing, digital recording allows for a range and power that didn't exist before.

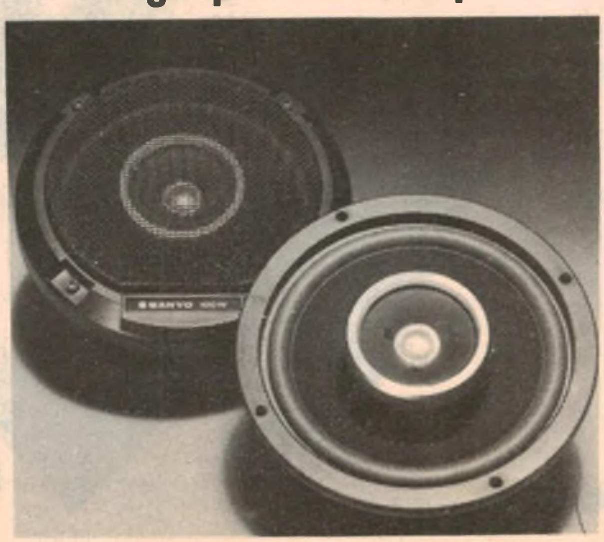
GS: *Even as compared with the best of conventional analog recording equipment?*

MG: I would say so. Even most of the great analog recordings were basically illusions. With conventional recordings, you would say to the percussionsts "It should sound like double forte but don't play louder than mezzo forte". You tried to give the illusion of a double forte, and of a pianissimo, but you could never really do either as they were done in a concert hall. These were all things one learned to cope with.

Back in the days when virtuoso studio orchestras were assembled, they would be made up of players who knew these things. You looked at them at the appropriate moment and they knew that they had to pull back, or to play out more.

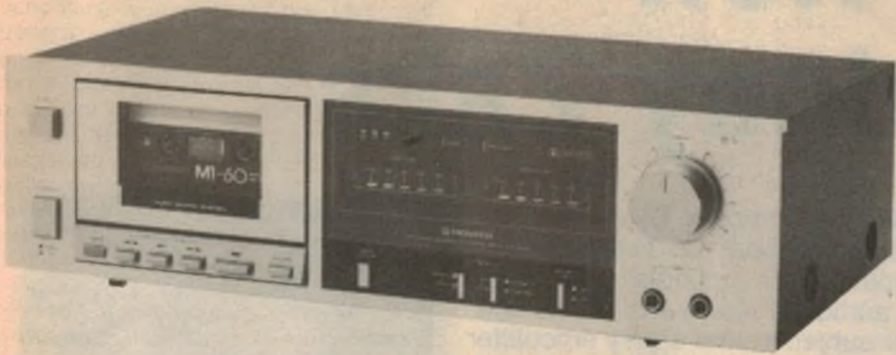
When I recorded with the London Symphony using digital equipment, though, I had to first tell the percussion players to play out, not be afraid of a sforzando or a forte. At first they looked at me as if I had two heads. They were one of the great recording orchestras of the world, yet they had never before been able to do this. From what I know now — unless there are things I haven't heard or don't know yet — digital recording is a tremendous progressive step.

Ultra high power car speakers from Sanyo



If you're looking for automotive loudspeakers with more than usually generous sound, the Sanyo SP 904H models pictured can accept an input of up to 100W. The woofer has a 16cm parabolic cone with Fibre Flex suspension and a 3.2cm long-throw voice coil on aluminium former. A coaxial tweeter looks after the high frequency response. RRP is $99 per pair. (Mr W. Fabiszewski, Sanyo Aust Pty Ltd, 225 Miller St, North Sydney.)

PIONEER'S NEW BUDGET-PRICED DECK



Retailing for a low $189, this Pioneer CT-320 cassette deck from their "Avant Silver Component" range is expected to prove a top seller. It features soft-touch controls, LED level displays, Dolby-B noise reduction, electronically controlled DC servo motor drive and accommodation for ferric tape (hi and lo bias), chromium dioxide and metal. S/N ratio (with Dolby) is quoted as 68dB and wow and flutter 0.05%. MSS – Music Search System – enables the deck to perfform fast wind or rewind and stop automatically at the next unrecorded section of tape.

GS: *Given the availability of digital and dbx techniques, among others, how do you think the musical compositions and arrangements of the future will be affected?*

MG: The clearer the sonic air — and one might use that image — the more signal that can be heard and the more subtlety that can be found in the music. This cuts two ways, of course. We will certainly expose more frailties with better recordings, and where a slightly inept phrase or a passage with bad intonation might not be too evident on a record with a degree of extracurricular noise, with a better recording it will suddenly be exposed. The development of digital and of dbx — which to my experience is also a tremendous contribution to pure sound — will open up a still wider palette of not only primary colours but also intermediate and inner colours, and subtle gradations of colour. Any expansion of the ability to convey the colour of music through the orchestral palette will ultimately be to the good. It makes us all the beneficiaries of the rich sounds that go up to make music.

In Brief . . . .

BELL & HOWELL AUST PTY LTD are marketing a degausser especially designed to cope with the high energy tapes used in the instrumentation, video and audio markets. They say that the TD-500 is the first automatic eraser on the market capable of dealing with tapes having a coercivity of up to 750 Oersted.

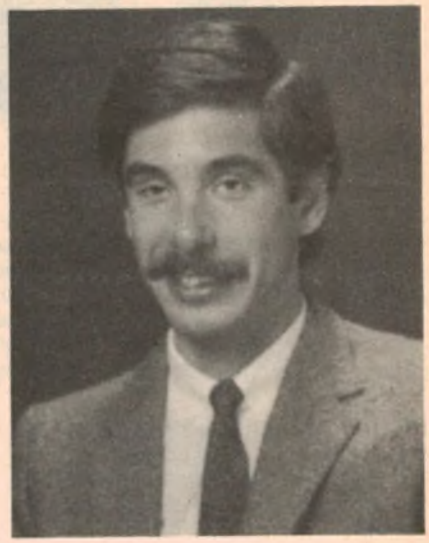
The unit can be switched for 1-inch wide to 2-inch wide tapes in a matter of minutes but, in practice, it can generally be used in the 2-inch position for all tapes.

Heavy duty construction is used throughout and an over-temperature protection circuit is included to guard against the effects of excessive temperature rise with repeated erase cycles at high current settings. For further details: Bell & Howell Aust Pty Ltd, Box 4778 GPO, Sydney, 2001. Phone (02) 660 5366.

This RN-Z03 microcassette recorder has a two-speed facility, providing one hour of recording at slow speed, two hours at half speed and three hours using Angrom tape. It operates from internal batteries or an external mains adaptor. It has cue and review facilities and power output is about 350mW. Dimensions are 60.5 x 127 x 22mm. Details from National Panasonic offices or distributors.

An interview with Rodnay Zaks

Rodnay Zaks, president of the publishing company Sybex Inc is a pioneer of the microcomputer field. For almost 20 years he has been designing and installing computers for industrial, scientific, home and business use. He is the author of numerous books and papers on a wide range of computer subjects, and a very articulate commentator on microcomputer developments. Recently we had a chance to talk with him.



Rodnay Zaks, founder and president of computer publishing company Sybex Inc.

by PETER VERNON

Dr Rodnay Zaks has been involved in computer development and research since 1968, working on almost everything from mainframe computers to microprocessors. In 1972 he designed the first microcomputer urban traffic control system, using the "original" Intel 4004 microprocessor. Since 1973 he has lectured and taught around the world and written more than 40 research papers and 15 books on all aspects of computer design and application. Many of them have become international "best-sellers" in their field.

In 1976 Dr Zaks founded Sybex Inc, a company dedicated to computer education. At first a face-to-face teaching organisation, Sybex has since become one of the leading publishers of computer books world wide, with offices in Berkeley, California, Paris, and Dusseldorf in Germany.

We owe the ready availability of Dr Zaks' wide range of books to a happy accident. Thanks to summer holidays in the United States, many participants were unable to attend a pre-arranged seminar. Dr Zaks decided to write out the seminar – an effort which took two days because of his familiarity with his subject. The first 5000 copies of the material sold out in 10 days. Since then the Doctor (his PhD was in computer science – implementation of an APL interpreter, specifically) has not looked back.

Each book that Sybex publishes bears the stamp of the original intention of its founder. Sybex books are designed from the start to be educational. They address a specific problem for a specific audience, and are organised for ready access, clearly presented and easy to follow. Not unexpectedly, they are produced on what is probably one of the most advanced publishing facilities in the world. Word processors on which the final draft of the manuscript is prepared are linked directly to photo-typesetting equipment, so only the final printing is done outside of Sybex.

Rodnay Zaks was in Sydney recently to promote Sybex in Australia, and we were able to talk to him in the midst of his busy schedule. The result was a fascinating insight into developments in the microcomputer scene.

We were intrigued to find out that Dr Zaks does not himself have a "personal computer". "No more than I have my own typewriter at home" he stated. "Having worked with large computers, I find most microcomputers to be toys frustrating to use for someone who is aware of the capabilities of large machines".

While not denying that a small computer/printer combination may be a powerful tool for a writer, Dr Zaks prefers to dictate his books to a secretary. The text is subsequently edited using a word processing system, and typeset automatically, but they at least begin life in the traditional way. Word processors are for authors who are not fortunate enough to have a secretary, he says.

New developments in microcomputing

Nor is this situation likely to change for Rodnay Zaks. From his vantage point as one of the first microprocessor design engineers, early hobby microcomputers were almost boringly predictable, "totally trivial designs". The future holds no surprises either – rather, more of the same hardware, with innovative software lagging a long way behind. When questioned on the most significant trends in the microcomputer world, Dr Zaks summed up future developments in one word – "marketing".

He sees the most significant development in the microcomputer scene not in terms of new hardware or software but in terms of spreading knowledge – public awareness of computers and what they can do. Last Christmas saw the beginning of a massive advertising campaign to popularise the idea of a "home computer". He fully expects that within the next two or three years a majority of the population of the United States will buy a computer. Scant regard will be paid to usefulness or need – the microcomputer will simply become a "must have" consumer item.

Such is "the nature of US society", according to Dr Zaks, that booming sales of microcomputers will be prompted by an intensive marketing campaign, emphasising "computer literacy". Small computers will become as pervasive as calculators. In this situation IBM, perhaps surprisingly, will be the big winner.

Computers marketed as a "must have" status symbol will create their own market for applications programs to answer the demand that the new gadget does something useful. Until that demand is fulfilled however, one is left with the impression that a plastic replica computer might serve its new owners equally well.

Although in Rodnay Zaks' words, the IBM personal computer "is the wrong product with the wrong design, with no software", he expects IBM to sell between 50,000 and 100,000 units in the next year – swamping Apple and Tandy almost overnight. Why?

The answer is to be found in the "me too" syndrome. Rodnay Zaks fully expects that most of those who will buy an IBM personal computer will have no idea of what they want to do with it. "They're not buying a better computer. They're buying a name, a belief, a product that's sold like soap". Perhaps in a year, he speculates, the sheer number of computers sold will create a market for software, as the impetus builds to put the hitherto useless new gadget to productive work. He seems proud to be able to say that such a situation couldn't occur anywhere else but in the United States.

(Since this interview with Dr Zaks, reports from the United States have confirmed his predictions. IBM spent almost $US12.5 million on print and television advertisting of their personal computer, and it is rumoured that over 40,000 of the machines were ordered on the first day it was introduced).

And what of the Japanese threat? Unlike many commentators Dr Zaks sees no Japanese challenge to the dominant position of the United States microcomputer manufacturers. "Once a product proves successful, the Japanese will imitate it. They produce special purpose machines – calculators that speak Basic, for example – but they will have no impact on the general purpose computer market in the short term." Indeed, the impetus given to the marketplace by IBM's entry may go some way towards reversing the slipping sales of US-made computers in Japan, according to Zaks.

Microprocessors — 8 bits or 16?

On the question of 8-bit versus 16-bit microprocessors, Dr Zaks maintains that 8-bit processors are entirely sufficient for most applications. "Even the IBM machine, with its 16-bit 8088, does not use anywhere near the full power of the processor." From the user's point of view, he says, it does not matter what sort of processor a computer is based on.

What developments will we see in computer languages? For the home computer, at least, Basic will continue to dominate the scene. "It's ideal. It's easy to learn, sufficient for most home needs and cheap to implement. Pascal will remain for academics and engineers who write complex programs. APL requires a 16-bit microprocessor, and will remain of limited appeal". Economic reality, he says, will ensure that Basic remains the most widely used language for microcomputers.

Similarly, computers of the future will remain be linear developments of present day machines. For the forseeable future we will still communicate with them via a keyboard and a CRT terminal. "Voice output, for example, is just not necessary". Technical hitches in voice recognition will prevent it from becoming widespread. One development, however, that will become widely used is the "touch sensitive screen", using either a conductive mesh or an array of infra-red sensing beams acros the face of the terminal.

More important than new hardware will be the use of data communications networks. Networks such as The Source are of "enormous significance, almost totally underestimated by business". Dr Zaks compares the spread of network communications to the popularity of the self-serve store. "It's like self-service for the businessman. He can confirm his own plane booking, for example, directly through the airline's computer, rather than relying on a travel agent. Programs, databases and electronic mail can be accessed by a personal terminal, in every office.

Use of data networks will increase tremendously, says Zaks. "Business will see their value first, then individual professionals, and last of all, the public". For those concerned with the prospect of a computerised isolation, Dr Zaks has some words of comfort. He believes that electronic mail by computer will not replace face to face meetings. "People would rather use a video phone to talk to their friends than a computer terminal. As for phone directories stored in a home computer, people would rather use a book".

What advice would a pioneer of the microcomputer field give to someone who wants to enter the area now? "Buy the cheapest computer you can, and assume that it will be the wrong choice. Play games with it, learn to program it. On the basis of that experience you can then decide what you a want in a computer and make an intelligent choice when the time comes to move up".

For a businessman spending the company's money the rules are different. "He should read everything he can find, consult with other users and think over his choice carefully".

Sybex computer books reviewed

Electronics Australia has been reviewing Dr Zaks' books since 1978, beginning with "An Introduction to Personal and Business Computing". Books reviewed include;

An Introduction to Personal and Business Computing (EA, Sept 1978)
From Chips to Systems: An Introduction to Microprocessors (Sept 1978)
Programming the 6502 (Dec 1979)
Programming the Z80 (Dec 1980)
The CP/M Handbook (With MP/M) (Feb 1981)
Your First Computer (Feb 1981 – this is the second edition of "An Introduction to Personal and Business Computing" retitled).
Don't (Or How to Care for Your Computer) (Jan 1982)
6502 Games (Jan 1982)

Other books by Sybex International which we have reviewed include;

Fifty Basic Exercises by J. P. Lamoitier (July, 1981)
Inside Basic Games by Richard Mateosian (Sept 1981)
Pascal Programs for Scientists and Engineers (Jan 1982)

Electronics Australia reviews:

Sony ICF-2001 AM/FM synthesised receiver

If "2001" reminds you of the space age, then it will have served its purpose as part of the type number of Sony's new ICF-2001 "FM/AM PLL synthesised receiver, with computer controlled tuning system". That may sound like so much jargon but, in this case, it means something!

Superficially, the ICF-2001 could be described as a battery operated portable mono radio, covering the FM broadcast band and AM between 150 and 29,999kHz – the latter with provision for CW and SSB transmissions. The dimensions are ordinary enough, being 310mm(W)x171mm(H)x56mm(D), with a weight of 1.8kg. The set is normally supplied with earphone for use in lieu of the loudspeaker, a shoulder strap, and an external antenna to supplement the in-built ferrite rod and telescopic whip. Optional accessories include adapters for operation from the power mains or a 12V battery.

A few other AM-FM all-wave portables might well approximate this description but not many – if any – could boast the futuristic all-digital tuning system that has been provided in the ICF-2001. In fact, for the dyed-in-the-wool "knob twister", unfamiliar with digital tuning, the initial encounter with an ICF-2001 could well come as something of a "future shock".

The fact is that there are no knobs to twiddle, unless you count two unpretentious thumb-wheels, one to peak the antenna circuit on AM only and the other to provide a plus and minus 6kHz vernier for resolving SSB signals. Everything else about the tuning is effected by calculator-style click-stop push buttons.

This being the case, the confirmed knob twiddler cannot grope his way across the spectrum, searching for interesting signals and then nudging the dial this and that way to get them "spot on". Nor is there any of that inglorious uncertainty about identifying the exact frequency and/or being able to locate the signal again the next day.

With the ICF-2001, DXing really happens the other way round: you decide on the station you want to listen to, you look up the frequency, punch it into the digital tuning system, press the "execute" button and there's your station – that is, assuming that its signal is available at the particular time and place.

Life shouldn't be that easy!

You rapidly discover that your most valuable asset, in getting to know the receiver, is a list of broadcast stations and their frequencies, a list of locally available FM stations, and a chart of the various amateur and international shortwave bands that you may want to check over. Memory can be a very poor substitute for a printed list, even for the dozen-odd local stations to which you most frequently listen.

With such a list, tuning is relatively easy. For example, to listen to the ABC FM program in Sydney, the band selector is set to FM, and the buttons 9-2-9 pushed in that order. Forget about the decimal point. The system knows that you want the 92.90 channel, and that figure appears in the LCD readout window. Press the "execute" button and in comes the station. Just like that!

Similarly, with the band selector on AM, punching in 576 in Sydney will bring in the ABC station 2FC, and so on. It works exactly the same for overseas shortwave stations; if you know the frequency and the appropriate time to listen, the ICF-2001 will do the rest. Frequency stability is not a consideration; the tuning system is locked to an in-built crystal and you get the frequency that has been punched in – no more and no less!

The receiver has a supplementary memory system powered by a couple of extra small cells, which maintain the memory while the receiver is otherwise not in use. It remembers the last station to which the receiver was tuned in both AM and FM mode and one or the other comes up automatically on switch-on, depending on the position of the band selector.A nice touch!

PRESET MEMORY

In addition, however, there are six preset memory buttons which can readily be set up for the six stations most frequently used. Whether six presets is sufficient could be open to debate, however, when account is taken of the number of AM, FM and shortwave stations available. Twice the number of presets would not be too many.

But what if the user wants to scan the bands – DX hunting style? Well, there are two options.

The user can punch in any frequency within the coverage of the receiver, then press the "up" or "down" Manual Tuning buttons, as desired. On AM, the receiver will increment up or down in frequency in 1kHz steps, equivalent to a slow tuning operation. For faster scanning, the user simply moves the finger so that it holds down the "Fast" button as well, and the increments increase to 10kHz.

On FM, scanning operates in either 0.1 or 0.2MHz steps.

An alternative approach is to punch in the limits of the band, which is to be the centre of attention, and switch the tuning to "Scan" mode. It will then automatically and repeatedly scan from the low limit to the high limit but the scan can be stopped at any point and re-started by using the stop/start button. Alternatively, the scan can be set to stop automatically at the next strong station.

Confused? That feeling only lasts for the first quarter-hour or so of actual use but, as a learning aid, Sony has provided four masks which fit over the face of the set and which carry the instructions appropriate to four methods of tuning: Direct (you know the frequency); Manual (you don't know the frequency); Memory Preset Tuning; Scan Tuning.

While interest in the ICF-2001 centres naturally on the digital tuning system, it is appropriate to mention other aspects of the receiver. Slider type controls are used for volume, treble cut and for bass boost/cut. Rated power output is 1.2W at 10% THD, delivered through a 10cm (dia) loudspeaker.

The receiver proper operates from three 1.5V "D" size cells but battery life is rated at a not very impressive nine hours for AM and 10 hours for FM – this with Sony SUM-1S super batteries. Fairly obviously, one would not seek to utilise the full available audio power, except when operating from a mains or 12V adapter.

Other provisions include antenna and earth terminals, push-button illumination for the frequency display, an RF gain switch, and a prop-up stand as part of the rear cover. There is provision for use with an external timer but an internal "sleep" circuit can be set to turn the receiver off after a period adjustable to 90 minutes maximum. There is no provision for muting on the FM band or automatic noise suppression on AM.

And how does the ICF-2001 perform?

As a portable, with its in-built antennas, or a modest external antenna/earth connection, it can give an excellent account of itself on all the major international stations, plus "traffic" on the HF amateur and CB bands. Its frequency stability is superb and resolving SSB "duck-talk" with the SSB/CW compensator thumb-wheel is a breeze.

Selectivity would appear to be a good compromise between the conflicting demands of normal AM and SSB/CW.

Perhaps the least satisfactory aspect is the 5-step LED signal strength indicator, which is of little help in picking the optimum tuning position for a station of unknown frequency.

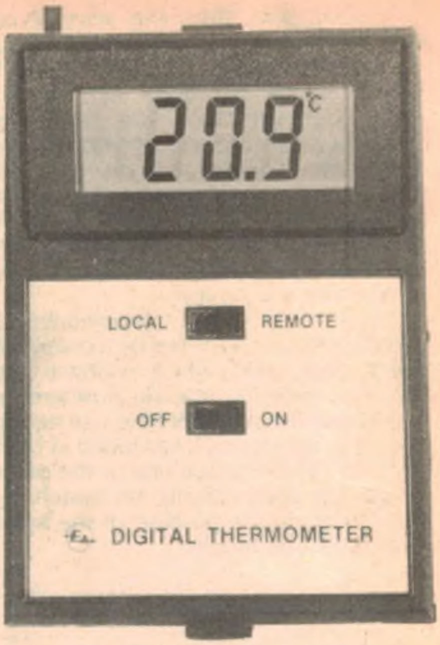
But, as we remarked earlier, this is not the natural role of the ICF-2001. It is at its best if the user works from a station list. Tell the receiver the frequency you want and it will give it to you, spot on, in double quick time.

Recommended retail price of the ICF-2001 is $289. For further details, inquire at Sony branches in the capital cities or direct to: Sony (Aust) Pty Ltd, 453 Kent St, Sydney 2000. Phone (02) 2 0221. (W.N.W.)

"You're too late – I fixed it and it's working perfectly!"

Simple circuit uses an LCD module

Digital Thermometer



Here is a handy portable digital thermometer which can measure temperatures from below freezing to around the boiling point of water with a resolution of 0.1°C. The liquid crystal display has digits which are 15mm high for easy legibility. Most of the circuitry is incorporated in a new 3½ digit LCD voltmeter module which is the basis of the unit.

by JEFF SKEEN and LEO SIMPSON

Accurate temperature measurement can be one of the hardest things to achieve outside of the laboratory. Many hobbies such as keeping tropical fish, photography and electronics all require a close watch to be kept on the temperature. With conventional mercury thermometers found in the home, resolution is rarely better than 1°C and often the absolute accuracy of the thermometer is suspect. Trying to read a thin column of mercury can be very difficult, particularly in a darkroom, and the scale often rubs off thermometers that are in constant use.

From the foregoing, we feel that this new thermometer is sure to be a popular project. It can be built with two temperature sensors: one internal for "local" or ambient temperature measurements and one "remote" for temperature measurement in tanks and so on.

Our new Digital Thermometer uses a DPM-200 LCD panel meter which has been imported by Jaycar Pty Ltd and which will be used in a number of future projects. The DPM-200 module will retail for $39.50. Also available will be a neat matching case which really adds the finishing touch to this project. The case will retail for $5.50.

Full technical details of the DPM-200 module are featured within this article.

CIRCUIT DESCRIPTION

Since a major part of the circuitry is provided by the DPM-200 module, the circuit diagram of the Digital Thermometer looks very simple, as indeed it is. The DPM-200 module should be regarded as an accurate voltmeter which can read up to ±199.9mV but which is connected to read temperature in degrees Celsius. To this end, the "°C" annunciator is enabled by connecting pin 18 on the module to pin 34. One of the decimal points is also enabled in this way: pin 28.

The temperature sensors employ LM334 current generator integrated circuits which produce an output current which increases linearly in proportion to the Absolute temperature which is measured in degrees Kelvin, °K.

The amount of variation of current, with temperature, may be set by an external resistor connected between the "R" and "-V" outputs of the LM334. With the appropriate value of resistance connected, the output current may be adjusted over the range 1μA to 10mA per °K. In this design the 100Ω multi-turn potentiometers in series with the 150Ω resistors are used to set the LM334 output current to 1μA/°K.

The output of the LM334 flows through a 1kΩ resistor and into the "Com" input pin 4, of the display module. The Com input is maintained at approximately 2.8 volts below the positive supply rail and all voltages measured by the display module are measured with respect to this. The current flowing through the 1kΩ resistor generates a voltage that increases at the rate of 1mV per °K. This voltage is measured by the "In Hi" input of the display module which has very high input impedance and so does not load the 1kΩ resistor to any appreciable extent.

A problem does arise however, because at normal temperatures the voltage developed across the 1kΩ resistor is greater than the full-scale voltage reading of the display module. Also, we wish to measure °C not °K and so we require the display module to read zero when the input voltage is actually 273.2mV. Both these problems can be solved by providing an offset or nulling voltage of 273.2mV that will "null out" or cancel the effect of 273.2mV being present at the input when the temperature is 0°C.

The 1MΩ, multi-turn potentiometer provides the necessary offset voltage adjustment. It is connected between "Ref BG" which is a very stable voltage source of 1.2 volts, and "Com". The wiper arm of the potentiometer is then connected to the "In Lo" input of the display module and the necessary offset voltage of 273.2 mV is generated between the "In Lo" input and "com", the "In Lo" input being the more positive of the two.

Essentially, that is all there is to the circuit apart from the three resistors which are marked with asterisks. These are only used for calibration during construction of the thermometer and are not present in the circuit of the completed project. The only other connection to the module which interests us in this circuit is the link from pin 7 to 23. This enables the – annunciator, which tells us when the temperature is below 0°C.

The additional resistors and the link, which are used in the calibration procedure, connect the module together to form a digital voltmeter with a full scale reading of 2V. The voltage across the 1kΩ resistor, and hence the current supplied by the LM334 at zero °C, is adjusted by the 100Ω potentiometers while the module is in this mode.

While our circuit specifies LM334 temperature sensors, these are only guaranteed by National Semiconductor for temperatures between 0°C and +70°C. To guarantee reliable operation over more extreme temperature ranges you will have to use the LM234 which is guaranteed over the range from –25°C to +100°C or the LM134 which is guaranteed over the range from –55°C to +125°C. However the two latter devices are more expensive and not readily available.

However, for most applications it appears as though the LM334 will give satisfactory performance even if used at temperatures outside its normal temperature range. More specifically, we feel confident that the LM334 will operate reliably at temperatures below freezing and up to 100°C provided the bare sensor is not immersed in water.

Current drain of the circuit is normally about 0.5mA which means that a type 216 9V battery should have a long life. The circuit will work at voltages from 15V down to 5V but battery voltages lower than 7V will light up the low battery warning on the display.

CONSTRUCTION

All the circuit components apart from the temperature sensors are mounted on a small printed circuit board measuring 69 x 71mm and coded 82th2. This board has been designed to fit into the plastic case that comes with the DPM-200 display module and its use is recommended because of the small clearance between the display module and other components once the case is assembled. The thermometer is calibrated as it is built so the construction details should be followed closely.

The resistors specified for this project are all 1% metal film types. This is not so much for accuracy but for the high thermal stability of this type of resistor.

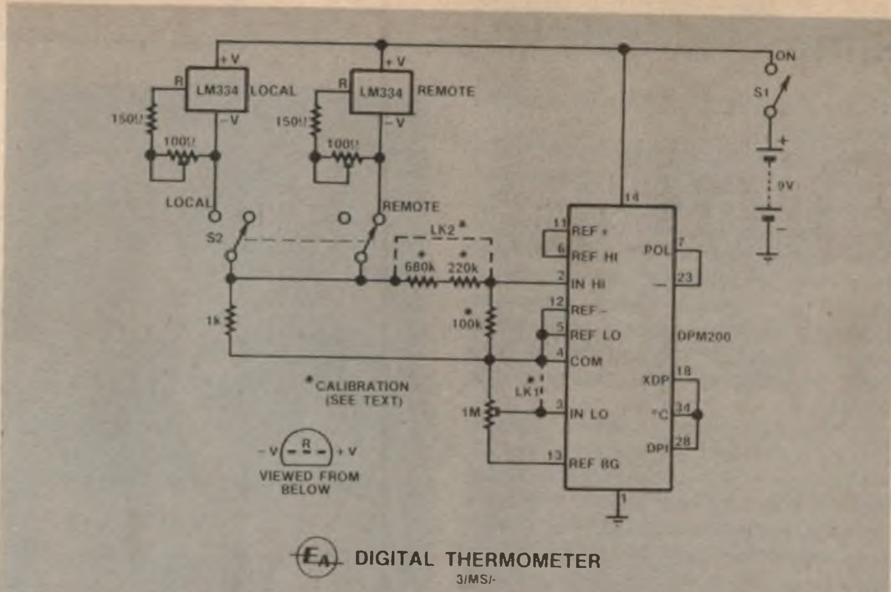
Begin construction by mounting all components, except for the 1MΩ potentiometer and link Lk2 on the printed circuit board. Take care not to forget link Lk1 which replaces the 1MΩ potentiometer for the moment.

The holes for the switch tags may need to be enlarged slightly, depending upon the type of switches supplied. The switches are inserted so that the top of the switch body is not more than 10mm above the PC board. More than this and the two halves of the plastic case may not fit together. Some switches may have side supports that are too long and these should be trimmed to 10mm in length.

Solder the switches into place, then mark out holes for the switch actuators in the top of the plastic case. To obtain the correct positions, take measurements off the front panel artwork printed in the magazine. The front panel fits into the recess in the top of the plastic case and measurements on the plastic case should be made from the edges of the recess.

When the hole positions have been marked out, use a drill with a diameter smaller than the width of the switch hole to drill out most of the plastic in the hole. A small triangular, square, or flat file can then be used to take the hole out to its proper size and to square up the corners.

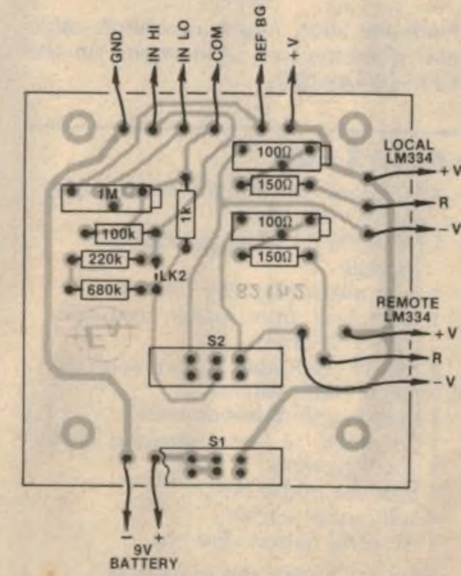
Before the two halves of the plastic case will fit together two small locating stubs will have to be removed from the



The components marked with asterisks are used for calibration during construction.

bottom half of the case. These are the two stubs next to the top snap clip. They can be snipped off quite easily with a pair of side cutters and the rough edges finished off with a small file.

The PC board can now be screwed into place, the two halves of the case clipped together, and a check made to see that the switch actuators can move freely in their holes in the case. If they don't, pull the case halves apart, remove the offending plastic from the sides of the hole with a flat file and then square up the hole again.



Note that the high value fixed resistors are removed after calibration.

Trim the Scotchcal front panel to size with a sharp pair of scissors. Holes can be made in the front panel for the switch actuators by pushing the point of a "Stanley knife" blade through the aluminium and making a line of small holes along the inside of the black borders. By running the knife blade along the line of holes, they can be joined together to form the cut-out required for the switch actuators. A ruler placed along the border side of the hole will prevent the front panel being scratched and also provide a straight edge along which to run the knife blade.

The backing paper can now be removed from the Scotchcal and the front panel stuck into place. Assemble the case halves again and check that the switch actuators will still move freely. If not, use a flat file to open up the holes in the Scotchcal front panel until the switches move freely.

The display should now be inserted into the top half of the case and checked to see that it mounts flush with the case. If it does not, then very carefully bend over Q1 and the associated resistors near it on the DPM-200 module as these will probably be touching the circuit board. Take extreme care when bending the resistors because the leads can easily be broken off. An alternative to bending over the components is to shave a small amount of plastic off the mounting posts for the PC board.

The display and the PC board can now be wired together using an 8cm length of ribbon cable, and then the point-to-point wiring on the display module completed. It is easiest if the display module is not mounted in the case at this stage. Solder the wires from the battery clip onto the PC board, taking care that the polarity is the right way around and then screw the PC board back into the lower case half.

Now mark out the position of holes in the case for the local and remote temperature sensors. Ensure that there is enough room for wires from the sensors to run through the holes without fouling the PC board. On the prototype we located a hole for the local sensor directly under the snap clip on the lower case half. The hole for the remote sensor cable was located in the corner of the same panel.

If both temperature sensors are to be employed then the local one may now be glued into the hole made for it in the case. Leave about half of the sensor body extending from the case so that there will be a good air circulation around the sensor. Once wires are soldered to the sensor, place small pieces of spaghetti tubing over the bare leads to prevent them shorting one another.

An external probe assembly should now be constructed. We used an empty pen tube as a case and glued the sensor body in one end with epoxy adhesive. Again leave at least half of the sensor body extended from the tube so that there will be good thermal contact between the sensor and the environment. Also make sure that the adhesive seals the sensor leads completely because if any moisture finds its way between the sensor leads the temperature reading will be incorrect.

The cable from the remote sensor to the PC board is critical. For best results this cable should have conductors that are as thick as possible so that lead resistance will not upset the readings. Twin core shielded cable may be used if the distance is one metre or less, however the shield must be connected to the −V output of the sensor. A greater separation between the remote probe and the PC board (up to 100 metres), may be achieved by removing the 100Ω potentiometer and the 150Ω resister associated with the remote probe and locating them in the probe body, near the sensor.

If it is envisaged that the probe may be used in either extremely hot or corrosive environments, eg a car engine bay, then it would probably be best to construct a probe using a small bore aluminium or stainless steel tube as a case.

If only a local sensor is to be employed then this should be prepared for calibration by installing it into a temporary, waterproof probe. The reason for specifying that the probe be waterproof is that during calibration the sensor is placed into a mixture of ice and water. This is assuming an accurate thermometer is not available. If one is available, then the sensors may be calibrated without recourse to an ice-water mixture and a waterproof probe is not necessary.

CALIBRATION

With the probe built, all that is left to do is to double check the circuit for errors. If none are found turn the thermometer on, switch the sensor switch to the "local" position, and adjust the 100Ω potentiometer associated with the local sensor until a reading of around 30.0 appears on the display. Place half a dozen ice cubes in a glass, just cover with water, and insert the probe. Leave for about 10 minutes after which the display reading should drop to around 27.5.

Adjust the 100Ω potentiometer until a reading of 27.3 appears on the display. The temperature sensor has now been adjusted to give an output of 1μA per °K. For people adjusting the sensor with the aid of a thermometer, turn the 100Ω potentiometer until the display reads 27.3 + thermometer reading/10. For a room at 23°C this is a display reading of 27.3 + 23/10 = 29.6. Now remove the link marked LK1 on the circuit and insert the 1MΩ potentiometer in its place. Solder LK2 onto the PC board, and then insert the probe back into the water-ice mixture.

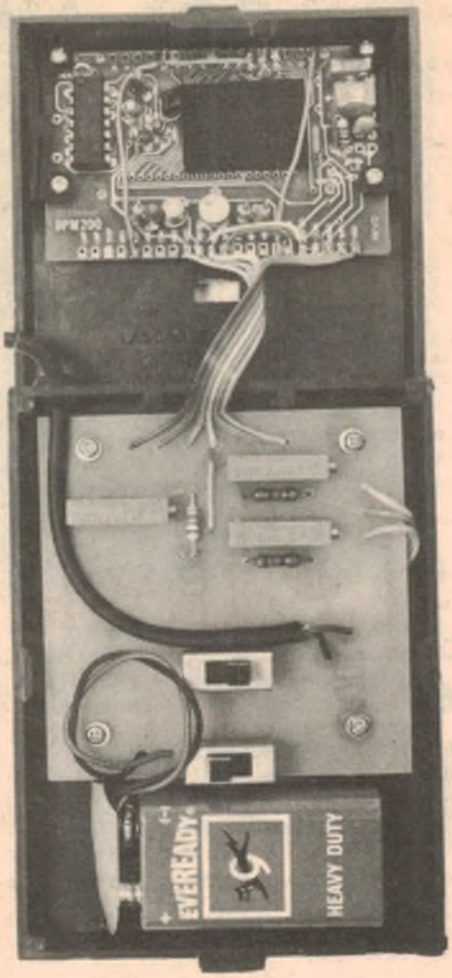
Again leave the probe in the ice-water mixture for about 10 minutes, then adjust the 1MΩ potentiometer until the display reads 00.0. The correct offset voltage has now been reached and the thermometer is calibrated. To calibrate the other sensor, place the probe just calibrated next to it, wait for about 10 minutes to allow the temperatures to equalise, then take a note of the probe temperature. Switch to the sensor to be calibrated and adjust the 100Ω potentiometer associated with this sensor until the display reads the same as the probe just calibrated.

The second sensor has now been calibrated and no adjustment should be made to the offset voltage. People calibrating the probe with the aid of a thermometer should adjust the 1MΩ potentiometer until the display reads the same as the thermometer temperature.

CONCLUSION

The thermometer as built is an accurate device but allowance should be made for the way in which the temperature is measured. To obtain the most accurate readings the whole sensor should be in good thermal contact with the object being measured and time allowed for the two temperatures to equalise. If you are measuring say heatsink or transistor temperatures then a smear of heat conducting grease on the end of the probe will provide much better thermal contact.

A changeover between °C and °F can be made quite easily by switching in a 1.8kΩ resistor in place of the 1kΩ resistor and an offset voltage of 460mV in place of the present 273mV. The °C annunciator should be turned off when displaying temperatures in Fahrenheit.



Note the short length of ribbon cable and point-to-point connections on the DPM-200 module.

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

$60

including two temperature sensors.

PARTS LIST

1 PC board coded 82th2 and measuring 69 x 71mm
1 DPM-200 liquid crystal display module
1 case measuring 80 x 110mm
1 Scotchcal front panel measuring 71.5 x 59.5mm
2 LM334 adjustable current sources
2 DPDT slide switches
1 8cm length of ribbon cable
1 1m length of 2-core shielded cable
1 small grommet
1 tube for probe body
4 self tapper screws
1 9V (216) battery and clip

RESISTORS (¼W, 1% tolerance)
1 x 680kΩ, 1 x 220kΩ, 1 x 100kΩ,
1 x 1kΩ, 2 x 150Ω,
1 x 1MΩ multi-turn trimpot
2 x 100Ω multi-turn trimpot

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

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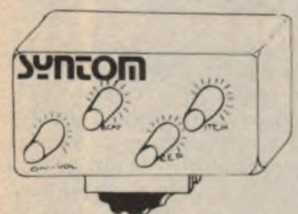
DRUM SYNTHESISER KIT
JOIN THE DRUM REVOLUTION

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 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds
Pitch control — sweep control and volume on/off.



As used by WARREN CANN of "ULTRAVOX"
Send SAE for more information.

$36·50

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FULLY IMPORTED

This project was originally described in the UK publication "Practical Electronics". We have fully imported "Clef" kit
This attractive kit is presented in an attractive metal cabinet with silkscreened front panel.
The Master Rhythm can be programmed (in RAM) to play back:
— 24 Rhythm patterns 8 parallel tracks 12 instruments
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Basic functions of 19"x 14" rack mountable mixer panel:
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Total cost of all above including all electronics, knobs, professional black heavy guage prepunched & silkscreened front panel — $495
Console mount chassis and power supply ONLY $98.00
Set of Cannons included in the price. (worth over $30!!!)

only $495

"Blueprint" 5000 preamp

$275

Refer ETI July 81 — Oct 81

We have produced a vast number of kits for this fantastic preamp and we have subsequently learnt a lot about them.
To celebrate our first years trading and as a tribute to the perfectionists amongst you we are offering a very special kit
THE "BLUEPRINT" 5000 PREAMP
This kit is individually assembled with only the highest quality components including:
- Gold plated RCA jacks on ALL phono inputs.
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- Military specification LM194 in lieu of the commercial grade LM394.
- Low capacitance screened cable used throughout — over 12 metres total.
- All I.C. sockets provided (high quality sockets).
- Special multi-coloured LED display no cost optional extra.
- All metal film resistors used.
- Pretinned PCBs.
- Special black anodised rear panel with silkscreened white lettering and format borders.

The standard kit is still available at only $245.00.

Lyrebird Piano

This fantastic kit is now available ex-stock. If you prefer the full 88 note 7¼ octave version we have this also. Each kit is complete down to the last screw and washer! Buy the complete kit or buy the individual modules. Modules start from $47 for the hardware pack through to the full 73 note keyboard at $169.50.
The 'Lyrebird' covers 6 octaves from F-F. The controls include: normal voice, mellow voice, bright voice, harpsichord voice, honky tonk voice selects. Plus many other features. A great kit for the piano enthusiast.

6 OCTAVE $525
7¼ OCTAVE $589

Refer EA Oct 81 — Jan 82

chorus generator kit

This kit consists of a PCB measuring 115x130mm and all components including Bucket-Brigade Delay lines and instructions. (A —15V power supply is required at an extra $14, if purchased from us). The Chorus Generator creates an apparent multiplicity of sound sources (i.e. 'Chorus') from a single-phase signal. Sophisticated but straightforward circuit using 2 BBD's, 2 VCO's, fast & slow modulator, low pass filters etc. Add new effects to your music!

only $59

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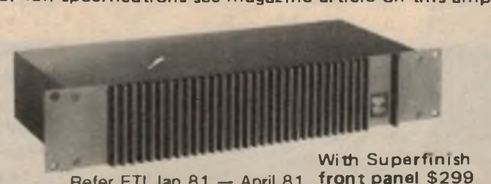

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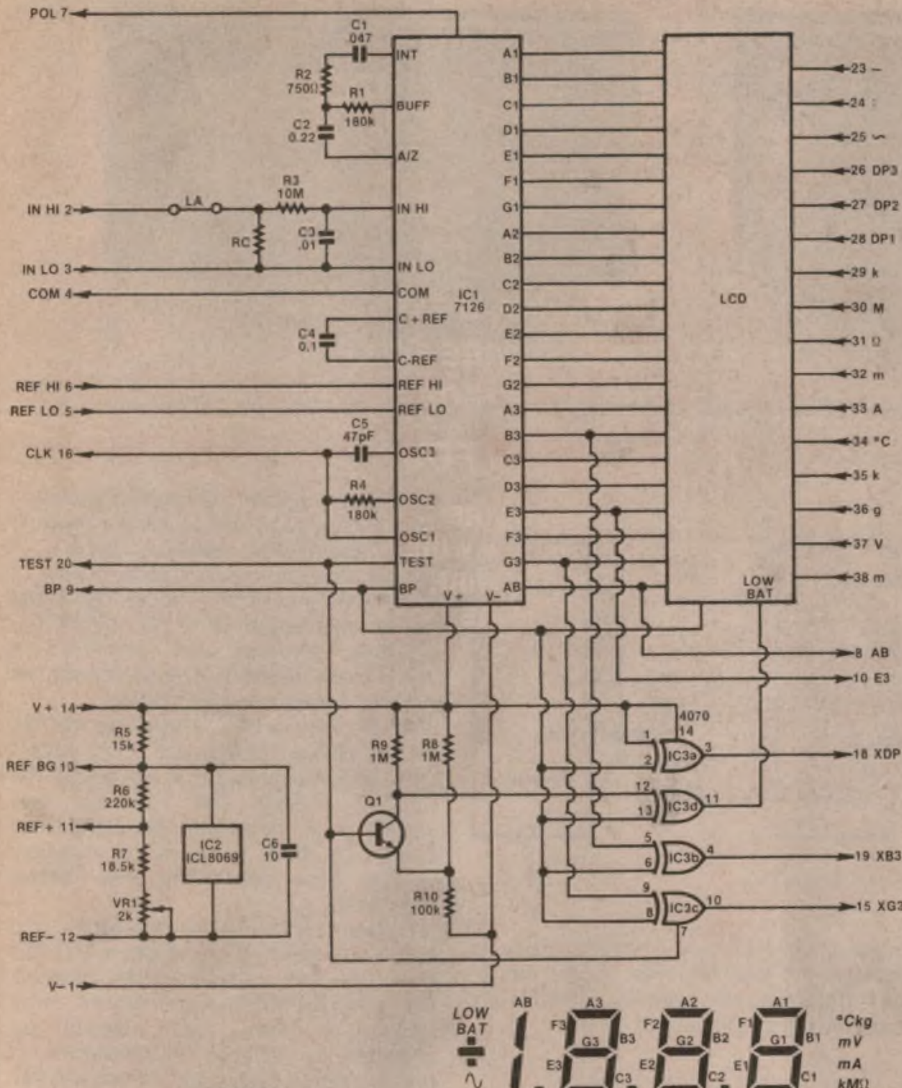
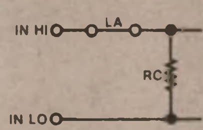


FIG. 1 DPM200



REQUIRED FULL SCALE	LA	RC
2V	9M	1M
20V	9.9M	100k
200V	9.99M	10k
2kV	9.999M	1k
200uA	LINK	1k
2mA	LINK	100Ω
20mA	LINK	10Ω
200mA	LINK	1Ω

FIG. 2

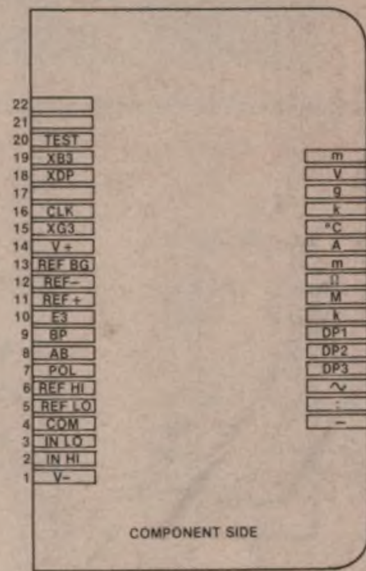


FIG. 3

The circuit of the DPM200 module is split into three parts: A-D converter (IC1), voltage reference (IC2) and exclusive-OR gates (IC3).

The DPM-200 is a new panel meter module imported by Jaycar Pty Ltd. On board the module are all the components necessary to provide the basis of a wide range of accurate instruments. We will be publishing a number of projects using this module for the display and so we present here some application notes on the module to allow you to become familiar with how it operates.

Physically the DPM-200 module is a double sided printed circuit board assembly with an integral 3½-digit liquid crystal display mounted on one side. The LCD has a black bezel surround measuring 72 x 36mm while the gold-plated PC board measures 68 x 45mm.

Mounted between the display and the PC board is an integrated circuit chip which is terminated directly to the board. In the accompanying photographs, the area occupied by the chip is marked by a piece of black insulation tape. Also accommodated on the board is a 4070 quad two-input exclusive-OR gate, a transistor, an additional IC which is described below, a preset pot which should not be touched or adjusted and a few resistors and capacitors.

The DPM-200 module is essentially a high input impedance voltmeter with a full scale reading of 199.9mV. Various annunciators are available (such as °C, kg, mV, decimal points etc) and these may be connected as desired.

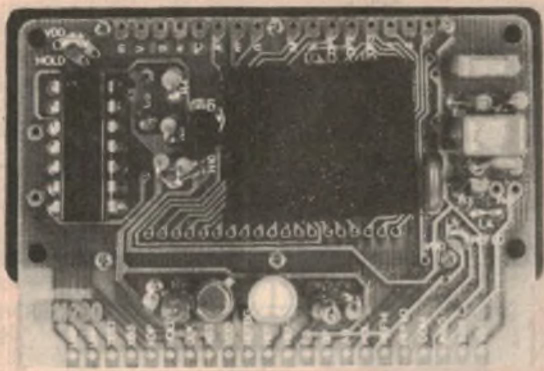
The heart of the digital panel meter is the Intersil 7126 dual slope integration analog to digital converter chip. This chip also drives the liquid crystal display direct and yet draws only 50μA.

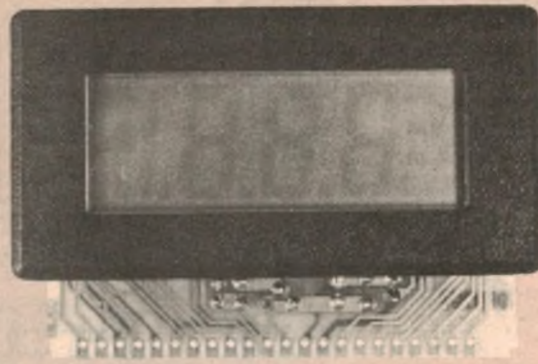
Components R1, R2 and C1 on Fig. 1 determine the integrator time constant while C2 reduces the susceptibility to noise of the auto-zero circuitry and determines the speed of recovery from overload. The display is guaranteed to read zero for an analog input of zero volts. An input filter is formed by R3 and C3 and assists with overload protection of the 7126 chip. The input voltage may exceed the supply voltage provided the input current does not exceed 100μA. The input impedance is greater than 100MΩ.

The frequency of the internal oscillator appearing at the clock output is determined by C5 and R4 and is set at 48kHz in the modules supplied. The backplane signal necessary to drive the LCD is set at a frequency of 60Hz while the display is updated three times per second.

As supplied, the module is calibrated by means of VR1 for a full scale reading of 200mV with link LA in circuit and resistor RC omitted. Fig. 2 shows how the input sensitivity may be altered and how the module may be converted for current measurements.

The 7126 chip has an internal voltage reference that maintains circuit common at approximately 2.8V below the positive supply. The temperature coefficient of the internal reference is typically 80ppm/°C. A potential divider could be placed across the internal reference and used to derive the voltage required for the converter





These two views show the actual size of the DPM-200 module. Note the REF trimpot which must not be fiddled with.

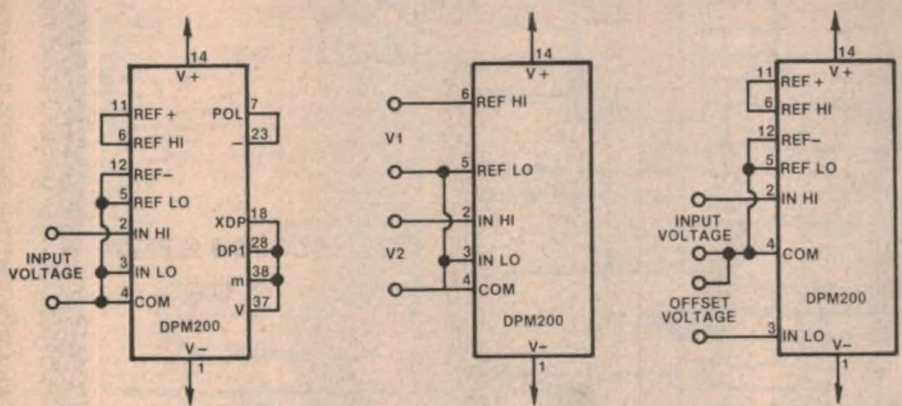


FIG. 4 (a) (b) (c)

Fig. 4(a) shows module connections for measuring a floating voltage source of 200mV maximum. Polarity and mV annunciators are enabled. 4(b) shows the arrangement for measuring ratio of two voltages. 4(c) shows the method of connecting an offset voltage if a zero display is required when the input is not zero.

reference input. The displayed reading is 1000Vin/Vref with Vref normally equal to 100mV.

However, in the DPM-200, a bandgap reference integrated circuit (IC2), is used to provide reference voltages. This integrated circuit acts like an extremely stable 1.2V zener diode and a voltage divider between REF BG and REF- is used to produce the 100mV Vref that is required for the converter reference. The module comes with Vref already adjusted to 100mV and VR1 therefore should not be varied.

The bandgap reference will maintain regulation with supply voltages down to 5V. A low battery detection circuit, Q1, is included in the module to provide an advance warning of battery failure directly on the display.

R8 and R10 form a voltage divider across the supply that acts to turn Q1 off when the supply voltage falls below a threshold level set by R10. When Q1 turns off the collector goes to a high level and exclusive-OR gate IC3d then acts as an inverter. A signal which is in anti-phase with the backplane input is thus generated and used to provide a drive signal for the LOW BAT warning. R10 may be changed if a different warning threshhold is required, some typical values being 220kΩ for a warning at 7.2V and 100kΩ for a warning at 6.4V.

An exclusive-OR gate IC3a provides an inverted backplane signal that can be used to drive any combination of the annunciators on the module. These annunciators are normally "floating" and under operation in an electrically noisy environment, may appear when not required. Annunciators may be suppressed by direct connection to the backplane if not required, or connected to the backplane by a 1MΩ resistor if required at certain times. The 1MΩ resistor prevents spurious signals from turning on the annunciator yet allows normal operation of the annunciator when connected to XDP.

The exclusive-OR gates IC3b and IC3c provide outputs that may be used to enable annunciators if the module is used in auto-ranging applications.

Pin connections for the DPM-200 module are shown in Fig. 3. The analog inputs can accept differential voltages from 0.5V below the positive supply to 1.0V above the negative supply. A typical common-mode rejection ratio of 86dB exists over this range. The COM pin is maintained at 2.8V below the positive supply and provides a convenient method of establishing the correct common-mode voltage.

An N-channel FET, internal to the ICL 7126, allows COM to sink up to 100μA while still remaining at 2.8V below the positive supply. The FET will only source 1μA however, so COM may easily be tied to a more negative voltage thus over-riding the internal reference.

Reference inputs are differential and may be generated anywhere within the power supply voltage of the module. For module applications where auto-ranging is used, four outputs are provided to enable annunciators or provide range switching. These are AB, E3, XG3 and XB3.

The POL output is a square wave that changes phase when the analog input changes polarity. With the analog input positive, the POL output is in phase with the backplane signal. When the analog input goes negative the POL output changes to being in anti-phase with the backplane signal.

The clock output (CLK) can be used for systems timing or as an input, in which case the internal oscillator may be over-ridden and the sample rate changed.

The module is supplied with REF+ adjusted to +100mV with respect to REF-. REF BG is + 1.2V with respect to REF-.

When the TEST pin is connected to the positive supply all the LCD segments should turn on and the display should read -1888 if none of the annunciators is connected. TEST should not be connected to the positive supply for long periods because a DC potential is applied to the segments and this may cause damage. TEST may also be used as a negative supply with a maximum load of 1mA.

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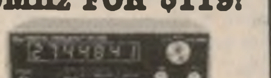

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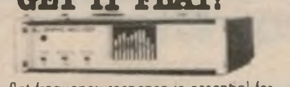

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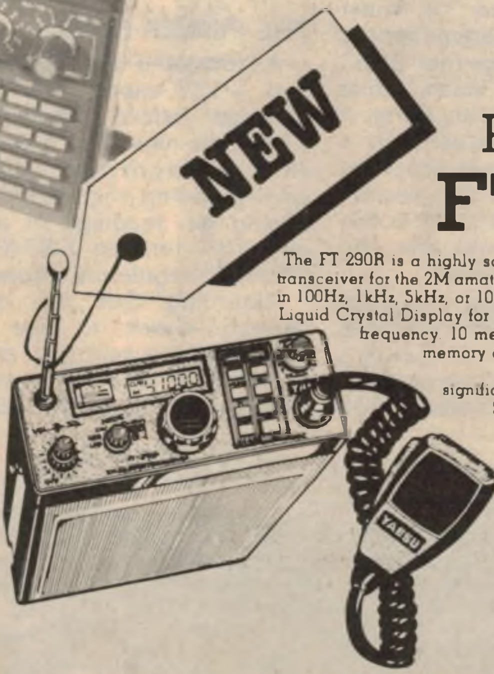

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500MHz 7-digit frequency meter

2nd article details calibration & troubleshooting

In this second article on the 500MHz frequency meter, we detail a useful troubleshooting procedure and describe several methods of calibration. Also included are some hints on using the new frequency meter.

by GREG SWAIN

Normally, we would expect the 500MHz frequency meter to work "straight off", provided that the constructor has made no wiring errors. But, if you are unlucky enough to strike trouble, the following troubleshooting procedure should solve your problems. It assumes that the constructor has access to little more than a multimeter.

The initial reaction of most constructors to a malfunctioning project is to use language that would make a bullock driver blush. While this doesn't really solve anything, it can help put the constructor in a more rational frame of mind to solve the problem at hand. So let's assume that your new 500MHz DFM is not functioning correctly and that the profanities have now ceased.

Before doing anything else, use your eyes. Go over the completed project carefully, checking component orientation, component values, and external wiring. You should also check the copper side of the PCB for missed solder joints, solder bridges between tracks, and faults in the copper pattern.

But while a careful visual check can save you a lot of hassles later on, the fault may not always be obvious. That being the case, it's simply a matter of checking the circuit stage by stage until the problem is "licked".

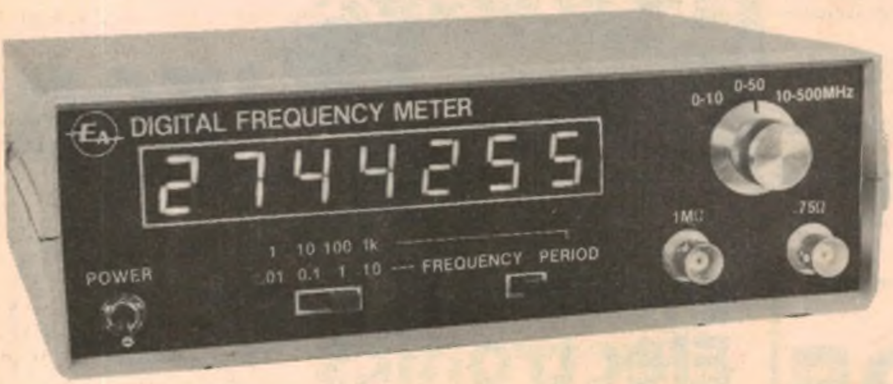
THE POWER SUPPLY

As indicated last month, the +5V and +12V supply rails should be checked before plugging in the 7216A counter chip. If either supply rail is incorrect, check the corresponding regulator input. You should get readings of about 20V and 10V for the LM340T12 and LM340T5 regulators respectively.

Assuming that the inputs are correct, check to see that the regulators are correctly oriented or have not been inadvertently swapped. If no wiring errors have been made, you may have a faulty regulator.

If the regulator input voltages do not check out, go over the remaining power supply components very carefully. You may have a faulty diode, or you may have installed a diode or capacitor back to front.

Once the power supply is functioning correctly, you should also check that the +5V and +12V rails are actually connected to the appropriate supply pins of the ICs. The 7216A may now be inserted into its socket.



Full constructional details for this 500 MHz DFM are in the December 1981 issue.

COUNTER AND DISPLAY

Troubleshooting the main section of the circuit begins with checking out the 7216A counter IC and display. This part of the circuit is actually quite easy to test by using the in-built "Display Test" function in the 7216A.

The procedure is as follows: Disconnect pin 1 of the 7216A from circuit and connect it to pin 15 (the D7 output) via a 10kΩ resistor. This is best done by withdrawing the 7216A from its socket and bending pin 1 out so that it is at right angles to the remaining pins. The IC is then reinserted in its socket and a couple of clip leads used to make the connections.

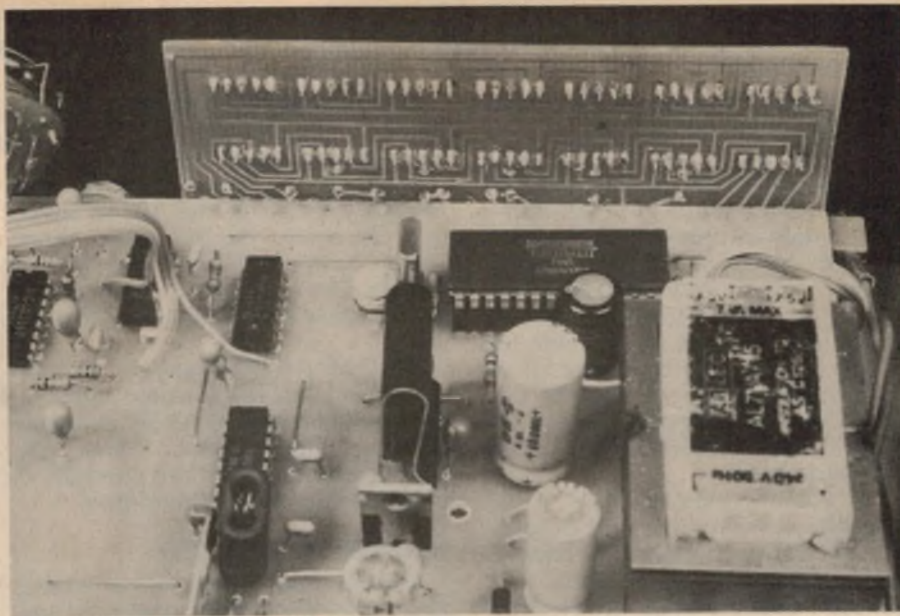
Note: pin 15 is left in circuit during this test procedure.

At switch-on, all digits in the display should be lit with each digit displaying an "8" — ie the "Display Test" function should enable all segments of the display. If any displays fail to light, check for continuity between the digit driver outputs (D0-D6) of the 7216A and pin 3 of the displays. These and other continuity checks can be made without removing the PCB from the case.

If there is continuity, disconnect pin 3 of the display from circuit and momentarily short it to pin 3 of the adjacent display. If the display still refuses to light it is defunct. If, on the other hand, the display does light, you may have a faulty 7216A counter IC (nasty!).

Similarly, if any segments fail to light, check for breaks in the segment drives lines between the 7216A and the displays, and between the displays themselves. For example, if the "g" segments on all seven digits fail to light, check for continuity between pin 6 of the 7216A and pin 10 of the first display digit. If there is continuity, momentarily short pins 9 and 10 of the displays; if the "g" segments now light, the 7216A is probably faulty.

Remember that the segment lines are common to each display. So if the "g" segments of only the last three digits fail to light, check the "g" segment line for continuity between digits four and five.



Held over from December, this photograph shows the wiring in the vicinity of the 7216A counter chip. Note how the display panel is mounted.

BLANK DISPLAY

One problem that could puzzle some constructors is a completely blank display at switch-on. Assuming that the power supply checks out, the most likely reasons for this situation are: (1) a fault in the wiring to switch S3; or (2) the 10MHz oscillator is not working.

To track the fault down, connect the unit in the "Display Test" mode. If all digits now light, the fault lies in the wiring to switch S3. You could have an open circuit between the wiper of S3 and pin 14 of the 7216A or an open circuit between the switch and one of the digit outputs D0, D1, D2 or D3.

If the display remains blank, the oscillator circuit is the likely culprit (either that, or that 7216A is a dud). Assuming that you don't have a CRO, go over the circuit carefully looking for wrong components and open-circuit or bridged PCB tracks. Check also that there is +5V to the 39pF capacitor and the 39pF trimmer.

If these checks lead you nowhere, don't assume that the 7216A is faulty. Before parting with around $40, it would wise to check the situation out thoroughly. The best way to do this is to substitute an external oscillator (or clock) for the on-board oscillator to discover just where the fault lies.

Fig. 1 shows a simple CMOS oscillator based on a low-cost 4011 quad 2-input NAND gate. This circuit can be quickly wired up on stripboard and powered from the +5V rail in the DFM. The fourth gate in the package is unused but should have its inputs, pins 12 and 13, pulled high.

Note: virtually any inverter-type CMOS IC can be substituted for the 4011, eg 4001, 4009, 4049. Check the pin numbering though.

Having wired up the oscillator, feed the output directly into pin 25 of the 7216A (there is no need to disconnect pin 25 from circuit). If the display now lights, the 7216A is cleared and the fault lies in the oscillator. You could have a dud crystal, for example.

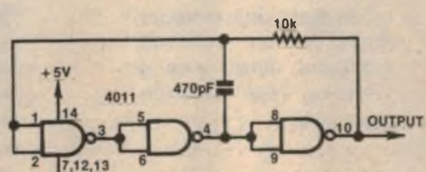


FIG. 1

Fig. 1: this simple CMOS oscillator can be used to check out the 7216A.

It is here that we come to an interesting side effect of our test procedure. With the resistance and capacitance values shown, the circuit of Fig. 1 oscillates at approximately 90kHz — roughly 100 times lower than the normal 10MHz timebase. This means that the digit multiplexing rate will be reduced to about 5Hz when using the external oscillator, since multiplex signals are derived from the timebase.

At this low frequency, you can actually see the digits flashing on and off in sequence.

Now withdraw the capacitor from circuit. The oscillator frequency will increase to about 1MHz and all digits will appear to be continuously lit. Even if your counter runs perfectly, why not make up the circuit of Fig. 1 for a practical demonstration of how multiplexing works. You can slow down or speed up the oscillator by increasing or decreasing the capacitor and resistor values.

If the display refuses to light with the external oscillator, the 7216A is about to give you a severe pain in the wallet area. Either that, or your external oscillator is not working correctly — check on a CRO or another DFM if possible. One point to keep in mind is that failure of the 7216A will be relatively rare, unless you do something silly like inserting the IC back to front.

Assuming that the LED displays are now functioning, restore the pin 1 connection to the 7216A and operate the gating time switch S3. As stated last month, the display should show four zeros in the 10s position, three in the 1s position, two in the 0.1s position and one in the .01s position. Check the wiring to switch S3 if difficulties are encountered here.

If, at any stage, the displays give readings other than numbers, check for shorted segment lines and upside down displays. The tops of the displays are identified by small corrugations and, if you look closely, the decimal point should be just visible in the lower right hand corner.

0-50MHz PREAMPLIFIER

The 0-50MHz preamplifier circuit can be divided into three stages: a FET-input stage, a 10116 triple differential amplifier, and a transistor level translator (Q2 and Q3). Let's assume that there is a fault somewhere betweeen the input socket and pin 9 of IC6c.

Set the range switch to 10MHz, the gating switch to 1s, and touch the input to the 10116 (pin 9) with a short length of tinned copper wire. If the display now shows a large random count (but not when you touch the wire on centre conductor of the input socket), the trouble lies in the preceding FET stage. If no count appears, you will have to take some voltage readings around the 10116 and the following Q2/Q3 transistor stage.

As noted previously, the 10116 has differential inputs and outputs, all operating at ECL (emitter-coupled logic) levels of betwen 3.2V and 4.2V (at room temperature). Pin 11 of the 10116 should be around 3.7V while pins 2 and 3 will be at 3.2V and 4.2V (or 4.2V and 3.2V). All the other output pins will tend to sit around 3.7V with no signal applied.

If any of these voltages are not within reasonable limits (±0.3V), the most likely cause is a wiring error or open circuit or bridged PCB track. Replace the 10116 only as a last resort.

Voltages around Q2 and Q3 may now be checked. The emitters of Q2 and Q3 should be around 4V while Q2's collector will be at 0V or 3V, depending on the output of IC2a. Now put your finger on the input to the 10116. Assuming the use of a multimeter, Q2's collector should read approximately 1.5V, while pins 2 and 3 of IC2a should read 3.7V (note: these are average voltages, not peak voltages as displayed on a CRO).

This last test indicates whether or not the 10116 and level translator stages are working correctly. If the 10116 checks out but Q2's collector remains at 0V or 3V with an input signal applied, one of the transistors is probably either faulty or incorrectly oriented. Note that Q2 and Q3 should face in opposite directions on the PCB.

MULTIPLEXER & DIVIDER

Any problems here will most likely be due to incorrect wiring to switch S1. Check that pins 2, 12 and 13 of IC6 are low for the 10MHz and 50MHz ranges, and that pins 3, 4, 10 and 11 are high. On the 500MHz range, pins 2, 5, 8, 12 and 13 should all be high while pin 11 should be low.

Pin 6 should be at either 0V or 4V with no input signal, and about 2V (average) with an input signal.

A rough and ready check can be made of the 74196 in the following way. Set the range switch to 10MHz and the gating switch to 0.1s, and couple yourself to the 10116 input (pin 9) again. At the same time, switch between 10MHz and 50MHz ranges. The resulting random counts should show a ratio of approximately 10.

Pin 2 of the 74196 should read 0V or 5V with no input signal applied, and approximately 2V-2.5V (average) with an input signal. Check the circuit around the 74196 carefully if problems are encountered here.

500MHz PRESCALER

There's not much to go wrong here, since the circuit consists of just two ICs (IC4 and IC5) and a few minor components, Unfortunately, the circuit is difficult to troubleshoot without the aid of high-level signal source of 10MHz or more and (preferably) a CRO.

Carry out the usual wiring checks before replacing either of the ICs (which are expensive). In particular, check voltages at the various IC pins and look for possible shorts between the signal line and ground. You could have a short at the input socket, a solder bridge, or D3 or D4 could be short circuit.

If these checks reveal nothing, remove the RF choke and the OM350 (IC4) from circuit and connect a wire link between the vacant pin 1 and pin 5 holes of IC4. Now feed a high-level (600mV) RF signal greater than 10MHz into the 75Ω input. If the circuit now functions replace the OM350; if not, the 11C90 is suspect.

Don't replace either IC4 or IC5 until you've verified that the 74LS00 (IC6) is working correctly, however. If you have any doubts, remove IC6 and test the circuit with a wire link between pin 11 of IC5 and pin 8 of IC3 (don't forget to re-insert the OM350 and the RF choke).

CALIBRATION

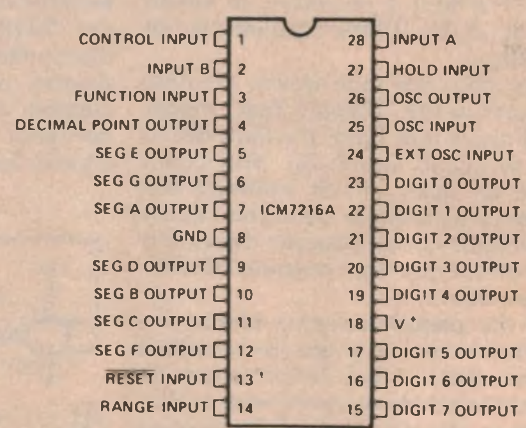
Calibration consists of setting the timebase accurately by adjusting the small trimmer capacitor in the crystal oscillator circuit. Before making this adjustment, however, the frequency meter should be run for 15 minutes or more with the lid on to allow internal operating temperatures to stabilise.

By far the easiest way to perform calibration is to use the horizontal output stage of a colour TV receiver as the reference source. In most cases, there is no need to make a direct connection to the TV receiver. All you have to do is dangle the input lead to the frequency meter in the vicinity of the horizontal output stage and adjust the trimmer until the display reads 15,625Hz.

The frequency meter should be switched to the 10MHz range and to 1s gating during this calibration procedure.

Do not try to pick up the 15,625Hz line frequency in the vicinity of the yoke — it generates too many spurious harmonics to give a reliable reading.

If you have a 10:1 divider probe (and are feeling adventurous), you can also calibrate against the 4.433619MHz PAL subcarrier frequency. To do this, locate the crystal oscillator in the chroma circuit and hook the probe onto one side of the crystal. Adjustments to the frequency meter may now be made, but make sure that the TV is displaying a colour program.



This diagram shows the pin-out configuration for the 7216A counter chip. Chip features include eight digit outputs (D0-D7), an external oscillator input, and a "Display Test" function (see text).

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Note that loading effects can cause the TV oscillator circuit to shift frequency, so that programs that would normally be in colour are shown in black and white. If you do experience this problem, try hooking onto another part of the oscillator circuit. By the same token, a 10:1 divider probe is mandatory if loading problems are to be avoided.

Other methods of calibration include making comparison measurements with a frequency meter of known accuracy, and using a CB or amateur transceiver as the reference source. Again, there is no need to make a direct connection to the transceiver. Just connect a short length of wire to the centre-pin of the 1MΩ input socket and dangle it close to the antenna or dummy load for the transceiver.

With no signal from the transceiver, the input wire will pick up ambient noise to produce a random count. This will be swamped when the transmitter is keyed. The transmitter should be set to AM, not SSB, and there should be no modulation.

This means of calibration assumes that the transmitter frequencies are accurate. If there is any doubt on this score, then the validity of the method is dubious.

Some constructors may find during calibration that their frequency meter reads low and that the trimmer capacitor has insufficient range to correct this situation. If this proves to be the case, connect a 15pF ceramic capacitor to the underside of the PCB in parallel with the trimmer and try again. If the frequency meter still reads way too low, it's possible that you have been supplied with a series resonant crystal instead of a parallel resonant type.

Note: a series resonant crystal in a parallel resonant circuit will oscillate at a frequency higher than its nominal frequency. The difference will usually be so much that the crystal cannot be trimmed to the wanted frequency. If the timebase is too high, the frequency meter will read low; if the timebase is too low the frequency meter will read high.

GATING SWITCH	FREQUENCY (Hz) (10MHz RANGE)	GATING SWITCH	PERIOD (μs) (10MHz RANGE)
.01	Multiply by 100	1	Divide by 10
0.1	Multiply by 10	10	Divide by 100
1	Multiply by 1	100	Divide by 1000
10	Divide by 10	1000	Divide by 10,000

NOTE 1: multiply frequency readings by 10 for the 50MHz range and by 100 for the 10-500MHz range.

NOTE 2: divide period readings by 10 for the 50MHz range and by 100 for the 10-500MHZ range

USING THE DFM

Finally, a few comments on using the new frequency meter. First, always use shielded cable for input connections — 75Ω TV coax is fine. Using unshielded leads, even short lengths, will lead to errors due to induced noise.

You should also remember that measurements may be affected by the degree of loading on the circuit under test, so a 10:1 divider probe may be a worthwhile investment in many applications. Input impedance on the 10MHz and 50MHz ranges is 1MΩ for signals less than 0.6V peak, and 100kΩ for low frequency signals greater than 0.6V peak. Input impedance for signals greater than 0.6V peak decreases rapidly as frequencies increase.

The 500MHz range has a nominal input impedance of 75Ω.

The maximum input voltages which may be fed to the two "front-ends" of the DFM are limited by the ratings of the protection diodes and associated limiting resistors and blocking capacitors. We recommend that the maximum input voltage to the low frequency ranges (0-50MHz) be no more than 30V RMS, while the voltage to the prescaler should be no more than about 500mV RMS.

Because our circuit does not employ decimal point indication, some readers may have difficulty in interpreting readings. The accompanying table is intended to overcome this problem. We suggest that you make a photostat copy of this table and mount it under a sheet of perspex on the lid of the case for permanent reference.

A couple of examples will suffice to illustrate how the table is used: (1) measurements on the 50MHz range with the gating switch set to 0.1s are multiplied by 100 to get a reading in Hz; (2) period measurements on the 10MHz range with the gating switch set to 10 cycles are divided by 100 to get a reading in microseconds (μs).

Finally, the circuit diagram (p45, Dec) should show a 0.1μF capacitor between pin 14 and ground. The wiring diagram on p47 is correct.

Large-screen TV storage CRO adapter

Synchronised display ● Graticule ● One-shot triggering

While oscilloscopes are now available at quite reasonable cost, storage CROs still remain beyond the means of most hobbyists. For around $100, however, our new Large Screen Storage CRO converts a normal TV into a storage CRO with features such as a fully synchronised display, electronic graticule, one-shot triggering and optional storage of up to four screen displays.

by RON DE JONG

Back in May 1980 we published a design to adapt any TV set for use as a large screen oscilloscope. Using only seven low cost ICs, this simple design allowed waveforms up to 300kHz to be displayed. While this adapter was very popular and is still being sold, it does have drawbacks which can be expected from a simple design. For a start, high frequency waveforms were displayed as a series of dots.

Due to the digital techniques used in generating the display, our new TV CRO also has a storage facility plus the ability to display very slow waveforms since there are no problems with persistence of the screen trace. These features can be used to display such "slow" waveforms as ECG or other biomedical signals, seismic waveforms and various transducer data like temperature. The storage facility is useful for capturing transient waveforms like human speech and it clearly displays the "voicing" of musical instruments, eg, electronic organs.

Perhaps the most obvious feature of this CRO is that it uses a TV as a display. This can be an advantage in classrooms, lectures or demonstrations where the large screen size of a TV makes it easily visible.

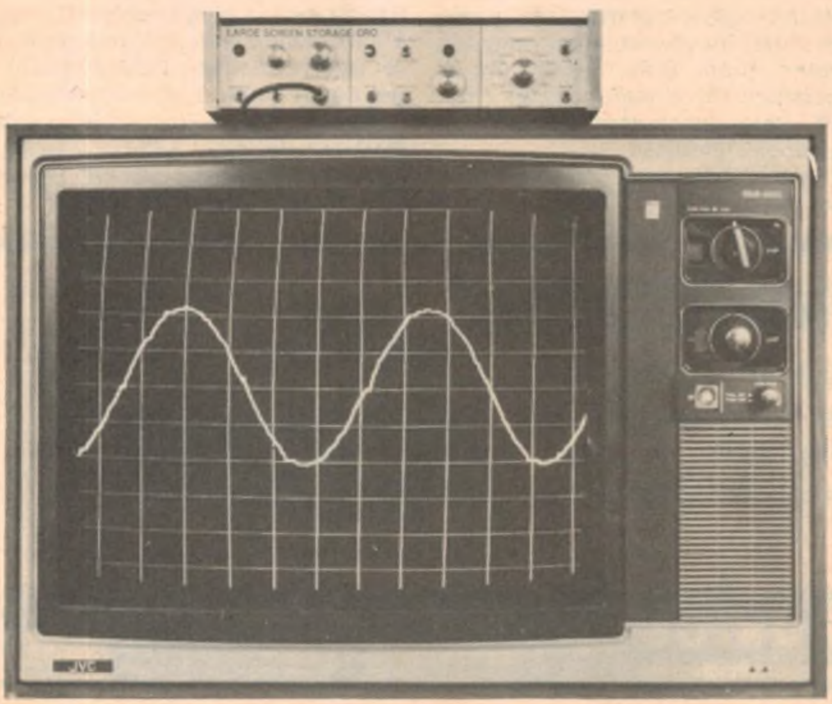
One feature our Storage CRO has over conventional CROs is that the timebase is crystal locked and fixed with respect to an electronic graticule consisting of 10 vertical by 12 horizontal grid lines. There are 12 timebase settings as follows: 32µs, 64µs, 128µs, 1.02ms, 2.05ms, 4.1ms, 8.2ms, 16.4ms, 32.8ms, 65.5ms, 131ms and 262ms per division. Accuracy of the crystal timebase is 50 parts per million.

Looking at the front panel of the unit we can see that the unit has the usual controls found on CROs: input attenuator, shift, AC/DC input coupling, BNC input socket, trigger level, one-shot/continuous switch, free-run/synced switch. The one-shot/continuous switch selects either continuous updating of the displayed waveform or a one-shot display in which case the trigger is armed via the ARM button, turning the SET LED on. When the CRO is triggered the SET LED turns off and the screen is updated with one sweep. Each time the ARM button is pressed, a new waveform will be displayed when the unit is triggered.

Additional front panel features include a LED above the trigger level control which indicates whether the unit is being triggered, thus allowing rapid adjustment of the trigger level. A HOLD/RUN switch freezes the currently displayed waveform and a PAGE located beneath the HOLD/RUN switch, switches from one stored screen display to another so that two waveforms can be captured and then compared by switching between the two "pages".

The unit interfaces to a normal TV set either via the antenna inputs or via a direct video connection. Input to the unit is via a standard BNC connector and the maximum input sensitivity is about 25mV per division.

The operation of the unit is in a sense similar to our previous TV CRO adapter



LEFT: This photograph shows the Large-Screen Storage CRO displaying a 6kHz sinewave. Note the electronic graticule.

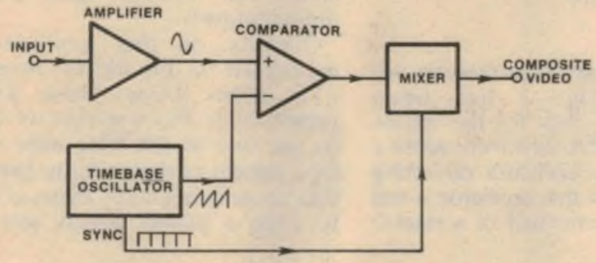
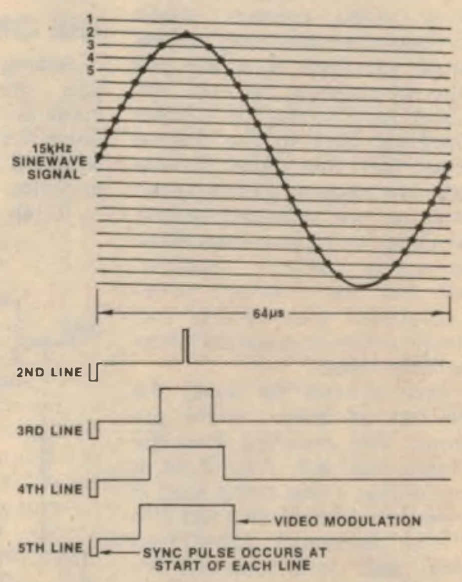


FIG. 1

ABOVE: Basic scheme for a TV CRO adapter. The input signal is compared with a timebase signal and mixed with the timebase sync pulses to produce a composite vide output.



RIGHT: The diagram shows how a basic adapter would display a 15,625kHz sinewave signal. Note the sync pulses at the start of each line, and that one complete cycle occurs during each horizontal scan of the screen.

in that the unit relies on the normal deflection system of the TV. By generating a video signal that turns the electron gun in the TV on at the appropriate times a picture of the waveform is built up.

In a normal television the entire screen is scanned 50 times a second. Each scan or "field" consists of 312.5 horizontal lines which are written from left to right across the screen. Clearly the field frequency is 50Hz and the line frequency is 312.5 x 50 or 15,625Hz.

Let's assume that we wish to display a sinewave signal and that by some stroke of luck its frequency happens to be exactly the same as the line frequency of the TV. Referring to Fig. 1 we can see that one complete cycle occurs during each horizontal scan of the screen. This input signal is compared to a ramp signal which falls linearly from some initial value at the start of each field with the output of the comparator connected to the video input of a TV.

In effect the ramp signal represents the vertical position of the current line being scanned. So as the TV scans across one line and the sinewave goes through one complete cycle the comparator will generate a high signal when the sinewave is above the ramp signal and a low signal when it is below the ramp. If this signal is combined with suitable horizontal and vertical sync signals the resultant composite video would generate a sinewave "picture" in which the area above the sinewave would be white and the area below would be black.

This is not exactly what we want but it is a start! Now if instead of comparing the input signal to just one ramp we compare it to two ramps, one just slightly below the other in voltage, then the two comparator outputs will be similar except that one sinewave picture is slightly lower than the other. If we invert one comparator output and OR it with another comparator output we obtain a thin sinewave where the two pictures overlap.

SYNCHRONISING THE DISPLAY

The resultant sinewave picture will appear stationary but only because it is locked to the line frequency of the television. Most signals however are not, and the only practical way of achieving a locked or synced picture for all input waveforms is shown in Fig. 2.

Basically the input signal is converted into a sequence of eight-bit binary numbers using an A-D converter and these numbers or bytes are stored in consecutive locations in RAM (Random

SPECIFICATIONS

TIMEBASE: 32μs, 64μs, 128μs, 1.04ms, 2.05ms, 4.1ms, 8.2ms, 16.4ms, 32.8ms, 65.5ms, 131ms, 262ms
INPUT SENSITIVITY: 25mV/div
INPUT IMPEDANCE: 1MΩ
FREQUENCY RESPONSE: DC to 100kHz
TRIGGERING: Adjustable trigger level and single shot facility.
DISPLAY: Approximately 200 sampled points on screen, each point is stored as an 8-bit binary number — ie, there are 256 discrete voltage levels.
GRATICULE: 10 vertical x 12 horizontal lines on screen
STORAGE: 2 pages (optional 4)
VIDEO OUTPUT: 1.5Vp-p from 100Ω output impedance

Access Memory). The rate at which the input signal is sampled and converted is set by the timebase clocking the "sampling counter" which generates the consecutive memory addresses. The counter is reset by a trigger circuit so that another input waveform is stored in RAM. Since the trigger is activated at one particular point in the input waveform, the input waveform stored in RAM always starts at the same point and effectively represents a locked image of the input signal.

At the same time as the input is being stored in RAM it is also being read out of RAM by a video counter which generates consecutive addresses starting from zero at the start of a line and reaching the full count at the end. The data read from the RAM by this counter is D-A converted back to the original signal except that this signal is now locked to the line frequency of the video circuits. Now, as we indicated before, this locked signal is simply compared to two ramp signals using a "window" comparator and the resultant video signal is combined with vertical and horizontal sync pulses to generate a final composite video signal.

So we have synced (or sunk) the unsyncable but as always there are complications. We assumed that the data was being read out of the RAM at the same time that it was being read in with two sets of address being fed into the RAM. Such memory is called "two port" RAM and unfortunately it's expensive and almost impossible to obtain.

Our solution is more complex but yields excellent results. What we have done is to rely on the vertical and horizontal blanking periods, ie, those times when the TV picture is blanked out at the end of each field and line scan. Using an address multiplexer, we let the video counter access the RAM while the picture is being generated and we let the sampling counter access RAM during the blanking periods.

Due to the speed limitations of the A-D converter that we have used, we can only sample at a maximum rate of 2μs. If we divide the period of one line trace, 64μs, by the number of sampled points, say 256, we find the required access time to be 250ns for the RAM or 200ns due to other restrictions. Of course it would be nice to have more points on screen and thus a higher resolution but it is difficult to get RAMs faster than 200ns.

With this information we can conclude that it would take 256 x 2μs or 512μs to take one complete picture of the input waveform at the highest timebase frequency. At this particular timebase setting and at the next two of 4μs and 8μs, we can sample during the vertical blanking period which lasts 1.6ms in our design. Hence at the beginning of each field, one entire waveform is sampled and for the remainder of the field the waveform is read out of memory and displayed.

Now for timebase settings greater than 8μs it is not possible to store an entire waveform during the vertical blanking period and we have to use another scheme in which we sample only during horizontal blanking periods. Since these occur at 64μs intervals we can successfully sample at 64μs intervals or multiples thereof such as 128μs, etc. Note that there is a gap in the timebase settings in that 16μs and 32μs sampling rates are not available.

THE CIRCUIT

Looking now at the circuit diagram we can see how Fig. 2 has been implemented. The clock for the whole unit is IC22a and IC22b which comprise a standard TTL crystal oscillator operating at 8MHz. Output of the oscillator is fed to IC14b which is one half of a dual-D flipflop. The $\overline{Q}$ output of the flipflop is fed back to the data input so that the flipflop changes state after each clock pulse, dividing the input frequency by two and generating a 4MHz clock.

The 4MHz clock goes to IC1 and IC2, both 74LS163 synchronous binary counters. We have arranged these counters in a parallel clocking configuration with the carry out of IC1 connected to the "T" input of IC2, resulting in completely synchronous operation of the two counters, ie, all the counter outputs change state at the same time. Briefly the carry output of IC1 is low until the counter is in its highest binary count, ie all outputs 1. Now the "T" input of IC2 inhibits its counting when low and permits counting when high, so IC2 will only be clocked each time IC1 changes from its high count of 1111 to 0000.

Referring to Fig. 2 again, IC1 and IC2 together comprise the video counter with their 8 binary outputs counting from 0 to 255 and hence addressing the entire stored waveform. Since these counters are clocked at 4MHz the addressing sequence takes 256 x 0.25μs or 64μs, which is the period of one line scan.

IC3 and IC4 are also 74LS163 synchronous counters and they are connected in the same configuration as IC1 and IC2. Together these two counters are the sampling counter shown in Fig. 2. The multiplexer which switches the address lines of the RAM between the sampling and video counters comprises IC5 and IC6, both of which are 74LS158 quad 2-to-1 line demultiplexers.

Outputs of the multiplexer are connected to the address lines of two 2114 200ns RAMs. These RAMs are organised as 1K x 4 so that we have had to use two to get 8-bit wide memory. One benefit of these RAMs, however, is that we only need 256 bytes of memory to store a screen display and yet we have 1K bytes available. In other words we can store up to four screen displays without any additional circuitry. To simplify switching we elected to just have two "pages" by simply switching one of the spare address lines high or low using switch S5 and leaving the other spare address line fixed.

The RAMs have four combined input-output data lines labelled 101, 102, 103, 104 plus a device-select pin labelled $\overline{S}$ and a write select pin $\overline{W}$. The $\overline{S}$ pin is connected to ground so the RAMs are permanently enabled while the eight IO lines of the two RAMs are connected to IC12, a DAC0800 D-to-A converter, and also to the outputs of IC9 which is an octal Tri-state latch. The inputs to the latch come from IC10 and IC11 which comprise an A-D converter.

Now the write-enable line of the RAMs is also connected to the output-enable pin of the Tri-state buffer IC9 so that when the write line of the RAMs is low, ie, the RAMs are in the write mode, the

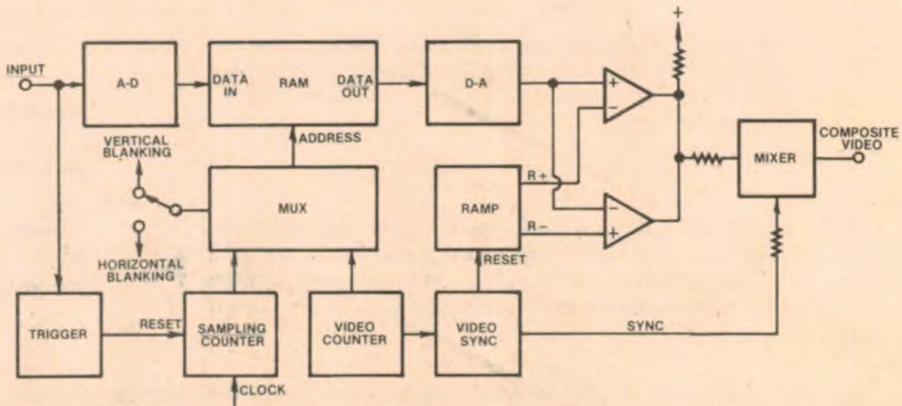
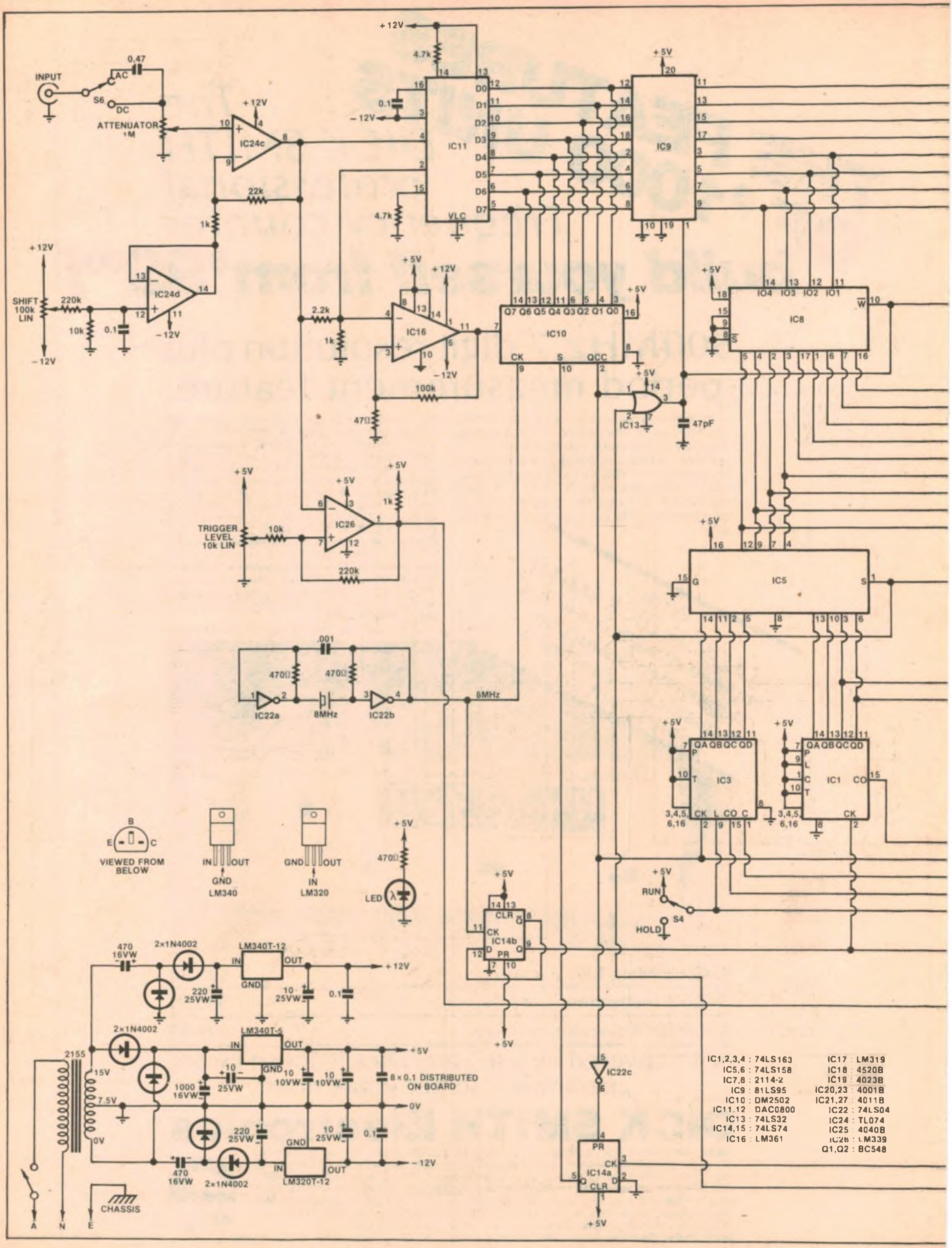
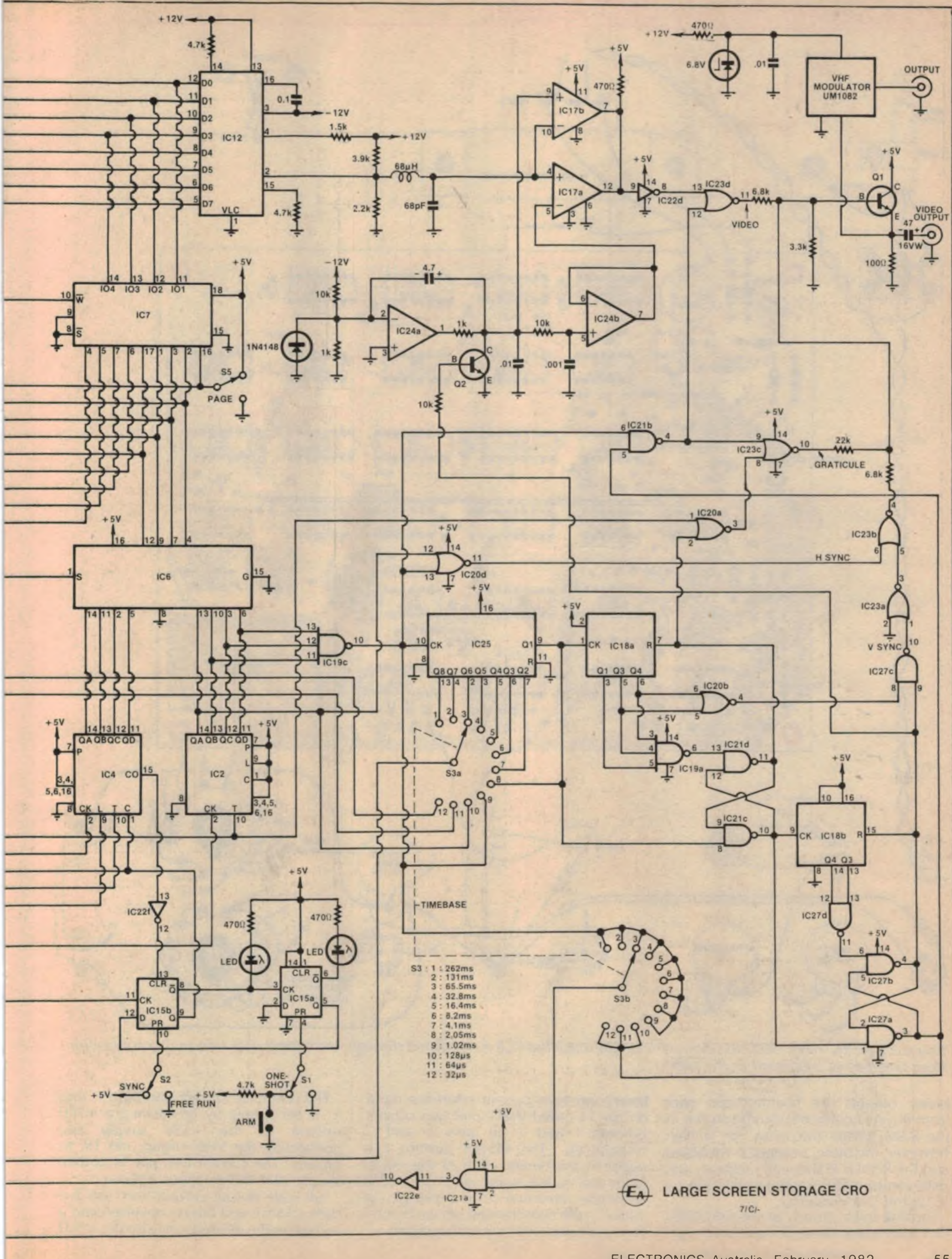
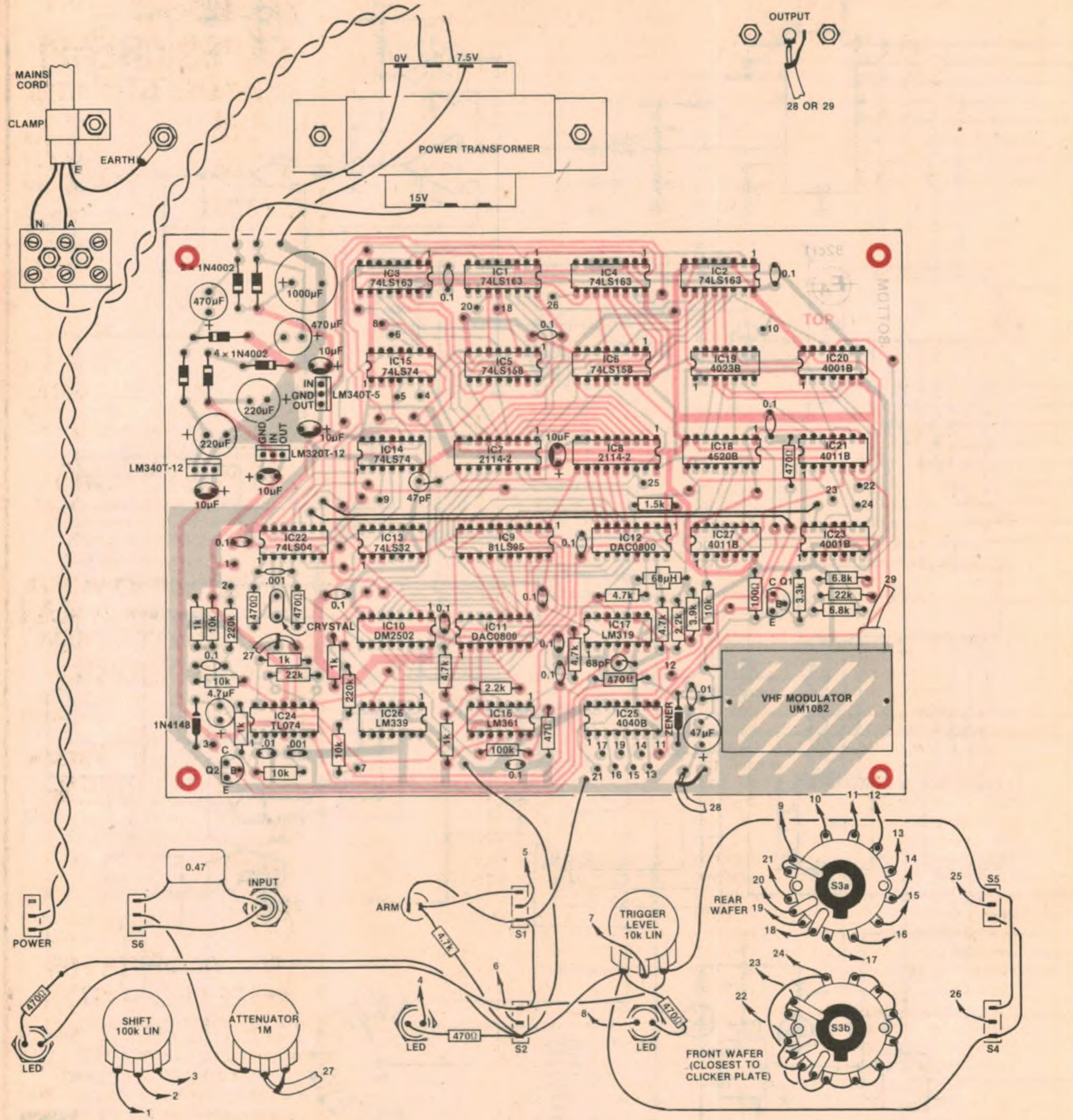


Fig. 2: Basic scheme for a storage CRO adapter with fully synchronised display. The incoming signal is sampled by an A-D converter and stored in RAM.


INPUT
S6
AC
DC
0.47
ATTENUATOR 1M
IC24c
IC24d
SHIFT 100k LIN
IC11
IC9
IC10
IC16
IC8
IC13
47pF
IC26
TRIGGER LEVEL 10k LIN
IC5
IC22a
IC22b
8MHz
IC3
IC1
RUN
HOLD
S4
IC14b
IC14a
IC22c
VIEWED FROM BELOW
LM340
LM320
LED
LM340T-12
LM340T-5
LM320T-12
2×1N4002
2155
15V
7.5V
0V
CHASSIS
8×0.1 DISTRIBUTED ON BOARD
+12V
+5V
0V
-12V
IC1,2,3,4 : 74LS163
IC5,6 : 74LS158
IC7,8 : 2114-2
IC9 : 81LS95
IC10 : DM2502
IC11,12 : DAC0800
IC13 : 74LS32
IC14,15 : 74LS74
IC16 : LM361
IC17 : LM319
IC18 : 4520B
IC19 : 4023B
IC20,23 : 4001B
IC21,27 : 4011B
IC22 : 74LS04
IC24 : TL074
IC25 : 4040B
IC26 : LM339
Q1,Q2 : BC548


+12V
4.7k
IC12
D0
D1
D2
D3
D4
D5
D6
D7
VLC
0.1
-12V
1.5k
+12V
3.9k
68μH
2.2k
68pF
+5V
IC17b
470Ω
IC17a
IC22d
IC23d
6.8k
VIDEO
470Ω
6.8V
.01
VHF
MODULATOR
UM1082
OUTPUT
Q1
VIDEO
OUTPUT
47
16VW
3.3k
100Ω
IC7
IO4
IO3
IO2
IO1
10k
4.7
IC24a
1k
1N4148
Q2
10k
IC24b
.01
.001
S5
PAGE
IC21b
IC23c
22k
GRATICULE
IC20a
IC23b
H SYNC
IC20d
IC6
IC23a
V SYNC
IC19c
IC25
IC18a
IC27c
IC20b
IC4
IC2
IC19a
IC21d
S3a
IC21c
IC18b
IC27d
IC22f
TIMEBASE
LED
IC27b
IC15b
IC15a
S3b
IC27a
S3 : 1 : 262ms
2 : 131ms
3 : 65.5ms
4 : 32.8ms
5 : 16.4ms
6 : 8.2ms
7 : 4.1ms
8 : 2.05ms
9 : 1.02ms
10 : 128μs
11 : 64μs
12 : 32μs
SYNC
S2
FREE RUN
ONE-
SHOT
S1
ARM
IC22e
IC21a
LARGE SCREEN STORAGE CRO



You will have to solder on both sides of the board, since the PCB is not plated through. Unmarked dots represent a connection from one side of the board to the other.

buffer outputs are enabled and data from the A-D converter can be stored in the RAM. When the write line is high however, the buffer outputs are disabled and the RAM is in the read mode so that data can be read out and converted by IC12, the D-A converter.

Looking more closely at the DAC0800 D-A converters, these devices have eight binary inputs, a current reference input on pin 14 called Vref+ and two current outputs I and Ī on pins 4 and 2 respectively. The output current I is equal to the binary value of the digital input and its full scale value is 255/256 times the reference current into pin 14 while Ī is the complement of I, so that I + Ī always equals the full scale current.

The reference current into pin 14, Vref +, is set simply by connecting a 4.7kΩ resistor to the +12V supply and connecting the Vref– input, pin 15, to ground. The current into pin 14 is then simply 12/4.7kΩ or about 2.55mA.

Full scale output current from pin 2 is then 2.55mA and this is converted into a voltage in the desired range by the 3.9kΩ and 2.2kΩ resistors connected to pin 2. The output voltage is, as we mentioned earlier, the input waveform continually repeated with each line scan. Due to the way we have sampled this waveform, however, the output will merely be a stepped representation of the input consisting of 256 points and 256 discrete voltage levels. To get a reasonably smooth image we then have to filter the waveform and this is accomplished by the 68μH choke and 68pF capacitor which, taken together with the impedance of the DAC output resistors, forms a second order Butterworth filter with a cutoff of about 2.5MHz.

Since the data points are clocked out at a rate of 4MHz, the highest frequency of the signal is 2MHz so the 2.5MHz cutoff point is high enough not to attenuate this signal appreciably but low enough to remove the harmonics. This smoothed output signal is then compared with the two ramp signals by IC17, an LM319 dual comparator. The outputs of the comparator are open collector so that the two outputs can be just connected together to achieve wi-OR-ed function. This output is buffered by IC22d, an LS TTL inverter and combined with the sync signals to generate our composite video signal.

Getting back to the A-D converter, this comprises another DAC0800 D-A converter, IC11, a successive approximation register DM2502, IC10, and IC16, an LM361 fast comparator.

The method used to achieve A-D conversion is called successive approximation and basically involves dividing the maximum input voltage range in two then testing whether the input signal is above or below the halfway mark. Having established this, we then divide the upper or lower half (whichever the input voltage is in) into half again and check in which half of this range the voltage is. At this stage we would have found in which quarter of the permissable voltage range the signal is in and thus have a 2-bit binary value for the input. By successively dividing these intervals we can establish an 8-bit (or more) binary value for the input.

In practice the 2502 achieves this scheme by setting its most significant bit (MSB) bit 7 high and all the others low, generating a binary digit which is half the maximum binary value. This is converted into a voltage by the DAC and then compared to the input voltage by the comparator, IC16. The result of this comparison is then stored in the successive approximation register as bit 7, which will be 1 if the input is greater than half and 0 if it is less than half. Bit 6 is now set high and the process repeated to determine whether it should be 0 or a 1 and so on for bits 5 to 0.

The DAC is connected in the same fashion as IC12 except that its output, pin 2, goes straight to the inverting input of the comparator IC16. The analog input signal is also fed to the inverting input but via a 2.2kΩ resistor and in effect the current through this resistor and that from the DAC are summed at this point and compared to ground at the noninverting input. The 100kΩ resistor and 47Ω resistor provide a small amount of positive feedback to improve stability.

Clock rate of the 2502 is 8MHz so that each bit is converted in 125ns. Naturally the delay in the DAC output and comparator should be less than this figure and in fact the typical settling time of the DAC output (current within ±½ LSB) is 100ns and propagation delay of the LM361 is 20ns maximum.

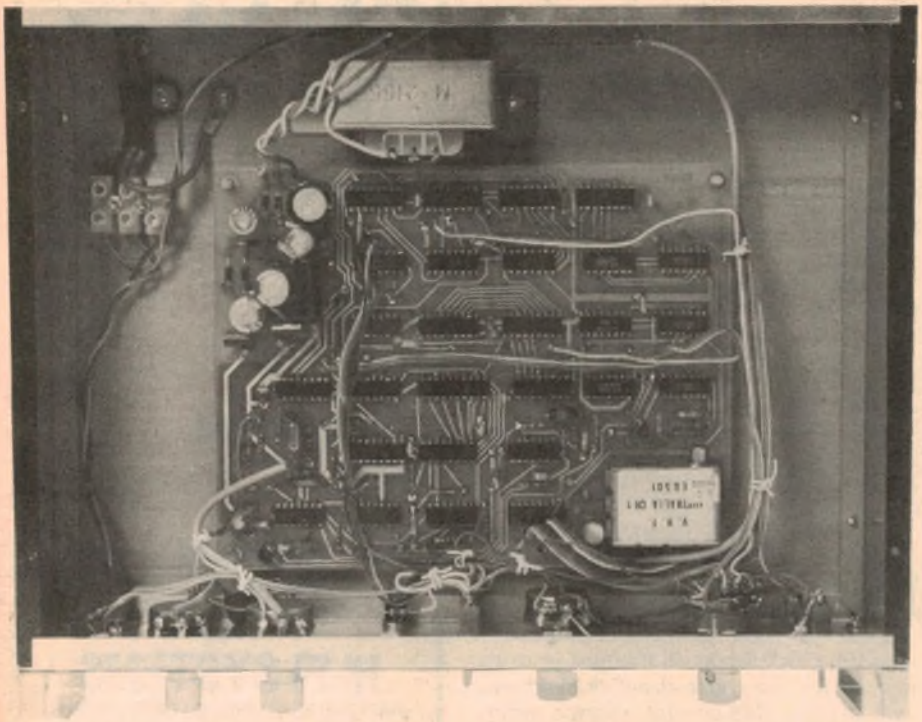
Two other pins on the 2502 register are the S or start input, pin 10, which must be low temporarily to start conversion, and the Qcc or conversion complete signal, pin 2, which is high during a conversion and low after conversion. Qcc is connected to the sampling counters IC3 and IC4 clock inputs so that just prior to conversion the counters are clocked and will present the correct address when the converted byte is ready to be loaded into RAM.

The timebase frequency which is selected via switch S3a goes to the clock input of IC14a, a D flipflop. The rising edge of this clock causes the zero at the data input, pin 2, to appear at the Q output, pin 5. This output is connected to the start input of the 2502 and initiates a conversion cycle causing Qcc to go high. Qcc is inverted by IC22c and applied to the preset input of the flipflop, pin 4, causing the Q output to return to 1. This satisfies the timing requirements for the S input and also resets the 2502 for the next timebase pulse.

Vertical blanking or horizontal blanking signals are buffered by IC21a and IC22e and used to select either the sampling counter or video counter via the select pin, pin 1, of the multiplexers IC5 and IC6. It is also ORed with the Qcc signal by IC13a to generate a write signal for the RAMs.

Like most static RAMs the 2114 don't like their address lines changing during a write operation (poor little beggars), ie, when the $\overline{W}$ signal is low. Due to the necessarily simple timing arrangement we have had to use, we found it necessary to delay the write signal marginally, using a 47pF capacitor.

As indicated in Fig. 2 the sampling counter is reset by the input trigger circuits. This is accomplished by IC15b which has its clock connected to the output of the trigger circuit and its Q output connected to the clear input of the sampling counter IC3 and IC4. The clear input of the flipflop is connected to the carry-out of the counters so that when the counters reach their last count, the carry output goes high, is inverted by



Despite circuit complexity, the unit is easy to build. Note that although this photo shows the modulator, we elected to use the direct video output from pin 28.

IC22f and clears the flipflop. The Q output then goes low and clears the counters, thus removing the carry out signal and therefore the clear input to the flipflop.

The flipflop and sampling counters remain in this state until the positive-going edge of the trigger pulse clocks in a high from the data input, pin 12, which sets the Q output high and enables the sampling counter to start counting through the whole sequence and store a complete input waveform.

Data input to the flipflop is not always high and is in fact connected to the Q output of another flipflop, IC15b. With switch S1 set in the CONTINUOUS position the preset input of the flipflop is grounded, forcing the Q output pins high and thus enabling continuous sampling of the input waveform as already described.

In the ONE SHOT position of S1, the preset input of IC15a is connected to the ARM pushbutton and a 4.7kΩ resistor. If the ARM button is pressed, it sets IC15a's Q output high and enables a sample of the input waveform to be made. At the end of the sampling sequence, IC15b's Q output goes low to clear the counters and the Q output goes high. This is connected to the clock of IC15a and clocks in a zero from the data input, pin 2, setting its output low hence stopping any further updating of the input waveform. A new sample of the input waveform can then only be made by pressing the ARM button again.

The SET LED connected to the $\bar{Q}$ output of IC15a indicates whether the trigger is armed. Another LED connected to the $\bar{Q}$ output of IC15b will turn on whenever sampling is in progress, ie, the clear to the counters is high. At low timebase frequencies it will blink on during each screen scan, while at higher frequencies it will appear to be on continuously.

Additional controls are switch S2 which is connected to the preset input of IC15b. In the SYNCED position the preset input is high and the CRO performs normally but in the FREE RUN position the flipflop output is forced high, regardless of triggering, and the sampling counters will continuously count without regard to any starting point on the input waveform. The input waveform will therefore appear to drift across the screen just as in a normal CRO which has lost triggering. Switch S4 is connected to the load input of the sampling counters and in the RUN position does not affect normal operation but in the HOLD position it forces the outputs of the counter high, disabling sampling.

THE SYNC CIRCUITS

Having covered the main features of the CRO circuit we can look at the sync circuits. Firstly IC19c, a three input NAND gate, decodes the last two counts of the video counter IC2. Output of the gate is the horizontal blanking pulse which occurs at the end of each line and is $8\mu s$ wide. This signal is further combined with the QA output of IC2 by the NOR gate IC20d to generate a horizontal sync pulse. The horizontal blanking pulse is also used to clock IC25, a 4040 CMOS ripple counter which supplies most of the timebase frequencies as well as a divide-by-two output for IC18.

The clock input to IC18a is a square-wave with a period of two lines (ie, $128\mu s$). This is divided by IC18a which is one half of a dual 4-bit binary counter which divides by 13 in conjunction with IC19a and IC21c, d. What happens is that when the counter reaches the desired count of 13, this state is decoded by IC19a, a three input NAND gate which generates a low pulse setting the RS flipflop made up of two NAND gates IC21c, d. This in turn resets the counter, the RS flipflop remaining latched until the clock input goes low, resetting the flipflop via pin 8 of IC21c.

Accordingly, the reset signal to the counter is high for one line period every 26 lines and we have used this to generate the horizontal lines in the graticule. The carry out signal of IC1 is a $.25\mu s$ pulse every $4\mu s$ and forms the vertical lines in the graticule. This is combined with the reset signal by IC20a to form the graticule signal.

The output of the divider, from pin 10 of IC21c, is now divided by 12 to obtain the vertical sync and blanking pulses. This is accomplished by IC18b which operates in the same manner as IC18a except that it divides by 12. The count is detected by IC27d and the flipflop is composed of IC27a and IC27b. The output of this divider is low for 25 lines and high for the remaining 287 lines in the 312 line field. This pulse is used as the vertical blanking interval.

The vertical blanking pulse is NANDed with the output of NOR gate IC20b by IC27c. The NOR gate decodes four states of the counter, ie it is high for only 8 lines of every 26 lines and so the output of IC27c will be low for 8 lines at the start of each vertical blanking pulse, forming our vertical sync pulse.

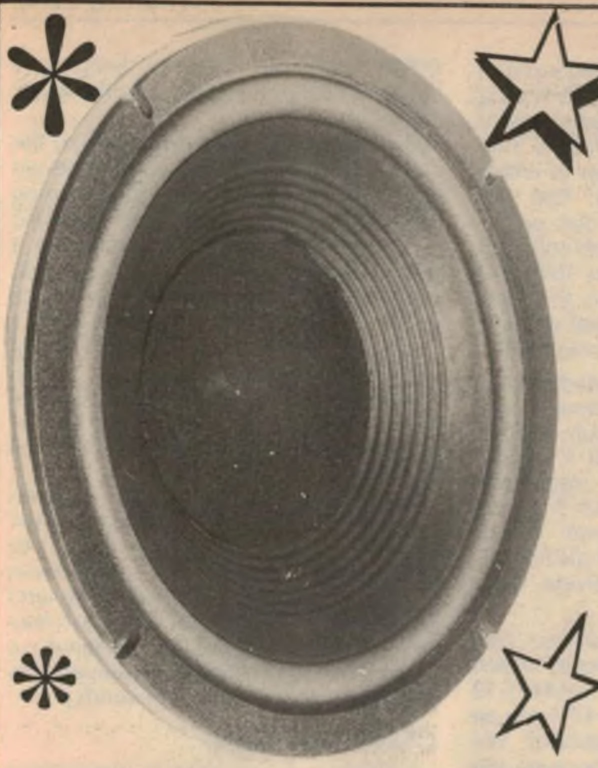
Vertical sync pulses from IC27c are NORed with horizontal sync pulses from IC20d by IC2b, generating a combined sync pulse. Both the graticule video signal and the "waveform" video signal are blanked by the combined blanking pulse from IC21b. The blanked outputs from IC23c and IC23d are resistively mixed via 6.8kΩ and 22kΩ resistors. The higher value 22kΩ resistor is used for the graticule signal so that it provides a light background display.

Sync pulses are also combined via a 6.8kΩ resistor from IC23b and a 3.3kΩ

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

$110

including sales tax.



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resistor to ground. This composite video signal is next buffered by Q1 which is a BC548 in emitter-follower configuration. The low output impedance of this stage is suitable for directly driving the video input stage of a TV set via the 47μF coupling capacitor or it can drive an optional VHF modulator for which provision has been made on the board. The suggested modulator is type UM1082 from Dick Smith Electronics.

The only circuits which remain to be discussed now are the input amplifier, trigger circuit, ramp generator and power supply.

Input to the CRO is via switch S6 which passes the signal direct for DC coupling or via a 0.47μF capacitor for AC coupling. This is followed by a 1MΩ potentiometer which provides input attenuation. The wiper of the pot goes to the input of IC24c which is one quarter of a TL074 quad BI-FET op amp arranged as a non-inverting amplifier. Gain of the stage is set by the voltage divider ratio of the 22kΩ and 1kΩ resistors to 23.

One feature of this amplifier is that, instead of the 1kΩ resistor being returned to earth it goes to the output of IC24d, another op amp. This stage provides the shift function by adding a DC offset to the amplifier. The shift control itself is simply a potentiometer swept between +12 and −12V, attenuated via 220kΩ and 10kΩ resistors, filtered by a 0.1μF capacitor and then buffered by IC24d.

The trigger circuit uses one comparator from an LM339 quad comparator package, IC26. The amplified input signal from IC24c goes to the inverting input of the comparator while the non-inverting input goes to a 10kΩ potentiometer swept between earth and 5V. This "trigger level" pot sets the voltage at which the comparator with toggle. The 1kΩ resistor on the output is a pull up required because of the open-collector output of the comparator. The 10kΩ and 220kΩ resistors connected to the non-inverting input provide a small amount of positive feedback to improve stability.

Power for the unit is obtained from a 15V centre-tapped transformer which feeds a full-wave rectifier circuit, 1000μF capacitor and an LM340T-5 three-terminal regulator. The regulator provides a 5V supply to the TTL and CMOS circuits. 10μF and 0.1μF capacitors on the output are distributed around the board to provide high frequency decoupling.

The transformer also drives two identical voltage-doubler circuits which both provide +17V into an LM340T-12 positive 12V regulator and −17V into an LM320T-12 negative 12V regulator. We have used doubler circuits because the ±12V supplies require very little current.

Ramp waveforms are obtained from IC24a and IC24b, both BI-FET op amps. IC24a is a standard ramp circuit with the non-inverting input grounded and the inverting input connected effectively to a −1.1V source via the 10kΩ and 1kΩ voltage divider. Since the op amp will adjust its output so as to keep the inverting input at the same voltage as the non-inverting input (virtual earth) the output will rise linearly, keeping a constant charging current into the 4.7μF capacitor.

The ramp must be synchronised to the vertical sync of the video circuits, so we have a simple resetting circuit using transistor Q2. This transistor is switched on by the vertical blanking pulse via a 10kΩ current limiting transistor and, when switched on, pulls the positive side of the 4.7μF capacitor to ground while a 1N4148 diode on the other side of the capacitor clamps it to ground (or −0.6V), causing the capacitor to discharge ready for a new ramp. The 1kΩ resistor on the output of the op amp isolates it from the transistor.

Output from this stage is the R+ signal and this is delayed via a 10kΩ and .001μF capacitor and buffered by IC24b to generate an R− ramp. Due to variations in offset voltages of the op amps and comparators, the .001μF capacitor may have to be altered to achieve a reasonable trace width. (Increasing this capacitor increases the line width.)

CONSTRUCTION

Well that finally covers the circuit description (phew!). The construction is certainly a lot easier and involves mounting most of the components on one doubled-sided PC board labelled 82cr1 and measuring 190 × 146mm.

While the PC board is double sided it does not have plated-through holes, considerably reducing cost. The plate throughs are replaced by pin throughs, ie, IC pins or component leads are used to achieve a connection from one side of

PARTS LIST

1 PC board, 82cr1, 190 × 146mm
1 Horwood instrument case, 305 x 232 x 78mm
1 2155 mains transformer
1 UM 1082 TV modulator
1 1-pole 12-position rotary switch
6 SPDT miniature toggle switches
1 momentary contact pushbutton
1 10kΩ linear potentiometer
1 100kΩ linear potentiometer
1 1MΩ linear potentiometer
1 8MHz crystal
1 panel mounting RCA socket
1 BNC socket
4 plastic board supports
1 3-way mains terminal strip
1 mains cable and plug
1 cable clamp and earth lug
4 rubber feet
½ metre of 10-way rainbow cable
½ metre of shielded audio cable
1 68uH RF choke

SEMICONDUCTORS
4 74LS163 synchronous binary counters
2 74LS158 quad 2-to-1 demultiplexers
2 2114 RAM (200ns access time or better)
1 81LS95 octal Tri-state buffer
1 DM2502 successive approximation register
2 DAC0800 D-A converters
1 74LS32 quad OR gate
2 74LS74 dual D flipflops
1 LM361 fast comparator
1 LM319 dual fast comparator
1 LM339 quad comparator
1 4520B dual binary counter
1 4023B triple three-input NAND gate
2 4001B quad NOR gates
2 4011B quad NAND gates
1 4040B ripple counter
1 TL074 quad BI-FET op amp
1 74LS04 hex inverter
1 LM340T-12 regulator
1 LM340T-5 regulator
1 LM320T-12 regulator
2 BC548 NPN transistors
1 6.8V 400mW zener diode
6 1N4002 diodes
1 1N4148 diode
2 green LED bezels
1 red LED bezel

CAPACITORS
1 1000μF 16VW PC electrolytic
2 470μF 16VW PC electrolytic
2 220μF 25VW PC electrolytic
1 47μF 16VW PC electrolytic
3 10μF 16VW PC electrolytic
2 10μF 10VW PC electrolytic
1 4.7μF 25VW PC electrolytic
1 0.47μF 400VW greencap
13 0.1μF ceramic or greencap
2 .01 μF greencap
2 .001μF greencap
1 68pF ceramic or polystyrene
1 47pF ceramic or polystyrene

RESISTORS (all ¼W 5%):
2 x 220kΩ, 1 x 100kΩ, 2 x 22kΩ, 5 x 10kΩ, 2 x 6.8kΩ, 5 x 4.7kΩ, 1 x 3.9kΩ, 1 x 3.3kΩ, 2 x 2.2kΩ, 1 x 1.5kΩ, 5 x 1kΩ, 7 x 470Ω, 1 x 100Ω, 1 x 47Ω

NOTE: THE "B" suffix on a CMOS part number indicates a buffered device. Where specified these devices must be used.

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* 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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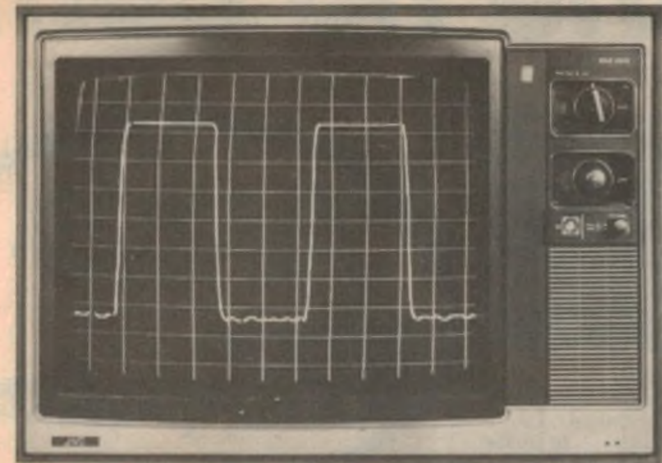
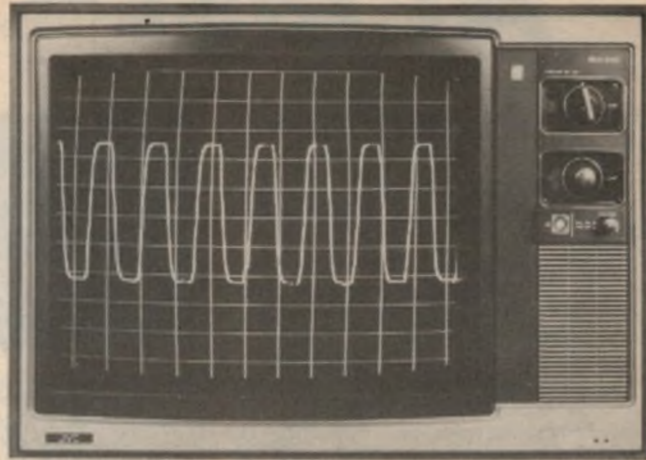




These two photographs show a 6kHz square wave signal (left) and a 17kHz square wave signal (right).

the board to the other. Hence, if there is a pad on the top of the board it must be soldered to, as well as the pad on the bottom. In the case where there is no component lead or IC pin, a short length of wire must be soldered in and then cropped close to the board.

The first step in construction is to mount the ICs, resistors and capacitors using the component overlay diagram shown elsewhere in this article as a guide. Make sure that the ICs, diodes and electrolytics are correctly oriented and take the usual precautions against damage to the CMOS ICs due to static electricity, ie, use an earthed soldering iron and solder the supply pins first, pins 7, 14 or pins 8, 16. Solder the leads to the pads on the underside of the board as well as those on the top of the board. If you wish to use IC sockets, then we would recommend using Molex IC pins.

We housed our unit in a Horwood Instrument case with black Marviplate sides and aiuminium front and back panels and measuring 305 x 232 x 78mm. Drill mounting holes for the PC board, transformer, terminal strip, etc, using internal photographs of our unit as a rough guide. Mounting holes for the front panel controls can be obtained by using a photocopy of the actual size artwork for our front panel. If you wish to use a Scotchcal front panel then this can be affixed directly and the panel drilled.

Some tips for those unfamiliar with Scotchcal panels: the panels can be cut to size by just scoring along the border with a sharp utility knife and bending the panel back and forth along the line to obtain a clean break. Care should be taken when affixing the panel as once it is stuck, it is impossible to remove in any worthwhile condition. Always drill or file from the Scotchcal side of the panel, being careful not to lift it.

Install the front panel controls, LEDs and sockets and mount the PC board in the unit using Richco plastic board supports or tapped brass spacers. The board can now be wired to the controls using rainbow cable. For neat connections and ease of servicing we would recommend that PC stakes be used on the board.

LED bezels on the front panel are wired as shown on the wiring diagram but note that 470Ω resistors must be wired in series with either the anode or cathode lead of the LEDs.

The mains cable should enter the unit via a grommeted hole and be securely clamped near the entry point. The earth wire should be secured to the case directly using a lug and the active and neutral wires terminated in an insulated terminal strip. Wires to the transformer primary and the power on/off switch should be mains-rated cable and any exposed lugs or terminals on the switch or transformer covered with spaghetti or insulation tape.

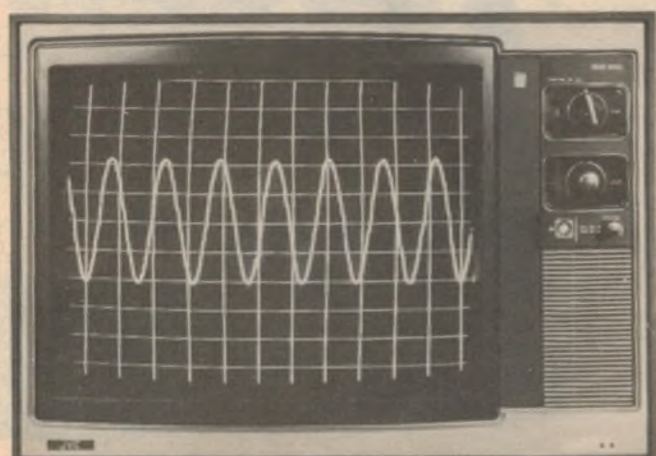
If direct video connection to the TV is desired, then an RCA socket should be installed on the back panel and connected to the video output on the board.

If you are using the VHF modulator instead of direct video then use a 75Ω coaxial TV cable such as RG-58 with an RCA plug on one end, which connects to the socket on the modulator, and a Belling Lee line plug on the other for connection to the 75Ω aerial input on the TV. Some older sets do not have a 75Ω aerial input and in this case it is necessary to use a 75Ω to 300Ω balun.

At this point it is worthwhile going over the PC board again and carefully rechecking the orientation of the ICs, diodes and electrolytics and check that all the pads on the top of the board have in fact been soldered. Also check for solder bridges or cold solder joints; these are the most common faults.

After making the appropriate connections to the TV and switching on, connect an audio oscillator to the input and switch HOLD/RUN to RUN, ONE-SHOT/CONTINUOUS to CONTINUOUS and adjust the shift, attenuator and trigger level to obtain a trace. Note the green LED above the trigger level indicates that the unit is triggering.

FOOTNOTE: Full sized PCB and front panel artworks for this project have not been published in order to save space. Finished PCBs and front panels are available from the usual retailers (see back page), or you can buy transparencies through our Information Service.



LEFT: An 18kHz sine-wave signal. Non-linearities in all the waveforms shown are due to quantising errors. These could only be cured by much faster sampling in the A-D and D-A process.

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With the release of the MicroBee, Applied Technology brings you a state of the art computer you can build yourself. MicroBee is unique among kit computers in its price range. It offers facilities which make it comparable to machines costing 2 to 4 times its price. Brilliant, cost effective design and new technology have come together to make this machine possible.
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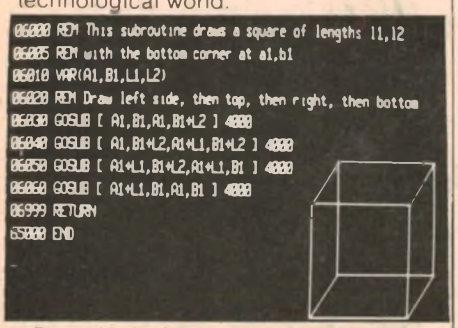

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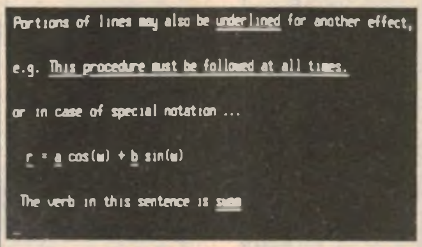

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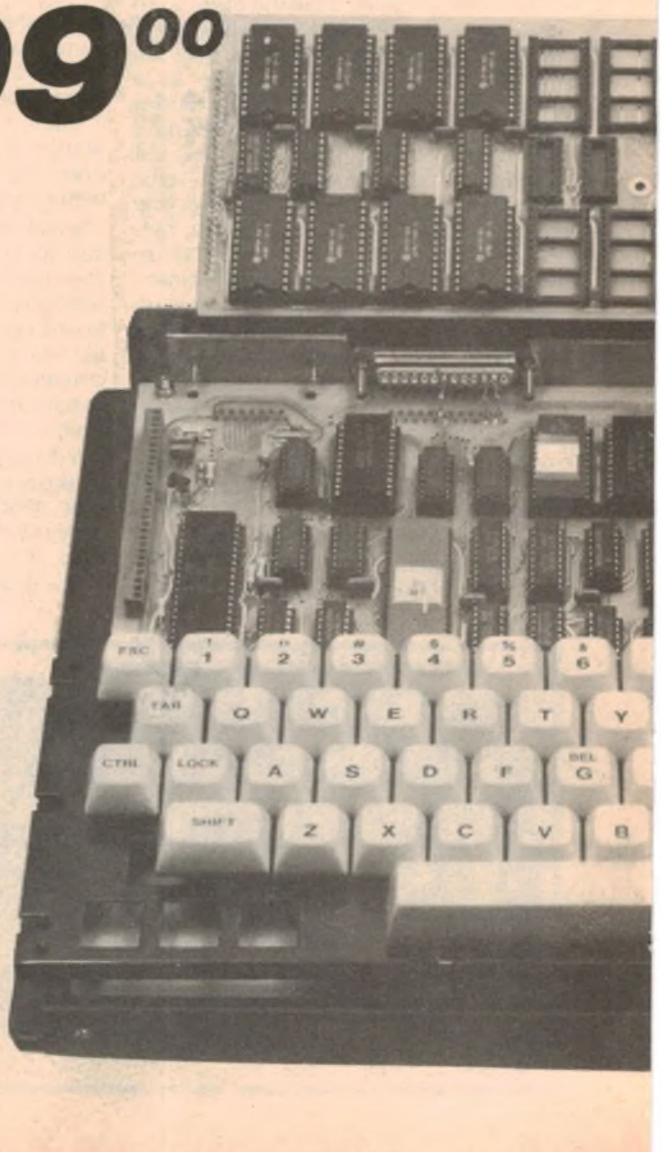

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Keyboard	Full size 60 key QUERTY standard layout.
Cassette Interface	Interface loads and saves at 300, 1200 BAUD.
Serial Interface	RS232. With connector. Suits printers, modems etc.
Parallel Interface	Optional 8 bit I/O. Fully programmable.
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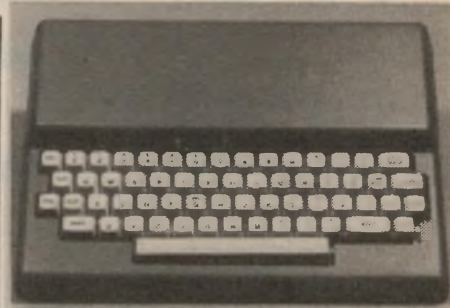

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We review Tandy's new Colour Comp

Combine colour graphics, music making, a powerful Basic interpreter and the advanced 6809 microprocessor and the result is the perfect computer — almost. Tandy's new TRS-80C Color Computer is an exciting machine — a hint of things to come and a sophisticated, readily available computer system for hobby and home use.

by PETER VERNON

Fast, easy to use colour graphics are the principal attraction of the Color Computer. Other features, such as the in-built sound generator, powerful 6809E microprocessor and an advanced Basic are also strong points. The result is an exciting prospect for the hobbyist and casual computer user.

For the non-programmer "Program Paks" plug into the machine to provide pre-written applications programs for games, personal book-keeping and education. Experienced programmers will appreciate the speed and convenience of "Extended Color Basic" and the power of the 6809 processor.

In appearance, the Color Computer is neat, compact and certainly not intimidating. It is packaged in Tandy's familiar grey plastic, in a console measuring 370mm x 350mm x 88mm (width x depth x height). A 53-key keyboard occupies the sloping front section of the console. On the right side is a slot for plug in program cartridges, and at the rear are connections for video, cassette recorder, two joysticks and an RS-232C serial port, in addition to the power switch and reset button. Power supply components are inside the console, so there is no separate transformer pack.

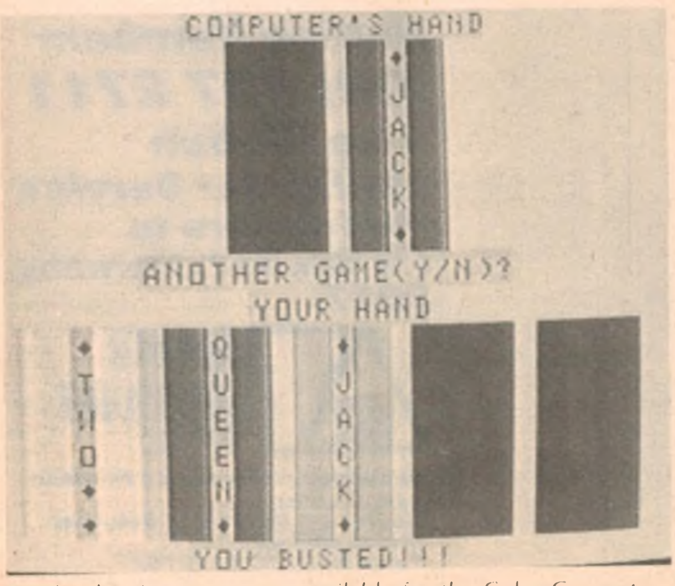
The keyboard of the Color Computer leaves something to be desired. The fully moulded key caps of the other Tandy machines have been replaced by square plastic buttons with the feel of calculator keys. On the plus side, the keyboard conforms to the standard "qwerty" lay out, for the alphabet at least. Some of the punctuation symbols are in unusual positions, and the "clear" key is adjacent to "Enter", so it is easy to inadvertently clear the screen instead of entering a line into a program. There are no shift lock or repeat keys, and the control key doubles as the down arrow.

The video display is very good, even within the limits imposed by a VHF modulator (there is no direct video output). A switch on the rear panel selects output on VHF Channel 1 or Channel 0, and since the machine is shielded to FCC Class B requirements (home computing devices) processor interference with the display is non-existent. Nor is interference with the neighbour's TV likely to be a problem.

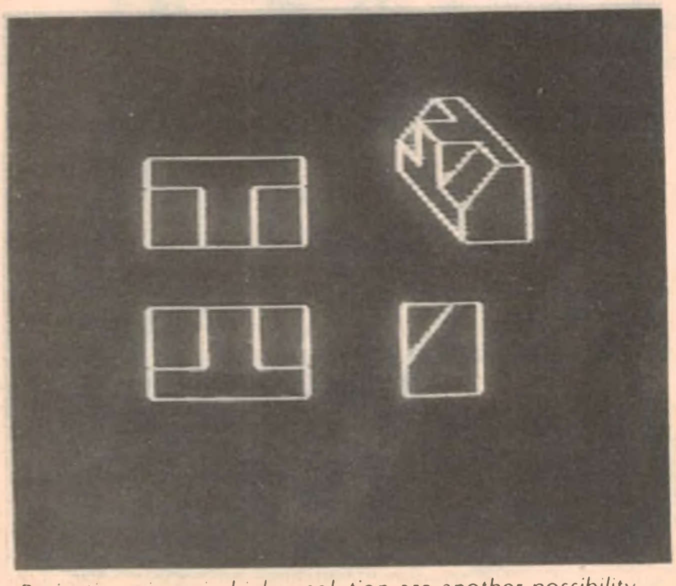
Text display is black on a green background, formatted as 16 lines of 32 characters each. There are no lower case characters as such. Entering lower case characters (by pressing the shift key) results in an upper case letter which is displayed in inverse (green on black). When output to a printer, these inverse characters will be printed as lower case. One small point is that the zero is not slashed (0), leading to slight difficulty in distinguishing it from the letter O.

COLOUR GRAPHICS

Displays are in eight colours plus black. Using non-extended Basic, graphics commands are similar to those of the TRS-80 Model 1, Level II. Graphics are created on a 64x32 grid, and are used with the SET and RESET commands familiar to users of Level II. Graphics block



Blackjack is just one game available for the Color Computer



Projection views in high resolution are another possibility

S

uter


Shown above is the Color Computer console, games cartridges and manuals. The display is a standard PAL receiver, showing "Dinowars" in action.

characters are also available in this mode. Of course, SET allows points to be in any of the eight colours available, with the restriction that points formed within the same character cell must be the same colour.

The Color Computer is available in two versions, Extended and Non-extended. The "extension" referred to is in memory size and programming facilities provided, as the hardware of the two versions is identical. It is in fact possible to upgrade a non-extended machine by fitting extra memory and new ROMs (Read Only Memory which contains the Basic interpreter).

Colour graphics are available in various combinations of colour range and screen resolution, and depend on the amount of memory available. In both versions of the machine, 12 different graphics modes are available. The difference is that non-extended Basic supports only one graphics mode, while extended Basic supports five modes. Other graphics modes are available by manipulating the registers of the display generator IC, either with machine language subroutines or Basic POKE statements.

So far there is no difference from Level II Basic except for the colours. Readers who have attempted to form detailed graphics on the TRS-80 Level II will appreciate the difficulty of using SET and RESET repeatedly in a program, and will know of the low speed of this function. The really exciting features of the TRS-80 Color Computer appear when Extended Color Basic is used.

Extended Color Basic divides the available video memory into eight pages of 1536 bytes each. In the highest resolution mode 256 (horizontal)x192 (vertical) points are available, in two colours. This mode uses four pages of the video memory for each screen display, a total of 6144 bytes. In medium resolution the grid size is 128x192, with a four-colour mode which uses four pages of video memory and a two-colour mode use using two pages. Lowest resolution is 128x96, with four colours using two pages and two colours using one page of video RAM. The unused pages are available for use as alternate screens which can be displayed on command. One screen can be updated while another is being displayed, making a limited form of animation possible.

Either black and green or black and buff are available in the two-colour modes. The four-colour modes offer colour sets of either green/yellow/blue/red or buff/cyan/magenta/orange. Only the lowest resolution 64x32 graphics let you use all eight colours at the same time from Basic.

The colour and resolution combination of Extended Color Basic require some study and practice to make the best use of the potential available. Generally, creating any graphics display involves compromises between the graphics resolution, the number of colours displayed at one time and the amount of memory dedicated to the display.

In Extended Color Basic the various graphics modes are selected by the statement PMODE followed by the number (0-4) of the mode you wish to use. Choosing the colour set is done by the SCREEN statement, which takes the form SCREEN X, Y. X is set to 0 for text mode and 1 for graphics, while Y chooses the colour set.

The COLOR command instructs the computer to use the specified colours for the background and foreground. The specified colours must be in the allowable colour set for the graphics mode being used.

Text and graphics cannot be mixed on the same screen except for the low resolution 64x32 SET and RESET statements. This is a definite handicap. Selecting a text display means that the graphics vanish from the screen and vice versa. Whenever a program outputs any information, the display automatically reverts to the black on green text mode. This means, for instance, that graphs cannot be labelled or results printed in tabular form at the same time as pictorial representation is created. It also means that the powerful TRON command is of no use in graphics programs, as printing out the number of the line being executed is incompatible with displaying the results of the program.

A Motorola 6847 Video Display Generator handles the colour display for the computer. This chip can be accessed directly by the programmer, allowing even more possibilities for the video display. With appropriate programming, eight colours can be displayed with a resolution of 64x192, or four colours with a resolution of 128x128. In the manual "Getting Started with Color Basic" programs are provided to illustrate all of these possibilities. All told, there are 12 graphics modes available, rather than the five supported by Extended Color Basic.

Any hobbyist with an interest in computer graphics could spend quite a bit of time exploring the full potential of the Color Computer.

GRAPHICS STATEMENTS

Once the colour and graphics modes are set, creating graphics displays is easy. It is possible to use the PSET and PRESET statements, but the 49152 graphics points available in high resolution would make this a time consuming task. Extended Color Basic makes it easy with statements such as LINE, CIRCLE, PAINT, GET and PUT.

LINE draws or erases a line between specified start and endpoints, or if a start point is not specified, draws a line from the last end point used to the new endpoint. It will also draw a rectangle, using the two points specified as the diagonally opposite corners. Another variation fills the rectangle with the foreground colour currently in use. And that's just one statement!

CIRCLE draws a circle centred on a specified point with a radius specified in the same statement. The height/width ratio of the circle can also be specified for drawing ellipses, and parts of the circle can be drawn selectively to produce curves and arcs. Colour of the circle can also be set by this statement.

Another powerful feature is the DRAW statement, which draws a line with the direction, angle and colour specified by the user. These specifications are in the form of a string, and can be used as follows:

```
A$="BM128,96;U25;R30;D25;L30"
DRAW A$
```

BM moves the point to 128,96 without drawing a line. U,R,D and L draw lines up, right, down and left respectively. Other parameters can be specified for lines at an angle, or a relative offset can be added to the Move parameter. "Sx" in a string sets the scale of the drawing, so the same shape can be magnified or reduced.

PAINT fills an area on the screen with a specified colour, starting at a point selected by the programmer and ending when it meets a boundary of another specified colour. It is used for filling areas of the screen with colour, shading line drawings, etc.

GET allows the graphics display within a specified rectangle on the screen to be stored in an array, while PUT uses the array to redraw the graphics, perhaps in a different area of the screen. With PUT, logical operators AND, OR and NOT allows two or more graphics images to be combined in a number of ways.

All of these statements execute very quickly, with lines and circles appearing on the screen almost instantaneously. PAINT is a lttle slower, but even so a large area can be filled with colour in only a fraction of a second.

In the highest resolution, two-colour mode there is considerable "smearing" of the colour signal when using the black/buff colour combination due to the bandwidth limitations of the modulated video signal. This produces a constantly changing colour jitter which is quite pretty, but hardly the thing for fine detail line drawings. For this reason, the two-colour high-resolution graphics mode is not the best for all purposes.

Another view of the computer, with a Program Pak in place. Joysticks are an extra.

SOUND EFFECTS

Colour displays can be greatly enhanced by sound, and the Color Computer also has a music capability, giving a five-octave range of notes with durations programmed in increments of 0.06 seconds. Color Basic (non-extended) supports this hardware with the SOUND statement, which controls frequency and duration only. Extended Color Basic has the more comprehensive PLAY statement, which allows programming of notes, octaves, note duration, pauses and volume through the use of a single string of parameters. Notes can be specified with a numeral from 1 to 12 or the notes themselves, C to B including sharps and flats. Duration can be varied widely and 31 volume settings can be programmed.

The sound generator itself is monophonic, so chords cannot be played. At the higher frequencies, some switching noise is evident which detracts from the purity of the tones played. Even so, the sound capabilities are a useful addition to the computer.

Apart from its special graphics and sound functions, Extended Color Basic is similar to Tandy's Level II Basic. Some differences show up in Input/Output commands. Since Color Basic uses device numbers for I/O operations (0 for the keyboard and video display, -1 for the cassette and -2 for the printer), OPEN, CLOSE. INPUT and EOF (end of file) statements are available. Outputting data to a printer is done by PRINT-2, not LPRINT, although the LLIST statement is available for printing program listings.

Cassette operations are also improved over Level II. Programs can be saved and loaded by name, with up to eight characters in the name. Also provided is a SKIPF command (Skip until Found) which instructs the computer to search a tape looking for a specified program. This command is very convenient for listing the contents of a tape.

Extended Color Basic also provides a DLOAD command, which allows Basic programs to be loaded at either 300 baud or 1200 baud, and CSAVEM and CLOADM, which allows machine language programs to be saved and loaded from cassette.

The cassette recorder routines have an interesting twist. Firstly, sound generated by the computer is input to the television set, and is heard over the set's loudspeaker. Both Color Basics include the statements MOTOR ON and MOTOR OFF for control of cassette recorders, and the statement AUDIO ON, which connects the sound from the cassette tape to the television's loudspeaker. One use of this feature is illustrated in the Color Basic manual — recording and replaying a spoken message under computer control.

Non-extended Color Basic has a USR statement for calling machine language routines, while Extended Color Basic has USR n, where n is between 0 and 9. A user call gives control to a machine language routine at a starting address previously defined by the corresponding DEF USR n statement.

Additional features include a TIMER statement. Circuitry inside the computer counts in 1/60th second increments (from 0 to 65535 in about 18 minutes). The statement PRINT TIMER will return the current value of this count, while TIMER=xxx will initialise the timer to a specified value. It is thus easy to build time limits into programs for games and quizzes, and to produce accurately timed motion on the screen.

Extended Color Basic also supports the use of hexadecimal and octal (base 8) constants in a program, and includes the statement HEX$, which will return the hex value of its argument.

Editing commands in Extended Color Basic are extensive, allowing characters to be inserted and deleted from program lines, lines extended and generally hacked about. Also useful is the RENUMber

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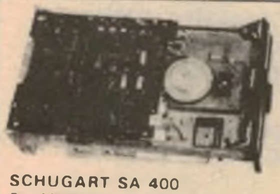

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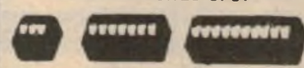

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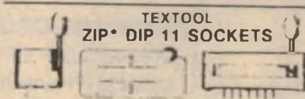

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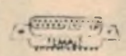

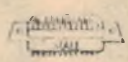

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IN4148	5c	4c
IN5404	30c	25c
IN5408	35c	30c
IN4007	12c	11c

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HS4 — 225mm	8 10	7 60	7 10	5 90	4 50	4 30
HS5 — 300mm	8 90	8 40	7 90	6 50	4 90	4 60
Unanodised						
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command the DElete feature, which allows sections of programs to be selectively deleted.

One of the limitations of the Color Computer is its relatively small memory. A memory map in the manual "Going Ahead with Extended Basic" reveals that with eight pages (12288 bytes) reserved for video memory (the maximum amount, equivalent to two high resolution screens), there are only 2559 bytes left for storage of programs and variables in a 16K machine. Extended Basic is quite a memory efficient language, so a lot can be done in the space available but nevertheless, there is a need for more programmable memory.

Maximum memory possible is 32K, since the Basic interpreter, program cartridge space and Input/Output vectors occupy the upper half of the 64K address space of the processor. Tandy offer a 32K RAM kit for $249, not including the "required installation charges". Note that if you install the kit yourself (or even open the computer console) you void the 90 day warranty on the machine.

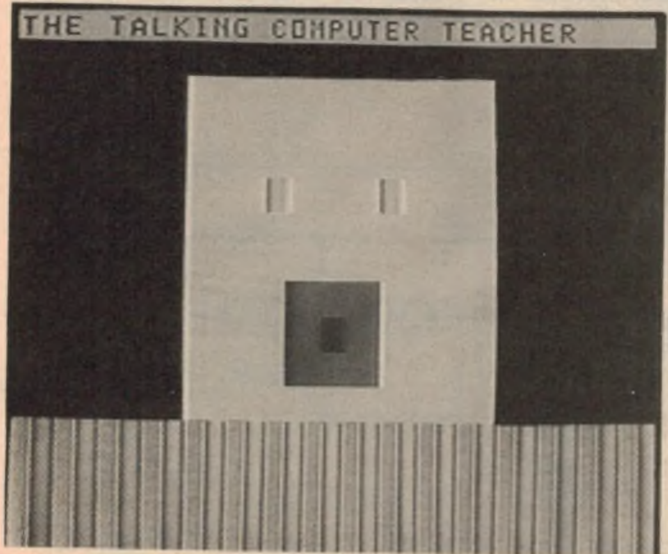
Other short-comings are the absence of parallel ports and the complete absence of any expansion bus for the addition of peripherals made by other manufacturers. This is in keeping with Tandy's policy that users of their computers be restricted to peripherals which are also manufactured by Tandy.

Up to four 14cm disk drives can be added to the Color Computer. The disk controller software comes in a cartridge which plugs into the machine, allowing the full 156K byte storage capacity of each disk to be used for programs or data. The first disk drive will cost $699, with additional drives for $499 each. Cost of the first drive includes the ROM cartridge and a cable for connecting two drives to the system. A serial printer/plotter will also be available for use with the Color Computer.

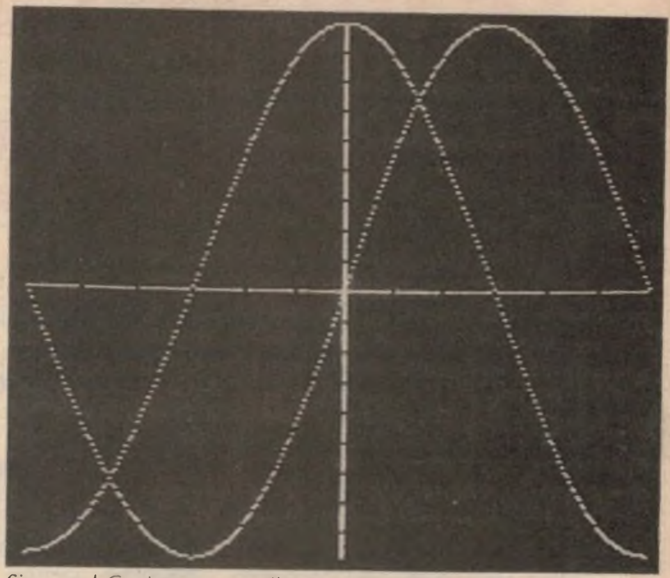
Manuals for the TRS-80 Color Computer are to Tandy's usual high standard, clear, informal and very readable. The material is well organised, and many sample programs are provided to lead the user step by step through the features of the computer. No circuit diagrams are provided, but the operating manual does provide pin-outs of the joystick and cassette connections.

A range of software is available in "Program Paks" which slot into the side of the Color Computer. We looked at several offerings, mostly unimpressive. Quasar Commander, for example, uses the joysticks to move sighting cross hairs around on the screen, and the firing button on the joystick to fire at enemy space ships. Considering the potential of the computer, the graphics of this game are poor, and sound effects are unimaginative. This program cartridge lists for $59.95.

More effective is "Dino Wars", in which two players battle it



"Talking teacher" is one of the educational programs available.



Sine and Cosine curves illustrate graphics capabilities.

out with graphic dinosaurs controlled by the joysticks. Realistic yelps and growls help this game along, and the graphics are good, but again, at $59.95 it is expensive.

"Color File" is a tape based computer filing system, intended for keeping inventories, appointments, mailing lists, etc. It works well, with menus appearing during each stage of use and single letter commands to activate each section of the filing system. This is perhaps the most useful of the programs.

We also tried out the Music program. Musical notation is displayed on the screen with bass and treble clefs. By using various keys, notes of whole, half, quarter and eighth notes can be positioned in each stave, together with rests and slurs. When a tune is composed it can be played on the computer's sound generator. Unfortunately the limitations of the sound hardware were most obvious when using this program. Catalogue price is $49.95.

Other cartridges available include a diagnostic ROM for testing memory, Football (American-style), Checkers, Chess, Backgammon, a Typing Tutor, Pinball, Personal Finance, A Color Computer programming tutorial, and Color SCRIPSIT – a menu driven word processing program.

The typing tutor is a useful program, giving a graduated series of exercises for letters, words and numbers, keeping track of the development of typing speed and the number of errors made. However because of the way the Color Computer keyboard differs from a conventional typewriter, this program alone would not suffice to teach all aspects of typing. This seems to be confirmed by the manual for the program, which details these differences, adding "which you should be aware of if you ever plan to use a standard typewriter".

Cost of the Color Computer with non-extended Basic and 4K of RAM is $599, with the instruction manual an extra $9.95. Two joysticks add $39.95 to this price, and a cassette recorder and cable is a further $69.95.

To convert from non-extended to extended Color Basic, a 16K RAM upgrade kit is available for $59.95, and the ROM kit is available for $180, not including installation charges. A fully extended, 32K machine is available for $1099.

All of these prices are for the computer only. A colour television set is also required, if you don't already have access to one, or if other members of the family would rather watch "Playschool" instead of your programming efforts.

The perfect computer? Well, almost . . . After all, the worth of a computer is in how well it fulfills the user's requirements. If you want a compact, relatively inexpensive colour graphics system for home or hobby use, the TRS-80 Color Computer has a lot going for it.

Cudlipp Cricket: the electronic bug

Bug your friends, office or home. This electronic insect-like gadget is completely harmless to humans but is sure to gain a lot of attention as it reacts to every sound that you make. We have named it "Cudlipp".

by COLIN DAWSON & LEO SIMPSON

"Where did you get such a crazy name as 'Cudlipp'?" you might ask. Well, why not? Cudlipp is an electronic novelty, so he has a whimsical name.

It is probably better not to refer to Cudlipp the electronic cricket, as a bug. After all, the word "bug" has nasty, emotive connotations. And while Cudlipp may be similar to eavesdropping bugs, Cudlipp is intended to draw attention to itself whereas the usual eavesdropping variety is not. No, Cudlipp is meant to be fun. You can make him up to look very "insect-like" and he will function as an excellent conversation piece.

So what does Cudlipp actually do? He responds to every brief sound with a short "cricket-like" chirp. If you shut up, he shuts up. If you make a noise he makes a noise. If you make a long and continuous racket, he will accompany you with a continuous series of chirps. And whenever he chirps, Cudlipp flashes his two LED eyes in a most fetching manner.

In this sense Cudlipp is quite unlike an ordinary "real life" cricket which makes its incessant chirping until you come to investigate and wreak possible vengeance. Then it lies "doggo" and you've Buckley's chance of finding it and bashing it insensible.

So if you're the unwitting victim of Cudlipp or his many brothers (and we are sure that many people will be when this article is published), his chirping and eye-flashing will lead you unerringly to his hiding place where you may, if you really wish, disable him harmlessly by disconnecting his battery (which would be sad).

Cudlipp listens to the outside world by means of an electret microphone and its tail produces its incessant chirping response by means of a crystal earpiece.

Actually, this project was first featured in the December, 1981, issue of the American magazine "Radio-Electronics". Their original version used some parts which are unobtainable in the land of Oz, so we took their intriguing little beastie and mutated it for local conditions.

Circuit Operation

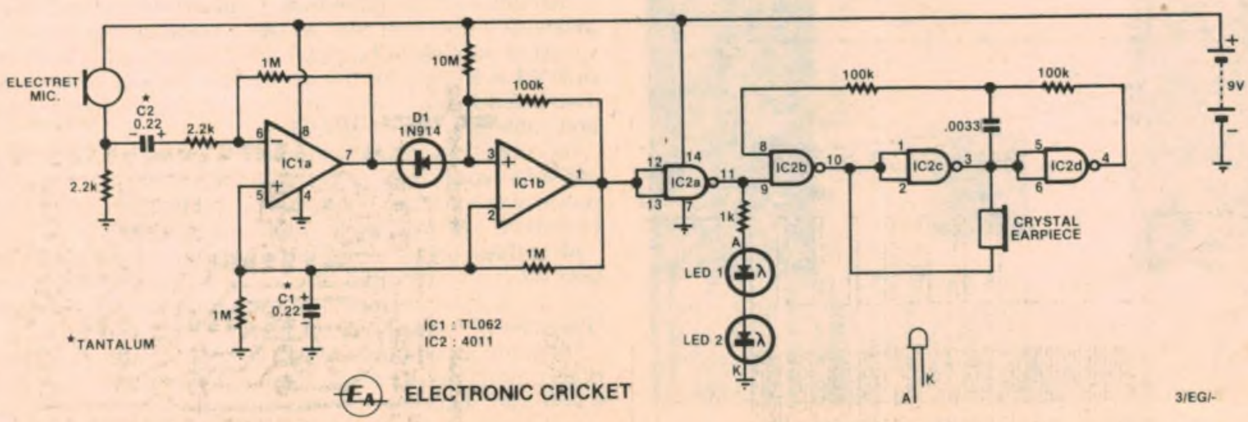
The circuit is really quite ingenious and uses two op amps and a CMOS quad two-input NAND gate package. The two op amps are used in several modes as amplifier, comparator and oscillator while the CMOS package forms a simple gated oscillator. IC1 is a TL062, a dual low-power FET-input op amp which is used principally because of its very low current drain, which is typically less than 0.5 millamps for the whole package.

There are two modes of operation. In the first, the electronic cricket listens for a noise via its electret microphone. In the second, the response mode, the microphone is effectively disconnected and the cricket emits a brief burst of "cheep" noise which is quite like a real cricket.

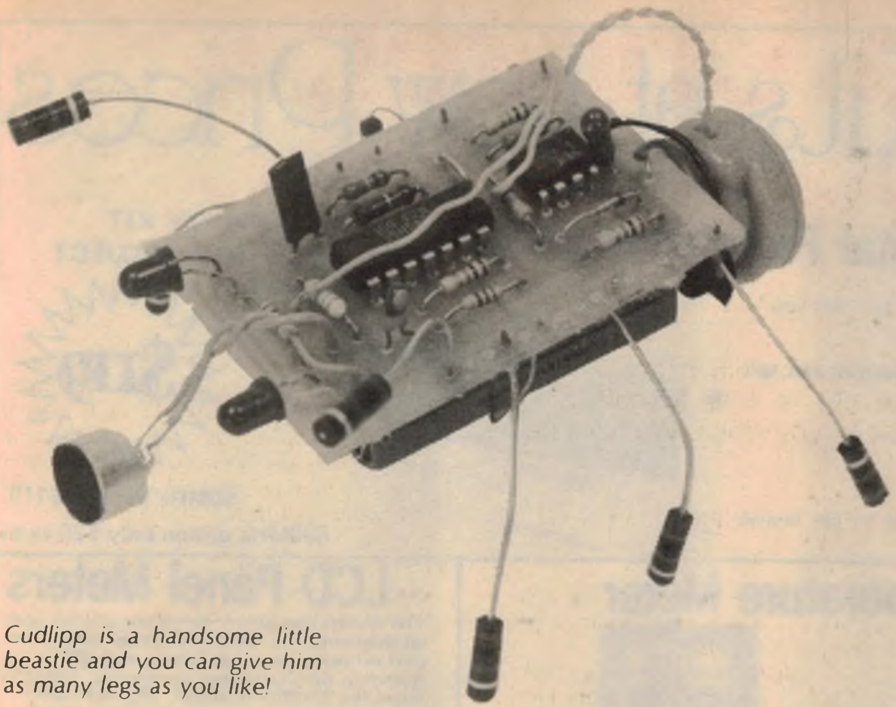
In the listen mode, IC1a functions as an inverting amplifier with a gain of about 450 for the electret microphone. The electret microphone is a conventional two-terminal model which has an internal FET acting as a buffer. The electret is fed from the 9V supply and drives a 2.2kΩ resistor which acts as a load for the internal FET. The signal from the electret is coupled to IC1a via a 0.22μF capacitor, C2.

IC1a is biased to the half-supply point by the voltage-divider consisting of two 1MΩ resistors, one of which is connected to the output of IC1b which is normally latched high, ie, at close to 9V.

The same voltage divider biases the inverting (-) input of IC1b while its non-inverting input is normally tied about 0.7 volts above the half-supply point by diode D1 and a 10MΩ and 100kΩ resistor. Thus, IC1b is a comparator which is latched high (as already mentioned) in the listening mode.



Cudlipp consists of two op amps (IC1a and IC1b) and simple CMOS gated oscillator (IC2).



Cudlipp is a handsome little beastie and you can give him as many legs as you like!

We estimate that cost of parts for this project is approximately

$12.50

including sales tax.

When the microphone "hears" a sound, the resulting signal is amplified by IC1a and fed to D1 which rectifies it. This tends to pull the non-inverting input of IC1b low and, if the signal is large enough, causes IC1b to change state, from high to low.

IC1 now enters the second mode whereby it produces a brief series of pulses from the output of IC1b. When IC1b first changes state, from low to high, it drops the voltage at its non-inverting input, pin 3, to a little less than 1V. The output of IC1b will then remain low until the inverting input, pin 2, drops below pin 3. And this is exactly what starts to happen as C1, the capacitor shunting the voltage divider which feeds pin 2 and pin 5, starts to discharge.

This does two things. First, because pin 5 of IC1a is now held below pin 6 (which is held at around 4V because of the charge remaining on C2), IC1a's output goes low and effectively ties pin 3 low via diode D1. Second, as C1 discharges it drops pin 2 just below pin 3 which causes IC1b to change state from low to high which enables C1 to begin charging up again. But since pin 3 is tied low by the output of IC1a, IC1b again changes state as soon as pin 2 goes slightly above pin 3.

So while ever the output of IC1a is forcing pin 3 low via diode D1, IC1b produces a string of pulses which are about 1.5 milliseconds long and about 22 milliseconds apart, ie, at a repetition rate of 45Hz.

The output of IC1a remains low until C2 discharges sufficiently to let pin 6 drop below pin 5. When this happens, IC1a's output goes high, which effectively stops pin 3 from being forced low. This means that as soon as IC1b again changes state from low to high, the oscillatory mode is stopped and normal bias is restored to pins 2 and 5 so that the circuit again reverts to the listen mode.

The length of the response mode is set by the time-constant formed by C2 and the associated feedback resistors around IC1a. So the duration of the train of pulses from IC1b is about 200 milliseconds.

CMOS Oscillator

By contrast with IC1, IC2 is quite a straightforward circuit. Three of the two input NAND gates are connected to form a conventional three-inverter oscillator which works in the following way. If the output of IC2a is high, then, since inverters 2b, 2c and 2d are in series, the input of IC2b, pin 8, must be low. The .0033μF capacitor now begins

Fig 1 (below) shows the waveforms produced at various points on the circuit as Cudlipp operates. At right is the component overlay, while below right is an actual size PC artwork.

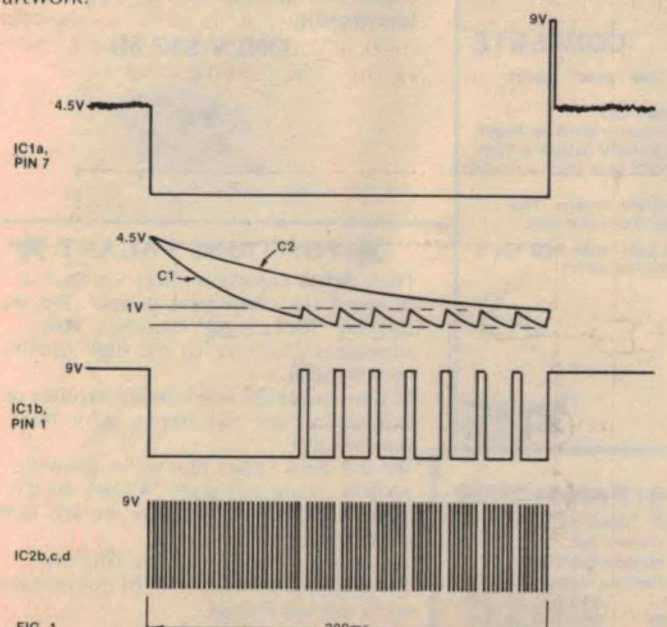
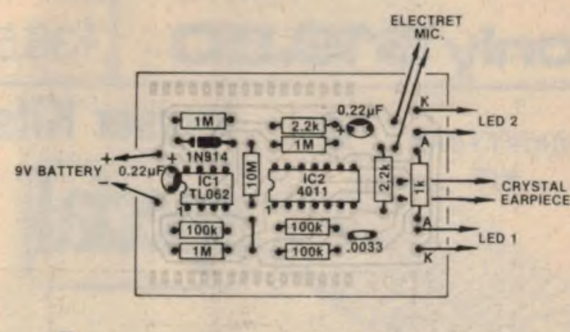
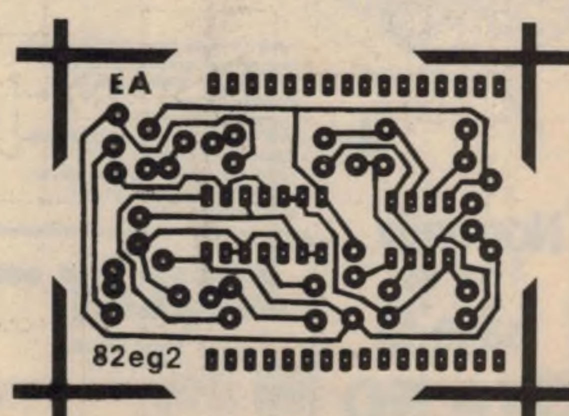


FIG. 1





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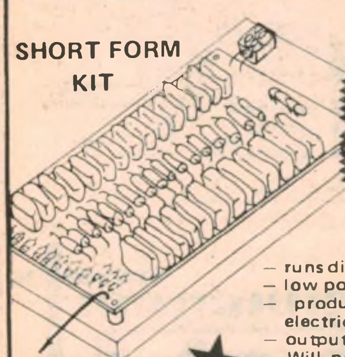

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to charge via the 100kΩ resistor connected to pin 4, until the voltage across it exceeds the threshhold voltage at pin 8, which causes all the inverters to change state and the capacitor then begins to charge in the opposite direction.

The natural frequency of the CMOS oscillator is about 1350Hz and this is enabled by IC2a which inverts the output pulses from IC1b. Thus, when IC1 is in the listen mode, the high output of IC1b disables the CMOS oscillator. When the output of IC1b goes low the oscillator is turned on, so that in effect, IC2 oscillates for about 200 milliseconds at 1350Hz during which it is turned off for 1.5ms every 22ms. Fig. 1 shows the waveforms.

The sound is emitted by a crystal earpiece which is connected across inverter IC2c so that it effectively has about 9 volts RMS applied to it during each chirp.

PARTS LIST

1 PC board measuring 61 x 43mm, 82eg2
1 electret microphone insert
1 crystal earpiece
1 9V battery, type 216 and snap connector
1 TL062 low current op amp
1 4011 quad two-input NAND gate
2 LEDs
1 1N914, 1N4148 silicon diode
2 0.22 tantalum capacitors
1 .0033μF metallised polyester capacitor (greencap).

RESISTORS
(¼W, 5% tolerance)
1 x 10MΩ, 3 x 1MΩ, 3 x 100kΩ, 2 x 2.2kΩ, 1 x 1kΩ
Plus assorted 1W resistors for decoration.

This may seem an unconventional and somewhat severe use for a crystal earpiece but remember that the alarm devices in all those clever digital watches uses the same sort of piezoelectric device and it does have a decided advantage in producing quite an audible noise for negligible current drain.

Finally, the two LEDs which form Cudlipp's eyes are driven in series via a 2.2kΩ resistor by IC2a, the same gate which enables the CMOS oscillator.

So, to sum it all up, the circuit uses just two ICs. IC1 functions as a microphone amplifier, dual comparator, oscillator and timer while IC2 functions as a gated oscillator and LED-cum-earpiece driver. What a clever little cricket Cudlipp really is!

Construction

Cudlipp is built on printed circuit board which measures 61 x 43mm and is coded 82eg2. The PC board carries all the components including the 9V battery which is slung underneath to form Cudlipp's belly.

Install the passive components first, taking due note of the polarity of the tantalum capacitors. Then install the LEDs and electret mic insert, again with due regard to polarity. Then wire in the earpiece, which should have the clear plastic ear insert removed to increase the sound output. Make sure that the earpiece you have is not a dynamic type which usually has a resistance of about 8Ω. The crystal type should measure open-circuit with a multimeter switched to the "ohms" ranges.

Finally solder in the two ICs, leaving the CMOS 4011 till last. When soldering this you should solder pins 14 and 7 first, with the soldering iron barrel connected to the 0V track on the PC board via a clip lead. When all is complete, check your work thoroughly and then connect a battery. You should now be greeted by a cheerful chirp every time you make a sound.

Is Cudlipp Stillborn?

If Cudlipp does not immediately spring to life when you connect a battery, you can give him a checkup in the following way. First, to check the CMOS oscillator, short pin 1 of IC1b to the 0V line. This should light the two LEDs and cause the earpiece to sound continuously, without any modulation. If not, there is probably something amiss with IC2.

Second, short the output of IC1a, pin 7, to the 0V line. This should cause IC1b to oscillate continuously and thus modulate IC2 which will give a slightly "burbly" sound from the earpiece. Finally, connect the junction of C2 and the 2.2kΩ resistor to 9V and the same sould should be produced. If this is the case, then you have checked all components except the microphone. If this does not work, check that you have not connected it the wrong way around.

Note that if you are unable to obtain the low current TL062 you may use the standard TL072 or TL082 Fet-input op amps from Texas Instruments or the LF353 from National Semiconductor, although these have a current drain which is about 10 times the figure for the TL062. To be specific, the typical current drain of the TL062 is about 0.5mA and that of the complete circuit in the listen mode is about 1mA. When in the response mode the current rises to about 9mA which is mainly due to the LEDs.

When the circuit is complete and going you can dress it up. Fit a wire sling underneath the PC board to hold the battery, remembering to place a sheet of cardboard between battery and PC board, to stop shorts. Then you can fit sundry 1W resistors to the PC board to provide legs and antennae.

We are sure that you will have a lot of fun with Cudlipp!

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.

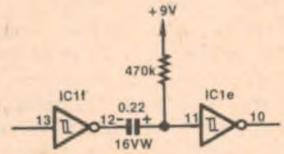
Using the Infrared Relay as a Door Minder

When operated from a suitable mains-sourced power supply, the Infrared Light Beam Relay, described in the April, 1981 issue of Electronics Australia, makes an excellent shop "door minder". Except that, in common with most such devices, it operates the buzzer continuously if a customer stands still in the beam.

Referring to the circuit of the receiver section, it will be seen that the signal is essentially direct-coupled between the output of the detector and the buzzer. If AC-coupling is introduced at an appropriate point in this signal path, the buzzer should only function for a brief period, determined by the time constant of this AC-coupling circuit. The most appropriate point to insert this coupling is between the output of IC1f and the input to IC1e. It will be necessary to return IC1e input to the 9V rail, so that Q5 will normally be held cut-off, so muting the buzzer.

To obtain a buzz period of about ¼ second, use a 0.22μF coupling capacitor in conjunction with a 470kΩ resistive return to 9V. Duration may be varied by altering the size of the coupling capacitor (larger capacitor longer time, smaller capacitor shorter time).

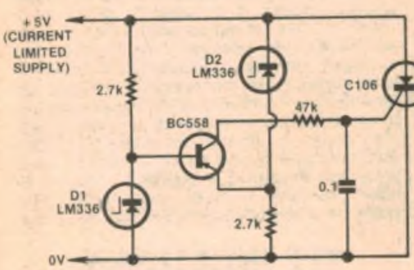
Implementation of this modification is very simple. On the copper side of the PC board, cut the track between pins 11 and 12 of the IC. Cut the leads of a



0.22μF tantalum capacitor short, and solder it across the severed track, with the +ve electrode to pin 11. Shorten the leads of a 470Ω, ¼ watt resistor and solder it between pin 11 and the track (9V) running to pin 14.

W. Pearce,
Croydon, NSW.

Simple Crowbar Protector



When working with TTL circuits and bipolar processors, an easily implemented overvoltage protection circuit can save costly replacements in the event of excessive supply voltage. The following circuit was designed to provide a simple solution to this requirement.

D1 and D2 are 2.5 volt reference diodes that simultaneously establish 2.5 volts at the base and emitter of the BC558 when the supply voltage is exactly 5 volts. In this situation the BC558 is cut-off.

Should the supply voltage rise, the voltage at the BC558 base remains at 2.5 volts; but the voltage at the emitter will rise (actual voltage being supply voltage minus 2.5 volts). When the supply rises to 5.6 volts or above, the BC558 turns on, supplying approximately 50μA (via the 47kΩ resistor) to the gate of the C106 thyristor. This turns on and latches until such time as the supply is removed. During this period the power supply is forced into its "current limit" mode.

Thus this design provides the necessary protection, is economical in parts count, and, most importantly, requires no adjustment.

Provided a reduction in temperature stability can be tolerated, each LM336 can be replaced with four forward-biased silicon diodes if a more economical approach is desired.

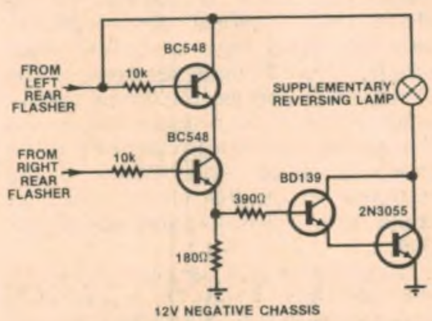
L.W. Murakami,
West Beach, SA.

Automatic Reversing Lamps

Whilst most vehicles use the rear turn signal lamps as reversing lamps, some drivers prefer to have a supplementary lamp, which can give better illumination of the area into which they are reversing. Naturally these drivers also desire that the supplementary lamp automatically comes on when they engage reverse gear.

Although this can be achieved with cabling from the reversing lamp switch to the new lamp, in many cars with front wheel drive the reversing switch is located in the engine compartment, and thus the cable has to run the full length of the vehicle. For many persons this then becomes a major undertaking.

This suggestion enables the supplementary reversing lamp to be automatically switched on whenever



reverse gear is selected, yet requires no new cabling from the front of the vehicle. When both rear turn signal lamps are on the supplementary lamp is illuminated, but if only a single turn signal is on (ie the normal turning situation) the extra lamp remains extinguished.

Referring to the circuit it will be seen that the two BC548 transistors are connected in an AND gate configuration, with their inputs wired to the left and right rear turn signal cables. The emitter of the "lower" BC548 drives a Darlington pair via a 390Ω current-limiting resistor. The Darlington pair control the supplementary reversing lamp.

It is suggested that the 2N3055 be mounted on a small heatsink, and the complete unit could be located in the boot of the vehicle.

G. Hennig,
Christies Beach, SA.

Editor's Note: A possible drawback to this circuit is the need to "float" both leads from the supplementary reversing

(Continued on page 79)

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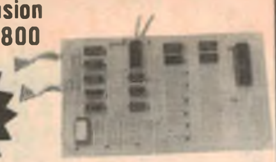

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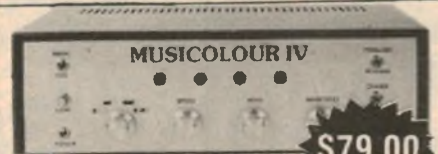

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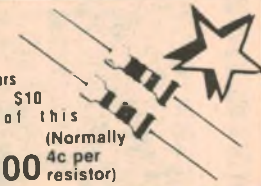

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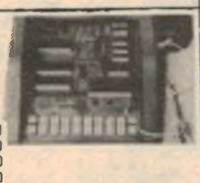

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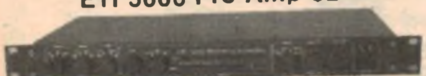

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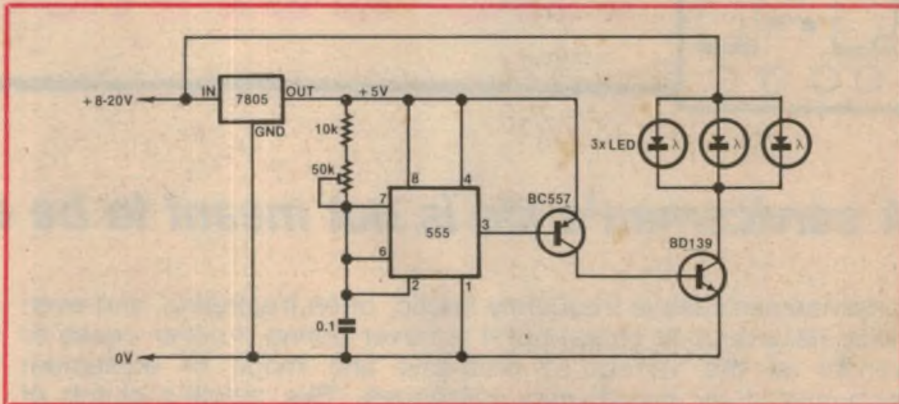
Low Power Strobe



Much of today's equipment incorporates drive motors which have black and white "striped" flywheels intended to be used with a strobe for checking and adjusting the motor speed. Suitable strobes can be large and expensive; however this circuit is designed around a 555 timer and three LEDs as the light source. The only drawback is the limited light intensity which restricts use to those applications where the ambient light can be subdued.

The 555 is connected for normal astable operation, although the usual "discharge" resistor (between pins 6 and 7) is omitted, in order to obtain a very short (discharge) duty cycle. Frequency may be varied by the 50kΩ trimpot.

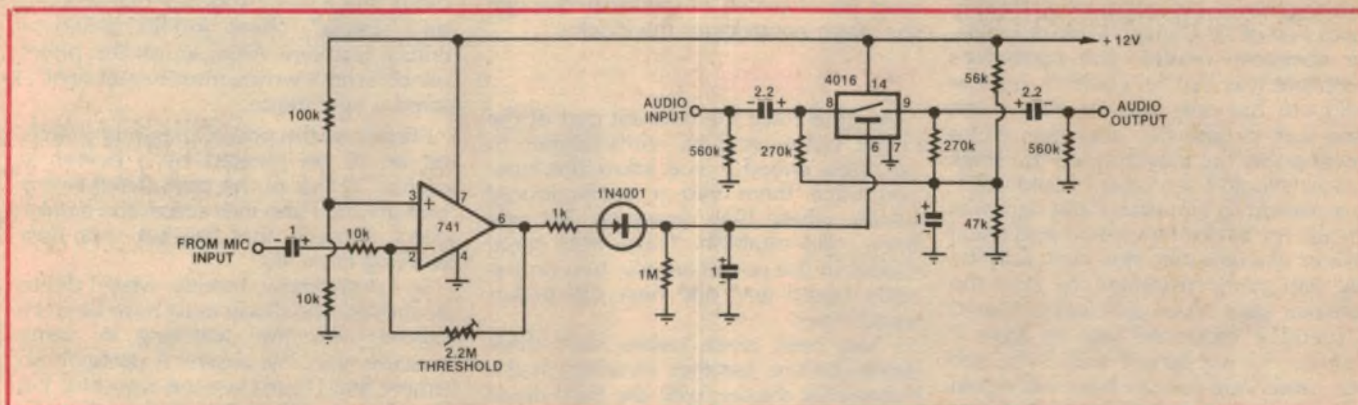
Output from the 555 is fed to a two-stage amplifier to drive three parallel connected LEDs during the 555's discharge cycle. Hence the LEDs will flash in exact synchronism with the 555.

A three-terminal five volt regulator maintains a constant supply voltage to the 555, to eliminate frequency drift with changes in actual power supply voltage, which may range from 8 to 20 volts. The two-stage buffer is required because the LEDs are returned to a higher voltage than the (regulated) supply to the 555.

The prototype was calibrated to 404Hz, the frequency required to correctly set the speed of a Model 15 Teletype motor. By holding the group of LEDs close to the flywheel, the motor can be adjusted to precisely the correct speed.

C. Wlodarczyk,
Brackenridge, Qld.

Simple Noise Gate



In some applications it may be desired to couple a microphone to an automatic noise gate, such that in the absence of acoustic input signal the preamplifier noise is "squelched". This particularly applies to noisy preamplifiers used in conjunction with high gain high power amplifiers; or in the case of the residual output from the balanced modulator in the Cylon-Voice Simulator (EA, January, 1981).

Referring to the circuit, it will be seen that the input to the 741 op amp is bridged across the microphone output. The 741 is connected in the inverting mode, with the series feedback resistor being a 2.2MΩ potentiometer which serves as a gain control for setting the squelch threshold. Output from the op amp is applied to a half-wave rectifier, and then fed to the control input of one "pole" of a 4016 quad bilateral switch. This switch is wired in series with the preamp output, such that in the absence of signal the preamp output is muted. With signal present the rectified output rises sufficiently to activate (and therefore "close") the bilateral switch, thus enabling the preamp output to feed the following equipment.

An RC time constant network is connected across the output of the diode rectifier to provide a controlled release time for the gate; and thus preclude gate closing during short pauses. Note that the threshold control allows manual adjustment of the input level at which the gate is opened. As the 4016 switch actually contains four separate devices, a relatively compact unit comprising four gates could be built around one 4016 and one quad op amp, such as the 4136 or TL074.

A. Stewart,
Gumdale, Qld.

REVERSING LAMPS
continued from p76

lamp. One solution would be to substitute a 2N2955 power transistor (PNP type) for the 2N3055, and move it to the other side of the lamp. Connect its emitter to the positive rail, and the lamp between collector and ground. The emitter of the BD139 should also be grounded and its collector connected to the base of the 2N2955. Finally install a resistor of, say, 1kΩ between the base of the 2N2955 and the positive rail.

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.

The Serviceman

A serviceman's life is not meant to be easy either

A serviceman's life is frequently hectic, often frustrating, and even mildly hazardous at times, but it is never boring. I never cease to wonder at the variety of problems and range of equipment encountered by myself and colleagues. This month's clutch of stories gives some idea of this variety, some being contributed and some from my own bench.

My contributed stories come from Mr J. L. of Tasmania who, you may remember, contributed a number of stories for the November, 1981 issues. Here are his latest:

A funny one cropped up the other day. I managed to repair something without knowing how it worked or why I fixed it. It was one of "El Cheapo's" clock radios, the economy model. The customer's complaint was that he couldn't turn the radio off; the only way to silence the thing was to pull the plug out of the power point, but that stopped the clock as well! Would I see what I could do?

I explained to him that, if the fault was difficult, my bill for time could well equal the cost of a new unit. However, as is the way with many customers, he liked the particular style of set and was prepared to spend a moderate sum to have it repaired. So we agreed that if the job took more than half an hour we would junk the set. He had been a good customer and I was prepared to give him this time if I couldn't fix it.

It seemed likely that the problem was in the main control switch, a simple four position slider type giving "OFF", "RADIO", "AUTO" and "ALARM" settings. I have often found these switches to be damaged by a knock on the switch knob, which opens the tabs securing the rear contact strip. In these cases the small "U" shaped slides stay on the contacts, leaving the knob to move backwards and forwards without any control of the slides.

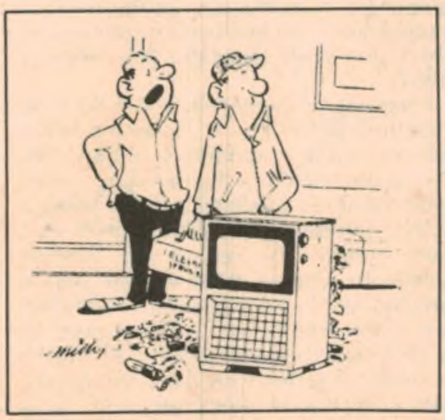
After removing the cabinet, it was clear that this was not the problem. The switch was still secure and a check with a multimeter showed that it was functioning perfectly. So why did it not switch the set off when the contacts were open circuit?

I had no circuit diagram for the set, but it seemed to be very conventional. The clock movement was energised directly from the mains, while the radio transformer was also permanently energised with switching effected on the low voltage side. It is usual for the radio to be switched either directly with the front panel switch or indirectly through the alarm contacts on the clock.

THREE DIODES?

I tried to trace the relevant part of the circuit, but most of the wires seemed to be single ended – you know the type; you trace them into a multicoloured bundle where they disappear. But one thing I did establish: There were three diodes in the power supply, two on the radio board and one near the power transformer.

I had seen clock radios with three diodes before, but they invariably had a fluorescent display, with the third diode supplying about 30V for this display.



You may have some trouble locating the difficulty. I know I sure did. ("P.F. Reporter.")

That didn't apply in this case, so what was going on? Did this set have some kind of three-quarter wave rectifier, or was it a "voltage one-and-a-halfer"?

But seriously, I had to make a decision soon; the customer's half hour was almost up. I was about to write the job off when I noticed that both the front panel switch and the diode on the transformer were attached to wires of a particular shade of green. There was no traceable connection between them but a check with the multimeter showed that they were one and the same.

Without any sense of having found anything significant, I idly tested the diode. It was short circuit. Even this didn't ring a bell. I suppose that working on a "simple", "cheap" job had dulled my critical faculties. Anyway, on the principle of "what's wrong must be put right", I fitted a new diode.

I replaced the power plug and switched on to be greeted by a deafening silence. A flick of the front panel switch brought the radio into action and a quick check showed that the set was now working perfectly.

So I don't know, exactly, what I did to fix the set. The diode must have been involved with the switching in some obscure way. The answer is probably so simple that I "can't see the wood for the trees", but with these cheap jobs one can't spend too much time theorising.

A HOT SANYO

My next story is on a quite different theme. A friend asked me if I wanted a Sanyo colour TV set that had been involved in a house fire. The story was that fire had destroyed the wall opposite the set, and heat, plus water from the firemen's hoses, had ruined the set. It had been replaced by the insurance company and the owner had put it out with other junk to be taken to the tip.

When I saw it, I doubted whether anything could be salvaged. The plastic surround supporting the picture tube had melted and the tube was tilted forward at an angle. The power switch had been pulled back into the set, along with the touch button panel, while the speaker and slider controls had been

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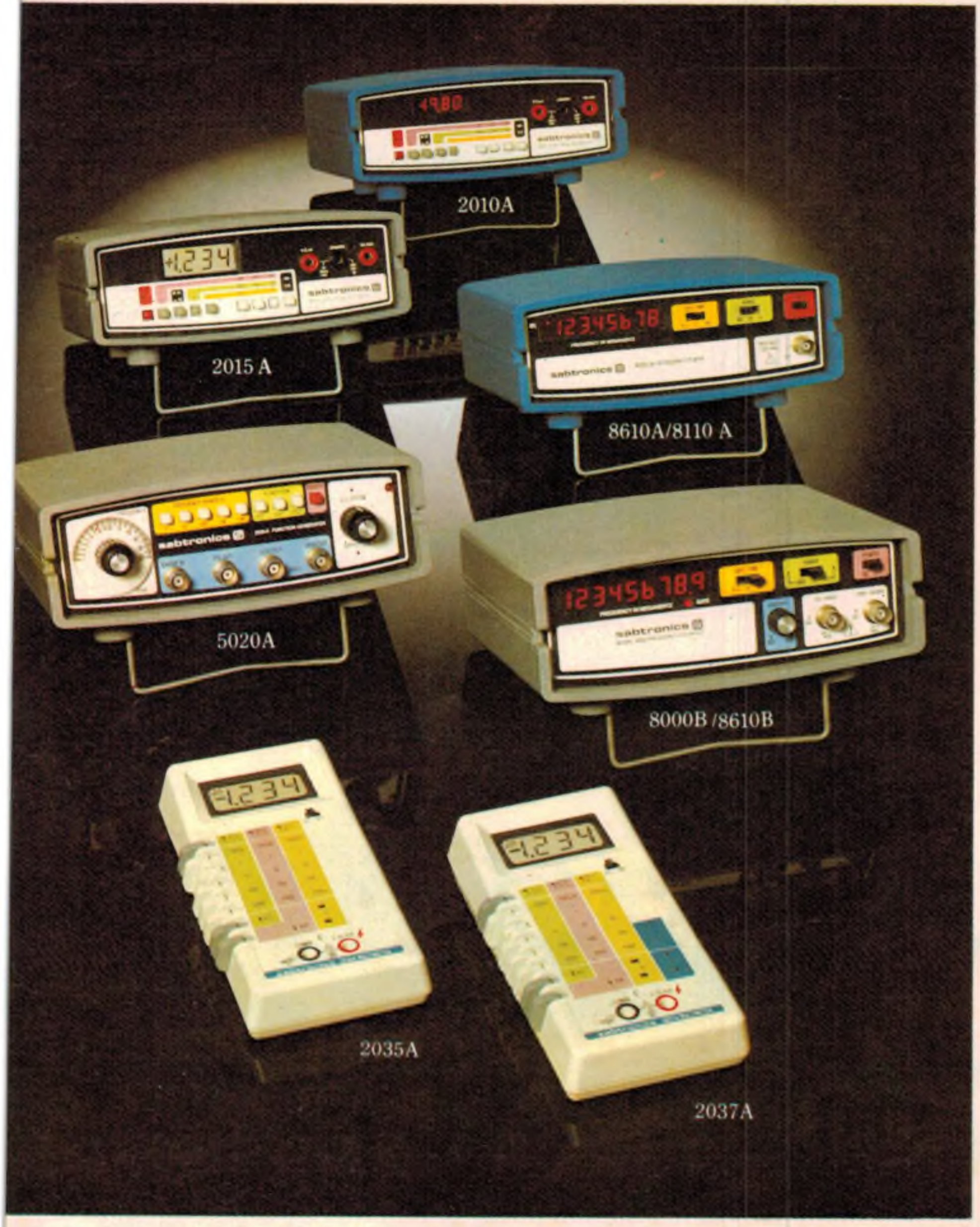

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pushed forward by the sagging picture tube.

At the back, the plastic cover had melted and drooped around the picture tube neck and onto the chassis. The chipboard cabinet was intact, but the plastic veneer had blistered badly. And the whole set was covered with soot and dust.

After wiping the face of the picture tube, I could see that the phosphors seemed to be undamaged, suggesting that the tube might still be under vacuum and so able to be salvaged. It took a long time to remove the cabinet back because it had become welded to the tube socket board and had to be cut away to release the tube.

Inside, everything was covered with greasy soot. There was not a trace of the tinplating on the varicap tuner cover. It didn't appear to be rusty, but the surface was covered with a fine hard black dust. There seemed to be no fire damage inside. Apparently the heat had melted all the external plastic, but only water and soot had penetrated inside.

I connected a tester to the tube and it gave a 100% reading. So, if nothing else, I could salvage the tube. But before dismantling the set I showed it to several colleagues and one of them suggested that we switch it on, just to see what would happen.

I should mention that he is the type of bloke who enjoys bursting balloons. The rest of us timid souls don't like loud bangs, so we put our fingers in our ears and waited. The result was an anti-climax because the set's power switch was off and lost amidst the mass of twisted plastic inside the set.

We eventually freed the switch and tested it. We also cleaned the ultor cap and EHT lead, and sprayed around the line output transformer. So now came the second trial. We were getting a bit blase by this time — no fingers in ears — and so we were startled witless when a very loud hiss burst forth from the speaker.

We located the antenna socket among the scraps of melted plastic and connected it to the workshop antenna. The hiss changed to loud music and a picture flashed on the screen which gave no indication of the damage which the set had suffered.

I wouldn't like to guarantee the set. It might run for a few days or a month. But it is amazing that a TV set could suffer such external damage without obvious internal faults of one kind or another. I don't think the set will ever be restored, but it is interesting relic just the same.

AND A WET RADIO

Well, those are two stories, in lighter vein, from J. L., and the second one reminded me of a rather similar story which was published in one of the trade magazines many years ago. It followed very severe floods on the NSW north coast and concerned a portable radio (valve type) which was recovered after the muddy waters subsided.

It finished up in the manufacturer's service department and someone jokingly suggested checking to see if it would still work. So they fitted new batteries, switched it on, and — yes, you guessed it — it gave forth music. Granted, the sound wasn't even medium-fi, due to the sodden nature of the speaker cone, but the set was still functioning electrically.

Naturally, the set manufacturer made a good deal of advertising capital out of the incident, though I don't imagine any serious attempt was made to salvage the set.

But, as in the case of J. L.'s TV set, incidents like this illustrate just how much punishment electronic devices can take — when it suits them! If it doesn't suit them, a hot day or a bout of humidity is enough to create the most elusive fault. Which, I suppose, is just another version of Murphy's Law.

The next two short stories are also from J. L., but at a more everyday level. He goes on:

My next story concerns a Philips K9 colour TV set. The customer complained that it made a popping sound, with no picture. There seemed a little doubt that the power supply was hiccuping so, as a first move, I isolated the tripler.

No luck there, so I isolated, in turn, the line output stage, the vertical output stage, the audio output stage, and eventually everything else connected to the power supply. Even on a dummy load it was still hiccupping.

On the bench I checked the supply thoroughly and eventually found that diode D175 (BY206) was shorted. After replacing this diode the supply fed the dummy load without trouble, so I reassembled everything into the set and switched on. Result: the now familiar sound of a hiccupping power supply.

BACK TO THE ORCHARD

It's no wonder that most middle-aged technicians are bald; at this stage I was ready to tear out my few remaining hairs and take to growing apples for the rest of my life! Back on the bench, and connected to the dummy load, the power supply worked perfectly, so I started the whole exercise over again.

Fortunately, it didn't take long this time. Disconnecting the tripler stopped the hiccupping and a replacement effected a complete cure. This was the first time, and hopefully the last, where I have encountered two simultaneous faults, with identical symptoms.

The next curly one concerns a Tyne 6200 with no vertical scan. Failure of the TBA800 vertical output stage is a common cause of this fault, so this was replaced, but with no result. In this set an SN76545 provides both line and vertical drive and, as there was a horizontal line on the screen, it seemed that we had line drive, output, and EHT.

It could have been a failure of the vertical oscillator section of the chip, so it was replaced, but still with no result. At this point a detailed study of the circuit diagram showed that the vertical drive line to the output stage also doubles as a 30V rail into the vertical section of the oscillator chip.

Backtracking along this rail led to the almost unbelievable conclusion that there was almost no HT anywhere in the set. The 300V rail was down to 130V, and the EHT was only 9kV, instead of the usual 26kV. So the horizontal line had been totally misleading.

The fault eventually turned out to be D306 (1S44) which had shorted, reducing the chopper "on" time to a mere fraction of what it should have been. But the really surprising thing is that the line oscillator, line output, and EHT stages were so efficient that they could produce a horizontal line with less than half the normal voltage.

I'm still thinking of growing apples instead!

Thank you, J. L., but don't give up yet. This next story, from my own bench, made its own small contribution to bald headed servicemen!

A POWERLESS RANK

The set involved was a Rank Arena model C2652 colour TV set fitted with remote control, but which in the relevant portion of the circuit is virtually identical to the model 2201. The customer's complaint was that the set would run about 15 minutes after switch-on, then shut itself off completely; no sound, no picture, no raster.

It would stay in this condition for about 30 seconds or so then, just as abruptly, revert to normal. It would run for two or three minutes, then switch itself off-again for another 30 second period, switch on again, and so on for as long as one could bear to let it run.

With the back off the set I noted that the picture tube heaters were still alight and also sensed that the EHT was OK. The next logical check point seemed to be the main 120V supply rail, so I connected the meter to it and watched as the set went through its on-again, off again, cycle.

The set was in its "Off" cycle when I made the connection, and the meter showed about 124V. A few seconds later the set came good and the voltage dropped to within a fraction of the specified 120V — 119.5 to be exact.

This suggested that there was nothing wrong with the 120V supply as such, but it did suggest that whatever was shutting down was dropping a significant load off the main supply rail, thus causing the voltage to rise. The next logical check point seemed to be the 19V supply rail, particularly in view of a couple of other Rank sets I have written about lately, with 19V rail problems. (February 1980, June 1981.)

The 19V rail supplies, among other sections, the tuner, sections of the IF amplifier, the video amplifier, and the vertical deflection board.

So, by easing the chassis a little further out of cabinet, I found a convenient check point and hooked up the meter. The result was quite positive: 19V when the set was working, dropping to about 2V when the set failed. The next question was, why?

This regulator circuit consists of a power transistor (TR505, type 2SD289) working in the conventional emitter follower mode, with the base pegged by a zener diode (D555) and a couple of ordinary diodes (D559, D560) to about 19.7V to give 19V at the emitter.

My first check was simply to put my finger on the 2SD289, to see whether it was overheating. It wasn't, which indicated that the problem was not due to overloading and this seemed to be further confirmed when I measured the collector voltage. This was rising when the set went dead, from around 28V when the set was working, to about 37V when it failed.

This left the zener network in the base circuit as the prime suspect. Measuring from the earthy end across the first diode gave about 1V, and across the two diodes a little over 2V, which was quite reasonable. But when I moved up to the other side of the zener – ie between the base and chassis – there was only about 2.5V. Fairly obviously, the zener had shorted.

I fished out a spare zener of approximately the correct voltage, and patched it across the circuit in place of the faulty one. Then I switched on, fully expecting the set to come good.

But it wasn't going to be that easy. The set was still dead, and for the simple reason that there was still no 19V supply. A quick check showed that TR505's collector voltage was still high, around 37V, indicating that the transistor was not drawing any current.

Since there was little else to go wrong in that part of the circuit, TR505 became the main suspect. Fortunately, I had a suitable replacement and I tacked it onto the board in place of the suspect one. And that did fix it.

From then on it was mainly a matter of tidying up. The zener I had chosen originally was a little on the low side, so I went through my stock and found one which gave almost exactly the 19V required. This, and the replacement transistor, were fitted more permanently, the chassis pushed back into the cabinet, and the set allowed to run for long enough to confirm the cure.

Back at the shop I tested both components and confirmed that the zener diode was short circuit and that the transistor was open circuit, not only between collector and base, which I had expected, but also between emitter and base.

I also speculated on the likely sequence of events. There seems little doubt that the short circuited zener was the original failure, but apparently was heat sensitive, thus producing the on/off cycle.

There also seems little doubt that the transistor objected to this condition, which is probably not surprising since it put an additional 17V across the collector/base junction. But it is also clear that the transistor must have failed while I was working on the set.

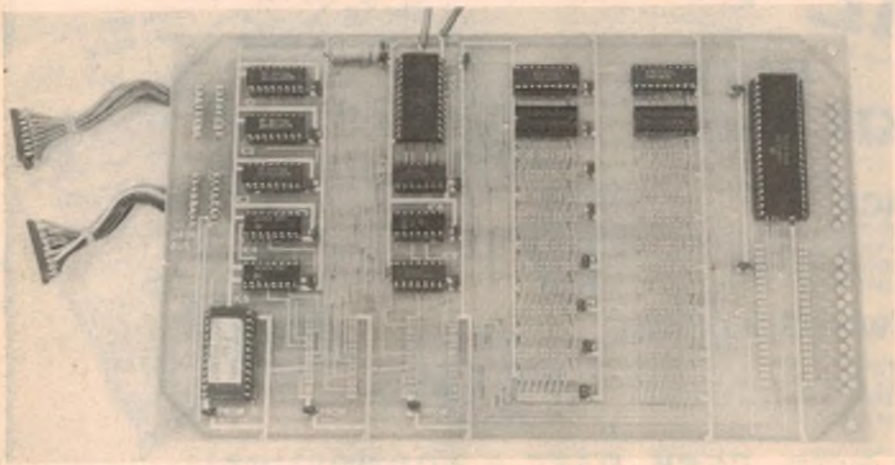
So that is just one more trap for the unwary; you start out looking for one fault and have another one crop up while you're looking. It wasn't too bad in this case, although it did have me scratching my own thinning locks for a few minutes.

If you have a factual and interesting story to tell about electronic servicing, write it in your own words and sent it to "The Serviceman", c/- "Electronics Australia", Box 163, Chippendale 2008. If the Serviceman uses it in his column, we will pay an appropriate fee.

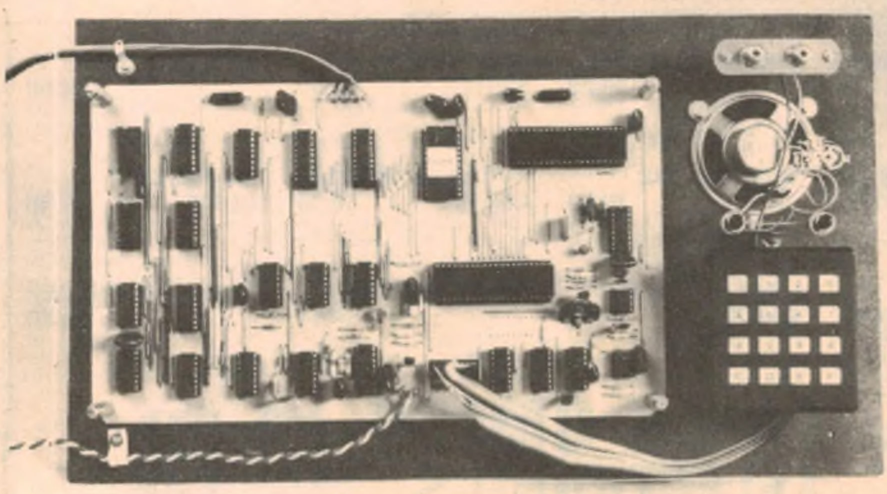
All-round expansion for the DREAM 6800

The DREAM 6800 has come a long way since its introduction back in 1979. With its enthusiastic adoption by radio amateurs and experimenters generally, the establishment of a flourishing users' group and the emergence of some dedicated software houses, its following has reached something of a cult status. Now there is a project that will make every user's DREAM a little sweeter — an expansion board accommodating enough RAM, EPROMs and input/output facilities to keep everyone happy for a long time!

by GRAHAM LEADBEATER & GRAEME HOLLIS



This new add-on board for the DREAM 6800 allows expansion to 8K or RAM, 6K of EPROM, and four 8-bit I/O ports. The DREAMSOFT monitor provides special graphics facilities and a variety of useful programming tools.



Published in May-August 1979, the popular DREAM 6800 computer features tape I/O, 1K RAM, and 1K CHIPOS monitor in EPROM.

Some of the things people have been doing with the DREAM 6800 are incredible! Over the last 12 months we have seen things such as Morse code generation from an ASCII keyboard, disassemblers, sound effects generator, telephone answering, light show controller, EPROM programmer, model railway control, burglar alarm systems, and word processors – not to mention endless TV games – some of which use joystick control.

Most of these applications require additional memory or I/O or both.

Another interesting development has been the release of a resident software package on a 2716 EPROM by the DREAMSOFT organisation. This provides the DREAM user with a full ASCII VDU, improved tape handling and other utility programs, driving routines for Baudot teleprinters with ASCII translation, memory dump and disassembler programs and a versatile text display for education or advertising.

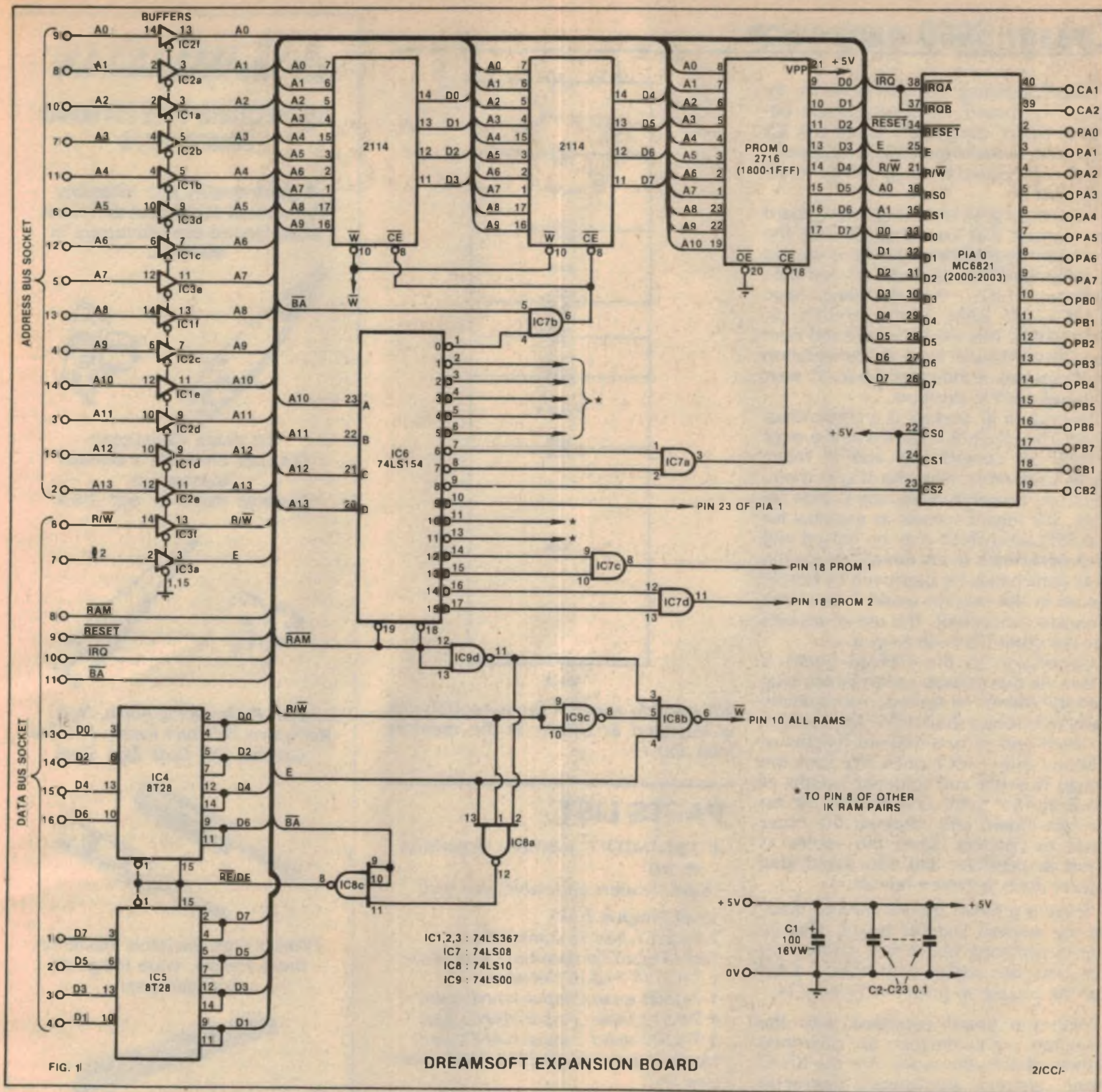
This EPROM is sold as the "DREAMSOFT No. 1 Package" and is intended to reside at addresses 1800-1FFF. There is a socket at this address on this board.

A fully equipped board will have 8K of RAM (1K of which is transferred from the DREAM Board), three 2K EPROMs, and two PIAs (Peripheral Interface Adapters). Why on Earth would anyone want all that!? The simple answer is that most people wouldn't! You simply equip the board with as much or as little as you do need.

The board is double sided so you won't have the chore of running a lot of links, and it is the same size as the DREAM board so it can be mounted either above or below the original board. Data and address sockets are in the same relative position, as are the power supply input terminals. A single +5V supply is required and a fully equipped board will draw about 1.5A.

HOW IT WORKS

In the original DREAM, the internal RAM was enabled by the "RAM" signal which is active over the address range 0000-3FFF (the bottom 16K). We remove the internal RAM and bring RAM out to enable our new board. Thus this expansion board occupies the address range 0000-3FFF. Refer now to Fig. 1. Address lines A10 – A13 are decoded by a 74LS154 (1-of-16 decoder). Each of its 16 outputs represent 1K of address space.



Minimal DREAMSOFT circuit has 1K of RAM, one EPROM and one PIA. Other components can be added as required.

These are used to enable the various devices on the board. The 2716 EPROMs each occupy 2K, so two 1K outputs are combined in a 74LS08 for each EPROM. Incoming address lines are buffered by 74LS367s as are R/W and Ø2. This provides adequate drive for a fully equipped board and also for further expansion if desired later.

The data lines are buffered by 8T28 non-inverting Tri-state transceivers. They are normally set to receive and only drive outwards to the main board when a read operation is being performed on the expansion board.

The only complication is that the video display generator circuitry must perform DMA on the "screen" memory at 0100-01FF. When this is desired, BA goes low and enables the lowest 1K of RAM via IC7. It also forces the data bus transcievers into the "talking" mode via IC8.

The 16K is allocated as shown in the Memory Map of Fig. 2. The 8K of RAM is not continuous because 1800-1FFF is occupied by the DREAMSOFT No. 1 Package.

CONSTRUCTION

Construction is quite straightforward, as there are only two types of components used, ICs and capacitors. These are all labelled on the board itself.

The board may be equipped to suit your needs (and budget). For example you may start with 2K of RAM, one EPROM and one PIA. The original power supply will cope with this easily. Other ICs can then be added as required.

We estimate the cost of this Project to be about

$90

this is for a "medium" level of 3K RAM (existing 1K + 2K more) one PIA and the DREAMSOFT No. 1 Package.

Dream 6800 expansion

Before installing any components, inspect the board for short circuits between tracks, particularly under the ICs which are virtually impossible to remove from the plated-through holes once soldered in.

For the purpose of testing a new board we suggest that you equip it with the minimum requirements to get it up and running which are the address and data buffers IC1-IC5, the decoding logic IC6-IC9 and RAM in the bottom 1K (0000-03FF). This will be transferred from the DREAM board. Note that orientation of IC sockets is indicated by a "1" near pin 1 of each IC position.

The use of IC sockets is a contentious issue. They are not regarded as the most reliable of components and in many cases cost more than the ICs in them. They are, however, a big help in fault finding. We regard sockets as essential for the EPROMs (which may be erased and re-programmed many times) and for the PIAs (which may be destroyed by hostile forces in the outside world – to which they are connected). The use of sockets for the other ICs is up to you.

Connection to the DREAM board is made via two 16-way cables which plug into the expansion sockets. Your friendly local electronics shop will crimp headers to each end of two 100mm lengths of ribbon cable – for a price. We took the cheap way out and soldered lengths of hook-up wire to the underside of the expansion board and soldered the other ends to headers. Keep the cables as short as possible, and also avoid long power leads between boards.

There is a minor modification to make to the original DREAM board. This involves replacing "A15.VMA" on Pin 8 of the Data Bus socket with "$\overline{\text{RAM}}$". $\overline{\text{RAM}}$ can be picked up from Pin 13 of IC12.

With the board equipped with the minimum requirements as described earlier, check your work. Are the ICs in their correct positions? Correctly oriented? Data and address lines connected pin for pin? If you've crimped headers to the same sides of a piece of ribbon cable then you're in trouble as pin 1 will go to pin 16, pin 2 will go to pin 15 and so on. (Next time, read the text before rushing in!)

Plug in data, address and power cables and power up the system. It should operate as before. If not, check power rails and apply the walking-finger test. (test to see if ICs are hot). The most likely cause of trouble will be a sliver of metal between tracks. Clearances are very small on this board and defects sometimes sneak past inspection.

Assuming that all is working OK you can install the other ICs. Test the RAM and PIAs with the monitor and put the DREAMSOFT EPROM through its paces as described in the handbook supplied with it.

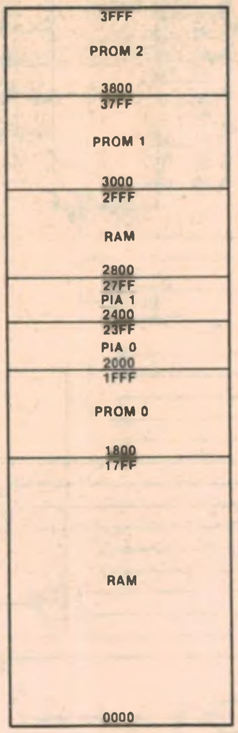


FIG. 2

16K address space of the expansion unit is allocated as shown in the memory map above.

PARTS LIST

1 DREAMSOFT Memory Expansion Board
16-pin headers and cable (see text)

SEMICONDUCTORS
3 74LS367 hex Tri-state buffers
2 8T28 quad Tri-state bus transceivers
1 74LS154 1-of-16 decoder
1 74LS08 quad 2-input NAND gate
1 74LS10 triple 3-input NAND gate
1 74LS00 quad 2-input NAND gate
Up to 14 (maximum) 2114 RAM chips (see text)
2 6821 PIAs (optional, see text)
1 DREAMSOFT No.1 EPROM
2 2716 EPROMs (optional)

CAPACITORS
1 100µF/16VW tantalum or axial lead electrolytic
22 0.1µF/100VW ceramnic disc

SOCKETS
1 40 pin for each PIA
1 24 pin for each EPROM
Other sockets as required

The PC board and the pre-programmed EPROM for this project are priced at $35 and $30 respectively from DREAMSOFT, PO Box 139 Mitcham, Vic 3132.

FOOTNOTE: The DREAM 6800 Users' Group publishes a monthly newsletter and can be contacted by writing to 27 Georgina Ave, Keiraville, NSW 2500.

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MK 1 and MK 2 SPECIFICATIONS

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The heart of the system is the Motorola 6809 CPU and considered to be the most powerful 8 bit Microprocessor available today. The CPU board is fitted with Memory Management hardware which allows it to directly address up to 1 Megabyte of memory using a 20 Bit address bus. The system is provided with a 2716 compatible 2k Monitor ROM or EPROM.

MEMORY
A 64K Ram board is provided as standard. However the system may be provided with as little as 8k if desired and more added later.

INPUT/OUTPUT
8 I/O Boards slots are provided, each of which may be fitted with a dual serial or dual parallel interface board using DB-25 "D-TYPE" Connectors. Many other types of interface Boards are also available.

PERIFERALS
Additional VDUS, Dot Matrix Printers, Daisy Wheel Printers, 8" and 5" Floppy Disk Systems, and a hard disk drive of up to 40MB may be connected to the system. Interface boards and software are available to support all these devices in a singular or multi-user environment.

POWER SUPPLY
Provides 8.5V, +12V, −12V unregulated supply to the buss. All components are P.C. board mounted and fuses readily accessible.

CABINET
The Cabinet is made of heavy gauge (approx ⅛") Aluminium Anodised in Delightful blue.

SIZE
Approx: 16" wide by 20" deep by 7.5" high.

WEIGHT
Approx. 10KG. (including supply, CPU, 64K RAM, and I/O board).
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Letters to the editor

Deltahet Mk 1 gave satisfaction

Having been a keen reader of "Electronics Australia" for over some twenty years, I thought it was about time I wrote to you to thank you for all the pleasure and education I have received from your publication.

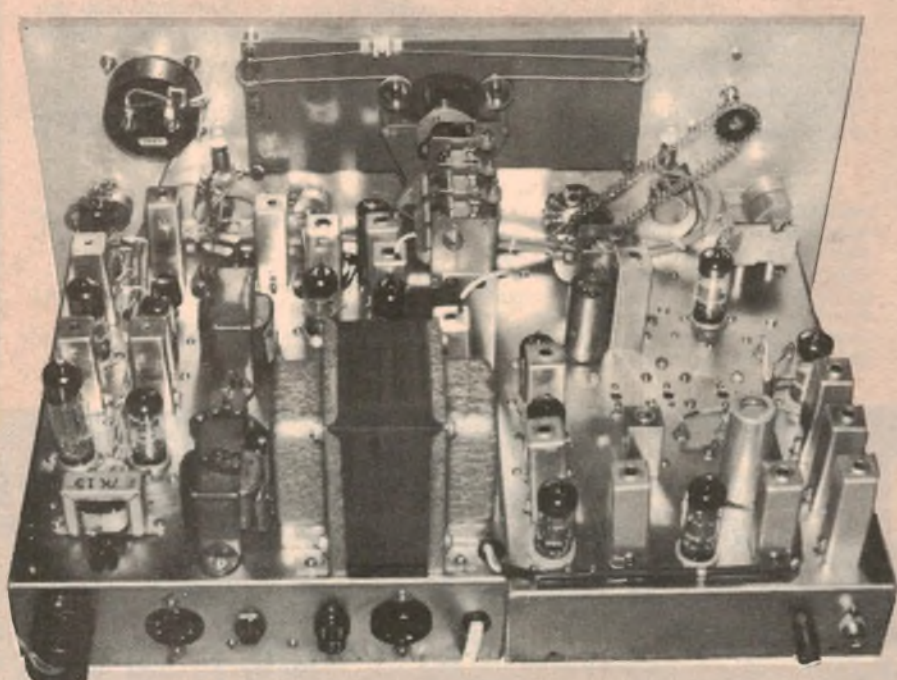
I suppose, like many of your readers, I have never had time or opportunity for any formal education in electronics, but thanks to the lucidity of your articles, and admittedly some intermittent help from friends and relatives, projects have not only worked, but continued to work trouble free over many years. All this has been a great source of relaxation and satisfaction.

I always enjoy your "Editorial Viewpoint", which in terms of insight and restraint must be unique in technological circles. In fact, the final paragraph of your recent December issue emboldened me to forward the enclosed photos of the Mk I "Deltahet". It occurred to me that it might amuse you to see what is almost certainly the last Deltahet Mk I to be constructed in Australia. It was a curious situation which somehow took off when I had been given the original metalwork and dial by a relative who had it lying round his garage for many years. I cleaned it up, and then found I had the valves, then some rather elegant ceramic valve bases, and thereafter it somehow assumed a life of its own.

After a two year construction period, it is now working superbly, and if one allows for thermal drift, and perhaps the internal noise, it is superior in performance to the solid state version I built in 1972. As the modern components showed such a reduction in size, there was quite a bit of spare room, so I tossed in a few probably unnecessary modifications such as extra filtering for the power supply. Anyhow it has proved a most interesting project, and put me in touch with a lot of people in diverse places.

Your current 500MHz frequency meter looks most interesting, and I hope to get around to it in the New Year. In passing, I wonder if a short paper, or some guidance could be given to "Deltahet" enthusiasts to convert to a digital frequency readout. I imagine that a lot of both Mk I and Mk II Deltahets have been constructed over the years.

G. S. Pestell,
West Perth, WA.



This Deltahet Mk 1 was built by G. S. Pestell (see above). The project was published in six articles between May 1963 and October 1964. The Mk 2 was published in 1971.

Complaints

As a long time reader of EA, RTVH and R & H, it is disturbing to find a project that cannot fulfil its intended purpose. I refer to Ron de Jong's "Electronic Eggtimer", EA November '81.

Ron is definite that the project is a solution for those people who wish to time an egg under weightless conditions. The inclusion of a gravitational operated device, viz mercury switch, nullifies the electronic sand concept, as the mercury switch is unpredictable in weightless conditions.

While few people would have the opportunity to utilise the electronic eggtimer under the intended conditions, those few people would possibly return their cooking failures to Ron with curt comments, or worse still, eject them as litter upon our habitat.

Dark Side Hobbit,
The Moon.

PS. Julius Sumner Miller's "egg in bottle" doesn't work here either.

COMMENT: For use in weightless conditions, special non-gravity operated mercury switches are required.

Speed Record

It was with great interest that we read the letter by A.M. of South Headland, WA (p131, Dec '81), and wish to draw your attention to a device which has been marketed for many years in Australia and is used worldwide for speed recording and as evidence in the courts of law.

This unit, which was previously driven purely mechanically, is now available as a fully electronic unit. It uses impulse generators for the purpose of producing the speed impulses required to operate the unit. However, it is doubtful whether it would be feasible to install a "tachograph" in every road vehicle at a cost of $200-300. It would also be difficult to enforce the compulsory fitting of charts on a daily or weekly basis into the units. This, however, can be achieved without great difficulties in commercial vehicles which are subject to much tighter operational control.

Many overseas companies are working on a foolproof, efficient and economical device as described in the above article. However, the main difficulty lies in the accuracy of the road speed, which in all present systems relies on tyre wear, road surface, tyre pressure, tyre slip etc. This makes it necessary that the unit be adaptable to each type of vehicle, depending on the abovementioned factors.

For your information I enclose a leaflet showing the electronic Tachograph Recorder, and should it be of any interest to you please ask for any more information.

R. W. H. Kiss, Managing Director,
Kienzle Instruments, A'asia Pty Ltd,
Brookvale 2100.

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Amateur radio to assist oceanic research expedition

The Oceanic Research Foundation expedition left Sydney on 12th December, 1981 to carry out a scientific study of marine and bird life, ice and weather phenomena in Antarctica. It is well equipped to maintain radio communication during a voyage planned to last four months.

By now the expedition, led by Dr David Lewis, is scheduled to be at Commonwealth Bay on the Antarctic continent and it is assumed that many radio contacts will have been made with it during the voyage via Hobart, Tasmania, and French Durmond D'urville base on the Antarctic continent.

The schooner is equipped with two ship-to-shore Stingray transceivers from Findlay Communications Pty Ltd; Nav-Sat navigation equipment from Amalgamated Wireless Australasia Ltd; Furuno radar equipment by Greenwich Marine Pty Ltd and Midland 27MHz hand held ship-to-shore units supplied by Dick Smith Electronics.

The two weeks prior to sailing were very busy ones for the crew, one of whom is the radio operator Don Richards, VK2BXM. Don's task of collecting equipment, helping to install it, and acquainting himself with its operation and performance was a very painstaking job.

In addition to the required small ships communication and emergency radio, the expedition is well equipped to maintain radio communication on the amateur bands.

The equipment consists of the very latest Yaesu Musen FT-ONE transceiver, made available by Dick Smith Electronics, which I had the pleasure of evaluating in last month's issue a Tono Theta 7000E communications computer and video monitor for radioteletype from Vicom International Pty Ltd; antennas from Scalar Industries; antenna tuning unit from Emtronics and Don's own Kenwood TS820S and Atlas 210 transceivers.

Several checks and tests were made by Don with myself, as amateur communications co-ordinator for the expedition in Sydney. Several contacts were made with the expedition as they headed down the east coast of Australia and Tasmania. Don's call sign from the schooner is VK2BXM/MM.

The special call sign allocated to the expedition is VK0DL which by now has been used many times when contacts were made with Don in Antarctica.

Also during the period of preparation Barbara Muhvich, another member of the expedition, was given a familiarisation session on amateur radio and an introduction to radioteletype, at the Museum of Applied Arts and Sciences amateur radio station VK2BQK.

In addition to her other work during the expedition, Barbara will be Don's assistant operator and has expressed interest in obtaining her own amateur licence.

As far as is known, this is the first time such an expedition has made substantial plans for amateurs to communicate with it and follow its progress.

In fact, amateur stations in New Zealand, Macquarie Island and other part of Australia have been in communication with the expedition, passing personal messages to and from crew members and their families and friends (a service that Australian amateurs are now permitted to perform).

For amateurs and shortwave listeners wishing to follow the progress of the expedition, sked frequencies and times arranged prior to departure from Sydney were: 3620kHz, 7050kHz, 14105kHz and 21220kHz at 8.00pm Sydney time. The mode, single side band. Propagation conditions at the time will determine the frequency used. Any updated information will be passed on for inclusion in the WIA Sunday morning news broadcast at 11.00am from VK2WI.

The communication centre on board the Dick Smith Explorer.

NEW AMATEUR BANDS

The Australian table of frequency allocations expected to be issued early this year will contain additional allocations for the amateur service.

Although full details of the high frequency band allocations are not available, the Department of Communications have advised that the amateur service in Australia will, as from 1st January, 1982, be allocated the band 10.1MHz to 10.15MHz on a secondary basis to the fixed service which will continue to be the primary service in the band.

It should be noted that in accordance with International Telecommunication Union radio regulations, stations in a secondary service:

(a) Shall not cause harmful interference to stations of primary or permitted services to which frequencies are already assigned or to which frequencies may be assigned at a later date.

(b) Cannot claim protection from harmful interference from stations of a primary or permitted service to which frequencies are already assigned or may be assigned at a later date.

In addition amateur stations should avoid the frequency 10141.5kHz plus or minus 4kHz which is currently assigned

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4Mhx kit	$174.00
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Kit no RAM	$120.00

DYNAMIC RAM

T.I. 4116-3 16K for **$16.00**
Upgrade Super 80, TRS 80, and others
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Dynamic RAM Board A&T **$425.00**
Guaranteed to work at 4Mhz or your money back

QT SILENCE+MOTHERBOARDS

The Silence + has become one of the most tried and proven motherboards on the market. Using a unique grounding matrix, each line is completely surrounded with ground shielding which eliminates necissity for termination and gives the unit a very high cross talk rejection. One of the OEM customers has used the Silence + as high as 14Mhz without terminations.

FEATURES:

- LED power indicator
- Eliminates necessity for termination
- Fits most industry standard mainframes
- Available in 6, 8, 12 and 18 slot configurations

QTCMB6BB	6 Slot Bare Board	**$ 31.00**
QTCMB6A	6 Slot A&T	**$ 81.00**
QTCMB8BB	8 Slot Bare Board	**$ 33.00**
QTCMB8A	8 Slot A&T	**$104.00**
QTCMB12BB	12 Slot Bare Board	**$ 39.00**
QTCMB12A	12 Slot A&B	**$138.00**
QTCMB18BB	18 Slot Bare Board	**$ 61.00**
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S100 Sockets	Solder Tail (Gold)	**$ 6.30**

SBC2/4 Z80 S100 SINGLE BOARD COMPUTER

The QT Computer SBC2/4 Processor Board is a versatile and powerful Z80 based design which is compatible with the proposed IEEE S 100 bus standard. Although the SBC2/4 may be used as the host CPU of a large system, it has all the necessary features to be used as a stand-alone computer system.

Unlike old designs it will work reliably with dynamic RAM boards and more importantly with soft sectored disk controllers, and hence standard versions of CP/M. This will give you access to the largest software base for microcomputers.

- Z80A 8 bit CPU
- 2 or 4 Mhz Switch selectable
- 1K RAM (which can be located at any 1K boundary
- Full 64K use of RAM allowed in shadow mode
- DMA compatability allows MWRT signal generation on CPU board or elsewhere in system under DMA logic or front panel control
- TWO programmable timers available for use by programs run with the SBC+2/4 (timer output and controls available for use on CPU board).

Shipping weight 2lbs.

QTCSBC24B	Bare Board	**$ 66.00**
QTCSBC24K	Kit	**$199.00**
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The MD+MD Mainframe offers the same quality as the MF+. It accepts two 5 1/4" disk drives with remaining space for either a 6, 8, or 12 slot Silence Plus Motherboard.

QTCMFMD	without Motherboard	**$400.00**
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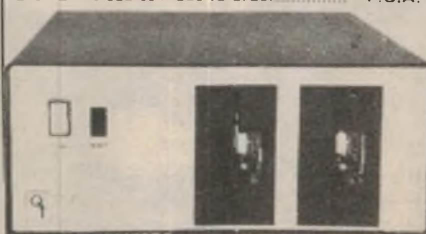

Also available without cutouts on front panel

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QT Systems are designed for both businessmen and engineers in accordance with the latest IEEE standards. Among other functions, they can be used for accounting and word processing as well as a variety of scientific applications. The systems are available with MP/M or QT DOS operating systems to allow multi-user, multi-tasking operations. QT also offers a full line of business and applications software, ranging from a business package to word processing.

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AMATEUR RADIO

in Australia to a large number of low power stations.

The Department intends at the earliest possible time to make a similar secondary allocation for the amateur service in the bands 18.068MHz to 18.168MHz and 24.890MHz to 24.990MHz.

The status of the amateur service would remain on a secondary basis until the existing fixed and mobile service are relocated in accordance with resolution eight of the WARC-79, at which time the amateur service would be the primary service.

The bands 18MHz and 24MHz should not be used until a further announcement is made.

Novice licensees are not permitted to operate in the new bands.

CENTRAL COAST AMATEUR RADIO CLUB 25th ANNUAL FIELD DAY

All amateur radio operators, their families and friends, and all interested in amateur radio are invited to attend the field day on Sunday, 21st February, 1982 at the Showground, Showground Road, Gosford, NSW.

Registration fee which includes, morning and afternoon tea, event entry and outings are: men $4, ladies $2, children 16 years and under $1.

Family groups, mother and father and two or more children in one car $7. Pensioner concession is 50% on production of appropriate pensioner concession card.

Tea, coffee and biscuits will be served in the dining-room between 8.00am and 5.00pm at no extra cost. A take-away food bar will be open for purchases from 9.30am to 3.00pm. You may bring your own lunch and use the dining-room.

If you are planning to enter any radio event, including junior events, an event registration card must be filled in.

The scramble rules require that no operation take place within 1km of the showground or the Gosford repeater sites. Log entry extracts must be handed in to the event entry registration table before 10.00am. Scoring – one point per contact regardless of mode. The same station may be worked on several bands.

Complimentary tickets for outings either to the Reptile Park or the bus tour may be obtained by presenting the registration card to the "Tickets" table.

There will be a disposal sale of radio equipment and a ladies stall with home-made jams, etc for sale.

Trade displays of the latest amateur station equipment will also be a feature of the day.

A special bus will meet trains at Gosford railway station, departing Sydney 7.25am and 8.50am and 7.33am from Newcastle. Off-street parking available in the showground.

A full program of mobile and pedestrian field events, plus quiz sheets, has been arranged to entertain the whole family. Registrations commence at 8.00am. Inclement weather will not cause postponement as there is plenty of shelter at the showground.

Bring the family to Gosford on Sunday, 21st February, 1982 – they will enjoy the experience.

UOSAT OSCAR IX

The first scientific event to be recorded by the UK amateur scientific spacecraft, UOSAT OSCAR IX, was a magnetic storm that occurred late in October 1981. The spacecraft was built by the University of Surrey AMSAT group and launched on the 6th October, 1981. The storm was detected by an onboard magnetometer and reported to earth monitoring stations via the spacecraft's telemetry system.

On 3rd November the "digitalker" was turned on for a few minutes and the Surrey control station was able to upload a few sentences in English which were played back.

Ian Freebee, G6BTU, spokesman for the Surrey group, said that the checkout was going well and all systems looked good.

Great interest is being shown in this amateur spacecraft's scientific and educational facilities. At the time these notes were being prepared engineering testing of the spacecraft performance was still being carried out.

RADIO CLUB NEWS

SOUTH EAST QUEENSLAND TELETYPE GROUP: This group meets in the library room St Brendan's School, Hawtree Street, Moorooka on the first Friday of each month (except January), at 8.00pm.

RTTY news broadcasts are conducted each Sunday morning at 10.30am on the normal HF RTTY frequencies and through the club repeater VK4RBT input frequency 147.050 and output frequency 147.650MHz. the club station call is VK4TTY. Club net and call-back is conducted after the news broadcast.

AN AWARD: "The South East Queensland Teletype Award", sponsored by the club, is open to all transmitting and listening amateurs. To be eligible for the award Australian amateurs must gain five points and overseas amateurs three points under the following conditions: Copy the official station of SEQTG VK4TTY, during the news broadcast and in the case of a transmitting amateur, participate in the call-back (two award points). A portion of the news printout, together with date, time, frequency, and broadcast number must accompany the request for the award.

In addition a transmitting amateur will gain one point for each RTTY contact made with a member station of SEQTG. Contact details are to be supplied with request for the award and each member station may only be counted once.

Listening amateurs are required to send contact details and/or printout of contacts involving different SEQTG member stations, one point each contact.

Applicants for the award should send the required information together with $A1.00 or three IRC's to cover postage and printing cost to the Secretary, SEQTG, PO Box 184, Fortitude Valley, Qld, 4006.

The club also has the following kits available for those wishing to operate RTTY mode. Modulator, demodulator, kanas cassette interface and monitorscope. These can be supplied either as printed circuit board only, drilled circuit board, or complete working and tested. Prices and other details can be obtained from the secretary at the above address.

ST GEORGE AMATEUR RADIO SOCIETY: Here is the latest information on the club. Meetings are held at 7.30pm on the first Wednesday of each month in the Allawah Scout Hall, corner Blakesley Road and Bellevue Parade, South Hurstville, NSW.

SGARS station call signs are: VK2LE, repeaters VK2RDX channel 6650 MT Bindo, VK2RLE channel 6800 Heathcote, and VK2RUH channel 8425 (proposed UHF) Hurstville.

Net frequencies and times are: Novice net 8.00am Sundays on 3555kHz; HF nets 7.30pm Tuesdays on 14120kHz and 8.00pm Tuesday on 28520kHz, VHF net 8.00pm Thursday on channel 6800.

The society's informative quarterly bulletin "Dragnet" is circulated to financial members. Postal address is PO Box 77, Penshurst, NSW 2222.

Further information from Derick Sellers, VK2AZS (02) 560 8644; (02) 529 8674 (AH) or Jim Button, VK2NPA (02) 543 3295; (02) 521 7303 (AH).

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, NSW 2200.

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The kit contains:

** One transducer
** One spare transducer
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** One assembled evaluation board containing all necessary electronics to measure and display in 3 digit LED's distances of objects from 26cm to 1066cm.
** Two Polapulse 6V batteries as used in Polaroid film pack
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** One technical manual

Suggested applications:

* Electronic 'measuring tape'
* Camera focussing
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IMS-6090 Triaxial car stereo speaker kit	$33.70 pr
Ralmar PSS-2 car stereo speaker control	$8.90 ea
AA Penlite ni-cad batteries	$1.75 ea
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ME-531	$79.00 ea
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CC-250 Universal Polarity Checker	$4.00 ea
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D Connector HD25 Cover to suit	$2.84 ea
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TDK SA C60	$4.30 ea
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Ti-54	$36.96	$41.58
Ti-50	$36.96	$41.58
Ti-40	$32.84	$36.95
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Ti — Dataman Learn Aid	$23.63	$26.57
Ti — Speak and Spell Learn Aid	$69.53	$78.25
Ti 58/59 Module Libraries	$33.40	$37.60
TP-30250 PC-100C Thermal Paper — 3-roll pack	$11.37	$12.68
Ti B PIA Battery Pack (For 58/59)	$7.28	$8.12
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SHORTWAVE SCENE

by Arthur Cushen, MBE

Major frequency changes for summer reception

Reception of international stations this summer has shown that high frequencies are still widely used after dark, despite the decline in the incidence of sun-spots. Berne, Switzerland recently began use of a new frequency, 25780kHz, while there have also been major changes in frequencies and schedules of stations around the world.

RADIO ULAN BATOR BROADCASTS

The English transmissions of Radio Ulan Bator, Mongolia have been retimed and now three transmissions are broadcast, each of 35 minutes. The broadcasts are Monday to Saturday only 1200-1235, 1400-1435 and 1445-1520UTC. Three frequencies are used, 6383, 7230 and 12070kHz. The latter frequency gives the best reception while 6383kHz is heard at fair strength. Transmissions on 7230kHz have also been heard although not carrying the English program. In the past there were two transmissions from Ulan Bator, 1220-1250 and 1715-1745UTC but these have been replaced by the new schedule.

ENGLISH FROM BUENOS AIRES

The English broadcasts from Radiodifusion Argentina Buenos Aires has been received on 11710kHz at 0100-0130UTC Tuesday to Sunday at good strength. After 0130UTC broadcasts continue in Spanish until closing at 0300UTC. The station announces that English is broadcast on 1171kHz Monday to Saturday at 1100, 1530, 1630, 1730, 1930, 2200 and at 0100UTC the following day. The frequency of 9690kHz carries the same program at 2300-0300UTC. Broadcasts in Japanese beamed to the Orient are heard at 1030-1100 and 1130-1200UTC.

ROME MAKES CHANGES

Broadcasts in Italian for listeners in Australia and New Zealand in recent months have run into considerable interference from other stations sharing the frequencies and a move is under way to provide clearer transmission. The broadcasts in Italian at 2050-2130UTC have been moved from 9575 to 9710kHz to avoid interference from Radio Australia. The writer has also suggested other improvements in reception as both the 31 metre band frequencies of Rome Radio are subject to severe sideband interference from Radio Australia. The transmission in Italian 0830-0930UTC has been difficult to receive on 9580kHz and a move to 9525kHz has been suggested. This transmission is also available on 11810, 15330, 17780 and 21615kHz and the latter frequency is generally the best received. The broadcast at 2050-2130UTC which is now on 9710kHz is also carried on 7235 and 11800kHz and the new frequency 9710kHz together with 11800kHz both give good reception.

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.

JAPAN'S EXPANSION PLANS

Radio Japan's announcement of plans to challenge the BBC for its place as the fourth broadcaster on international shortwave has been made after an intensive study of the shortwave services. A policy research committee of Japan's Liberal Democratic Party have recommended after a six month study that expansion of Radio Japan broadcasts would improve Japan's exports. Radio Japan will expand from the present 259 hours a week in 21 languages which places it in 14th position, as far as program output is concerned, to 700 hours a week in 40 languages.

Radio Japan broadcasts to Australia in English 0930-1030UTC on 11875 and 15235kHz. On Sunday there is a special session for the shortwave listener at 1010UTC, while on Saturday "Hello Australasia", a program designed for listeners in the South Pacific area, is broadcast.

Signals from Africa on the lower frequencies are again being received at dawn, including the reception of Radio Mauritania, which has moved to 4817kHz and is heard opening with a short English announcement at 1745UTC. Mauritius, which has been operating on 4855kHz for some months, carries BBC news at 1800UTC while on Fridays a religious program in English can be heard, closing at 1830UTC, according to Bryan Clark in the NZ DX Times. News in French from Rwanda on 3330kHz at 1900UTC has been reported by Don Mitchell and Chris Rogers in DX Post. Swaziland transmissions of Trans World Radio on 5055kHz with reception at 1900UTC have been noted by Ray Crawford of Gladstone, Qld. The transmission was in English and was heard to be closing at 1935UTC. Zimbabwe has been heard on 3307kHz and 3396kHz. Transmissions on 3307kHz have been noted by Don Mitchell, while Garry Bowles in DX Post notes transmissions on 3396kHz, beginning with jazz at 1820UTC, followed by news in English at 1900.

NEW TRANSMITTERS

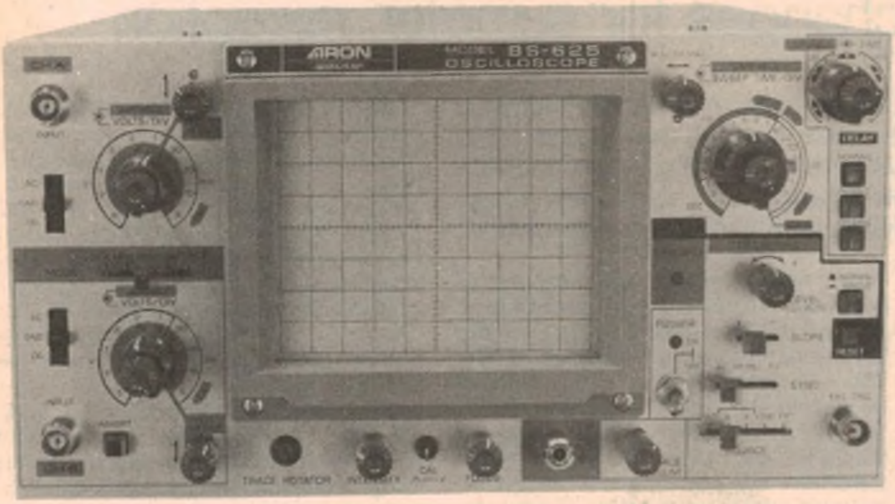
The rush by developing countries to get a voice on the international shortwave bands continues and this move is being promoted by aid from many Western or Communist countries. In the South Pacific Australia is helping with the upgrading of the facilities of the Solomon Islands Broadcasting Corporation, while New Zealand has given three transmitters to Western Samoa to expand their services.

In the international field the East German Government is providing Mexico with a modern shortwave complex and according to the BBC Monitoring Service a new shortwave site has been chosen near Tectihucan. The transmitters are expected to give wide coverage and to become one of the most important installations in Latin America.

ARGENTINA: Radio Nacional, Mendoza 6180kHz confirms reception with a hand written four page letter from the Director. The station was heard around 1000UTC with Spanish programming. The address is Padre Vera No. 270, Maipu 5515, Mendoza, Argentina.

BELGIUM: BRT has announced plans to re-time its English transmissions which would be broadcast in future to Africa at 2000-2045 instead of 1705-1750UTC, with a repeat at 2200. At present 6010 and 17595kHz carry this transmission. New frequencies 9870 and 1169kHz are used to North America at 0015-0100UTC.

Aaron BS-625 45MHz Dual Trace Oscilloscope



Recently introduced onto the Australian market is the Aaron BS-625 CRO, which features a delayed timebase facility. This will not only appeal to the advanced amateur, but also to the professional, especially in the computer and allied fields. It is the only CRO that we know of in the upper-medium price range that includes both "single shot" and delayed timebase operation.

Dimensions of the BS-625 are 145(H) × 280(W) × 422(D)mm which result in a compact appearance considering the many facilities designed into the instrument. Mass is approx 10kg. Somewhat unusual is the location of the CRT in the top centre of the front panel, rather than the customary top left corner.

Controls for the vertical channels are located to the left of the CRT and comprise the usual 5-2-1 stepped attenuators (ranging from 5V to 5mV/division), concentric vernier attenuators with detented calibrate positions, input coupling switches, vertical shift controls (including ×5 vertical magnifier when pulled out), and mode selector (Ch A, Ch B, Dual Trace, Add and Chop). A pushbutton allows Ch B's display to be inverted.

The CRT itself has a 150mm diameter flat-faced screen with an internal graticule (to minimise parallax error) marked out in the standard 8 × 10 divisions; each 10mm apart unlike some other CROs where cost-cutting results in spacings of less than 10mm. A nice touch is the provision of dotted lines to assist in locating the 10% and 90% voltage points on a waveform.

Colour of the trace is a bright cyan, which is very clear and especially effective at high writing speeds with low duty cycles.

Time base calibration is in 20 steps in the usual 5-2-1 sequence from 0.5s to 0.2μs/division, plus a concentric variable sweep velocity control (with detented calibrate position) for fine adjustment. Aaron also provides a ×5 (switched) sweep magnifier. Measured accuracy of both calibrated timebase velocities and ×5 magnifier was within ±2%, which is better than the 3% specification.

Calibrated vertical channel sensitivities were also found to be within ±2%, with or without the ×5 vertical magnifier. The specified bandwidth was 45MHz (−3dB point), and this was certainly correct. Selecting the ×5 vertical magnifier reduced the bandwidth to 10MHz as per specification.

Products cont'd p98

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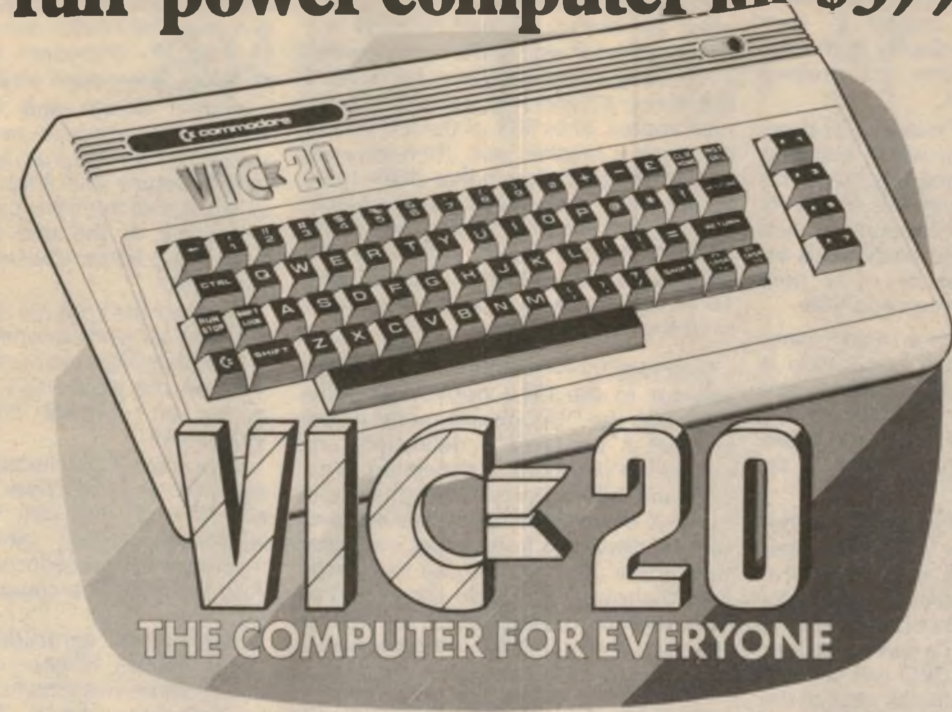

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VICTORIA

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The triggering circuitry performed well, maintaining effective trigger to over 80MHz, with a usable display at this frequency provided the ×5 sweep magnifier was selected.

As well as the usual "mains" LED there are two others, one of which indicates that the timebase is being triggered. This is very useful when working with very high frequency signals, since one can see at a glance whether the timebase is actually being triggered or in a non-synchronised free-running condition.

The third LED serves as a "ready" lamp when single-shot timebase operation is selected. This single-shot facility is not normally included on medium priced CROs, but is a valuable feature for those specialised applications where it is required.

As mentioned in the introduction, the Aaron BS-625 features a delayed time base facility, a feature rarely found in similarly priced oscilloscopes. This facility enables a detailed inspection of, say, a low amplitude pulse in a train of pulses, where a conventional CRO will not trigger on the small pulse. In the case of the BS-625, one of the large pulses is used to trigger the "delaying" timebase (with the "main" displaying timebase held "off") which is then manually adjusted to trigger the main timebase at the point where the desired pulse occurs. The main timebase can then be set to the optimum velocity for viewing the pulse.

Located in the top right corner of the front panel is a 5-step rotary selector for setting delays from 1 to 10μs, 10 to 100μs, 100μs to 1ms, 1 to 10ms and 10 to 100ms. Concentric with this selector is a vernier for fine setting the delay within each of the ranges.

Set-up is simple. Firstly adjust the sweep velocity of the main timebase to display the train of (large) pulses with the desired small pulse located on the right side of the screen. After setting the stepped delay control to minimum delay, press the button labelled INTEN'D and observe the left side of the trace. Portion of the start of the trace may be blanked out. If not, advance the stepped selector until approx 10 to 50% of the left side of the trace is blanked out. Then advance the vernier control such that all the trace to the left of the desired pulse is blanked. Maintaining this setting press the DELAY'D button, which will bring the small pulse to the left side of the screen. To expand the pulse increase the velocity of the main timebase.

Switching the stepped timebase sweep selector to the CH-B position puts the CRO into the "X-Y" display mode where channel A produces Y deflection, and channel B produces X deflection. Very often in medium priced CROs phase shift in the X channel limits the usefulness of the X-Y display to frequencies no higher than about 10 or 20kHz; but this Aaron BS-625 showed negligible phase shift to over 100kHz, and only 2 or 3° at 300kHz — a very commendable performance.

The leading edges of fast transient waveforms may be easily inspected on the BS-625, as they are delayed by inbuilt signal delay lines in each vertical channel. In addition, this is assisted by the 7.7ns rise time of the vertical amplifiers. amplifiers.

One minor irritation is that the sensitivity of the Y-shift controls is magnified in like manner to channel gain when the ×5 magnifier is brought into use. Thus, unless the trace is close to the vertical centre of the screen when magnification is selected, the trace disappears off the screen. Further, even when the trace is shifted back into the viewing area, the additional sensitivity of the shift circuitry make the controls very "touchy" to operate.

Internally the BS-625 is very neatly laid out, coupled with a high standard of construction and assembly. Notwithstanding the complex facilities which this CRO provides, the interior gives an impression of simplicity compared with many less complex, low-priced oscilloscopes.

External design and finish is quite satisfactory, although not to quite the standard expected from the instrument's other features and finish. For example, all corners of the front panel are "sharp" and some of the title labelling could have been better chosen, eg INTEN'D, TRIGGERD.

However the controls are well laid out; and they all work smoothly and precisely. Another nice touch is the provision of slots on the plastic CRT escutcheon to accept an optional Polaroid camera attachment.

A comprehensive Instruction Manual is supplied and describes the operation and use of the unit. In addition, a simplified circuit description and maintenance procedures are included. Also incluided is a comprehensive parts list.

Our overall impression is that the Aaron BS-625 is competitively priced, and provides many features not found in similarly priced CROs. The unit is well made and gives an excellent performance. At $1245 (plus 17½% sales tax where applicable) it offers good value for money. Probes are not included with the instrument but British made "Coline" probes are available at $25 each (plus sales tax). These are high quality switchable (1:1 and 10:1) "duoprobes" suitable for operation to 100MHz.

Further information can be obtained from trade outlets, or the Australian distributors, Elmeasco Instruments Pty Ltd, 13-15 McDonald St, Mortlake, NSW, 2137 (P.de N).

New products cont'd ►

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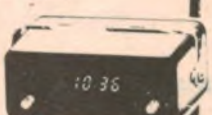

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New Products

PowerMate connectors for multiple outlets

For those situations where there never seem to be enough power points for all the appliances we want to use, PowerMate power connectors may be the answer. These portable, four outlet power connectors are compact, (20cm x 6cm) and said to be less expensive than competing types. A feature of the unit are curved ridges above each power outlet to protect against plugs which are not fully inserted.

The unit comes in white, with a 1.8 metre power cord. Because it is so compact it can be used in confined spaces or hung either horizontally or vertically by special moulded keyhole openings at the back of the unit.

PowerMate is distributed by HPM Industries, and is available from hardware and electrical storage nationwide.

Relays for CMOS

Teledyne Relays have recently released an electro-mechanical relay that can be driven directly by the signals of most logic families including CMOS.

The new Centigrid relay incorporates a FET driver in the input to amplify the signal, and a protective Zener diode, packing it all together with a DPDT relay and coil suppression diode in a tiny Centigrid style can.

For more information contact Quentron Optics Pty Ltd, PO Box 364, Box Hill, Vic 3128.

New range of cooling fans

Compact Fan Company Pty Ltd has recently been appointed the Australian agents for Papst-Motoren GMBH & Co of West Germany. Papst-Motoren manufacture a wide range of fans and blowers, suitable for applications in the electronic field. Most uiits conform to the tough West German VDE requirements.

Further information is available from the Compact Fan Company, PO Box 52, Moorebank, NSW 2170.

Sonic stylus cleaner

M.R. Acoustics now has available an innovative new stylus cleaner, called the Hervic Pro Sonic Stylus Cleaner, which uses a sonically operated stiff brush. There is no stroking or brushing; just switch the unit on and place the stylus to be cleaned on the pad. Obviously this method is very safe for expensive and delicate styli. The device uses a 9V battery.

For further information contact M.R. Acoustics at PO Box 15 165, Annerley, Qld 4103.

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

February 1932

3AW opens: A new broadcasting station, 3AW, the Vogue Broadcasting Co, located at His Majesty's Theatre, Melbourne, and owned and operated by Messrs J. C. Williamson, David Syme and Co ("The Age"), and Allan and Company, will be going on the air about the middle of February.

☆ ☆ ☆

New screen-grid valve: National Union Radio Corp has announced a screen grid radio frequency amplifier, designed especially for reducing cross-modulation and modulation distortion. Furthermore, its design is such as to permit easy control of a large range of signal voltages without the use of local-distance switches or antenna potentiometers. This feature makes the valve adaptable to automatic volume control design. It is designed for AC operation, and employs a cathode of the quick heater type. Designated type 235, it features the new variable-mu characteristic, in which the amplification factor gradually reduces with increasing grid bias.

☆ ☆ ☆

2CH opens: The Council of Churches' broadcasting station, 2CH, will go on the air for the first time on 248 metres on Monday morning, February 15. For a week before that date, the 1000 watt Telefunken transmitter will be testing on the air. Station 2CH promises to be one of the best of our B class stations.

☆ ☆ ☆

2UW to cover bridge opening: Through a link up of B stations in Queensland, Victoria, South Australia and New South Wales, 2UW has arranged to give a comprehensive cover of the Sydney Harbour Bridge opening celebrations, on Saturday, March 19.

☆ ☆ ☆

Wireless listeners: There were 341,394 broadcast listeners' licences in force throughout Australia at January 31, 1932. This is equivalent to 5¼% of our population.

It is interesting that whilst Victorian licences cover 7.48% of its population, NSW cover only 5.09%, and Queensland and Western Australia only a little over 2½%. Tasmanian licences cover 4% of its population, and South Australian 5½%.

RADIO TELEVISION AND HOBBIES 1/6

February 1957

Radio most popular: Listening to the radio is our chief leisure-time occupation, the Gallup Poll finds.

Throughout Australia, people were handed cards, listing six ways of spending spare time. They were asked which was their favourite way of spending their evening !eisure, both Saturdays and weekdays.

Answers show radio as top favourite, both on weekday evenings and Saturday evenings. During the week reading is second favourite, but movies are second on Saturday evenings.

If radio plus movies equals TV, then the prospect looks bright.

☆ ☆ ☆

New portable TV: The introduction of miniature TV sets overseas, particularly in America, is a feature of the TV scene in that country, and represents an important advance in techniques and ingenuity.

Weighing less than 13lb and no bigger than a breadbox, General Electric's new 9in portable TV receiver introduces many innovations in design, manufacture, and serviceability.

A new, lightweight, rectangular picture tube, printed and dip-soldered circuits, aluminium cabinet, miniature components and wider use of semiconductors contribute to its lightness and compactness.

☆ ☆ ☆

First satellite: It is hoped that the first satellite will be launched early in 1958 as part of the various scientific projects to be carried out during the Geophysical Year 1957-58.

The satellite itself will probably be merely a metal ball weighing about 20 pounds. It will, of course, be launched by means of a rocket.

☆ ☆ ☆

Transistors' long life: Replacement of transistors in portable radios and other electronic equipment may never be necessary if they are used within the limits set by the manufacturer.

According to overseas reports, life tests started in 1954 on transistors picked at random from regular manufacturing lots show no failures after 18,000 working hours at full power.

Books & Literature

Caring for Computers

DON'T (OR HOW TO CARE FOR YOUR COMPUTER): by Rodnay Zaks. Soft covers, 218 pages, 153mm x 222mm, illustrated with diagrams and photographs. Published 1981 by Sybex Inc Berkeley, Calif USA Price $11.95.

This book is a complete guide to the care and use of small computer systems, intended for the hobbyist and professional user alike. Rules and procedures are presented for each component of the system, mostly in the form of things to do and things not to do. Specific recommendations for each element of a computer system are given in separate chapters.

The first chapter is an introduction to the subject of computer care, justifying the procedures given later in the book. Typical problems are described, including those careless mistakes which don't show effects immediately, but which lurk "like a time bomb" to cause trouble at a later stage. Chapter two gives the basic definitions and descriptions required to understand a typical computer system, and can be safely skipped by readers who have been operating their own computer for any length of time.

Floppy disks are covered in Chapter three. This chapter is perhaps one of the most important in the book, since, according to the author, disks and disk drives are the most common cause of failure in a computer system. Proper handling, storage, back-up and labelling are described, illustrated with a "typical horror story" stressing the need for disk care.

Other chapters cover hard disks, the computer unit itself, CRT terminals, printers and tape units. Planning the environment of the computer is treated in a separate subject, as this is often neglected by home computer users. Both the hobbyist and the business user can benefit from the advice and recommendations given here, based as they are on the author's wide experience of computer installations.

Topics covered include floor planning, electrical power, furniture and fire protection. Later chapters cover software, documentation of the hardware and software and computer security. Finally a guide to maintenance agreements and services is given in the last chapter. Two appendices are given, covering tape and disk manufacturers and a list of addresses of US organisations assisting with computer security.

Altogether this book is a very useful addition to any computer library. In clear terms it guides the computer user through all the procedures required for getting the best use out of his system for the longest time. Both hobbyists and professional users can benefit from the author's light-hearted but forthright approach to his subject — a subject which seems to have fallen into neglect as small, relatively inexpensive computer systems proliferate.

Our review copy came from the Technical Book and Magazine Co. Pty Ltd, 289-299 Swanston St, Melbourne, Vic 3000. (PV)

Personal Computers

PERSONAL COMPUTERS HANDBOOK: by Walter H. Buchsbaum. Soft covers, 286 pages, 136mm x 215mm, illustrated with charts and diagrams. Published 1980 by Howard W. Sams & Co. Inc USA Price $16.25.

Intended for readers who have a knowledge of electronics but who wish to learn about microcomputers, this book deals with fundamental concepts of computers, their applications in the home, equipment available, programming and hardware and software trouble-shooting. As might be imagined, the wide range of the book prohibits any really detailed treatment of particular topics, but nevertheless quite a lot of handy information is included.

In 12 chapters the author moves from "Personal Computers for people interested in electronics" to trouble-shooting of typical small computer systems. On the way, chapters are included on computer applications (a brief guide only), computer operation, principles of programming and a comparison of some small computers.

The wide mixture of topics creates an impression of lack of planning. It seems from the attention devoted to it the subject, that the author is most at home with digital electronics on the level of individual chips. "How a computer computes" and "Microprocessors" are the most detailed chapters of the book, useful for hobbyists, servicemen and computer users who want a detailed description of computer circuitry.

Applications of computers are less well covered. In particular, most sections treating computer applications are nothing more than "a computer can be used for . . ." with little indication of how to do it. Similarly, the two chapters on programming, while giving some important basic information and a couple of good examples, are not really a satisfactory treatment. The chapter on typical small computer systems is sketchy, although worthwhile as a comparative guide.

Perhaps the best features of this book are the descriptions of the operation of computer circuitry and the chapter on trouble-shooting. Various techniques for isolating and correcting typical faults in computer systems are described, together with a description of the most frequently encountered defects. In comparison, the few pages on software problems seem an afterthought, with only the barest treatment of a few elementary programming errors.

Overall, one is left with the impression of a book which tries to do too much. As a text on computer circuitry and hardware problems the book is excellent. As a "Handbook", purporting to cover all aspects of computer systems, it falls short because of the patchy treatment of its subjects. In spite of this, it would be very useful to anyone interested in electronics who wants to know how computers work.

Our review copy came from McGill's Authorised Newsagency, 187-193 Elizabeth St, Melbourne, Vic 3000. (PV)

Intellectual Robots

THE YEAR OF THE ROBOT, by Wayne Chen. Soft covers, 182 pages, 212 x 137mm, illustrated with some diagrams. Published 1981 by Dilithium Press USA. Price $10.95.

This unusual book is split into two parts. The first and most relevent section is entitled "The Intellectual Robot" and presents a philosophical dissertation about human traits of robots and their application to the interpretation of human behaviour, social phenomenon and democratic institutions. It turns out that amplifiers, robots and humans all have a common factor in that they all have feedback systems.

Wayne Chen proceeds to enlarge on this feedback idea as being the foundation of all behaviour and the basis of an ideal robot behaviour.

The second part of the book is actually a reprint of a novel written by the author under the pseudonym, Wayne Hawaii and entitled "The Robotosyncrasies". It is about a robot who is so humanlike that he "falls in love" and marries.

My reaction to the whole book was "What a load of garbage". It is true that psychologists and social scientists have embraced the general idea of feedback as applied to human behaviour and it is also true that robots use feedback systems to control their operation. But there really is quite a large difference between the principles of feedback as applied to engineering practice and the rather general concept of feedback applied to the end encoder/decoder systems of psychology. Chen labours the connection between the two in my opinion.

Perhaps my reaction would have been more favourable if it had not been for the inclusion for the second-rate piece of fiction that makes up the remainder of the book. Before sampling Chen's little offering I had thought the Startrek novels adapted from the screenplays were the worst science fiction I had ever read but now I know better.

Our review copy came from the Australia & New Zealand Book Co Pty Ltd, 10 Aquatic Drive, Frenchs Forest, NSW 2086. (L.D.S.)

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

CONSTANT LAMBERT — Romeo and Juliet, Pomona

LAMBERT — Two Ballets. Romeo and Juliet and Pomona. English Chamber Orchestra conducted by Norman del Mar. World Record Club Stereo Disc R 08632.

I first met Constant Lambert in London during the late 1920s, some time after Romeo and Juliet had been presented amid massive quarrels among all those connected with its creation and production.

The ballet was not actually commissioned from Lambert by Diaghileff. Lambert had played him a suite of music he had written on another subject and Diaghileff, with his unfailing insight, had seen the possibilities of fitting it — with a few adaptations — to a familiar theme like Romeo and Juliet — brought up to date.

But things didn't turn out like that. Nothing could be decided without noisome disagreements. Lambert was a student at the Royal College at the time and consequently not flush with funds. but Diaghileff brought him to Monte Carlo and put him up at a very swagger hotel. Now Diaghileff, despite his genius, was a mean souled pig of a man. He was a practising — and self-confessed — homosexual and Lambert was a very good-looking boy who refused Diaghileff's ardent advances. In revenge Diaghileff moved him into a rotten little back-street pub.

Don't forget that this same genius sacked the great Nijinsky because he had dared marry a "woman" during a temporary absence from Diaghileff in Buenos Aires.

At any rate R and J finally got itself on, quietly at Monte Carlo but amidst uproar in Paris a little later. But it never really caught on as so many of Diaghileff's productions did, though the ballet did serve to make Lambert's reputation. But, what was more important, it brought him to the attention of the influential Sitwells, who remained his friends during the whole of his short life. He died at 46 of a

mixture of diseases not helped by copious drinking. He is best remembered by his cantata Rio Grande.

At the time Lambert composed what was to become Romeo and Juliet, he was much under the influence of Stravinsky who was, by then well into his neoclassical period. The French composer's Les Six also won his allegiance.

The ballet consists of 13 short items, most of which sound quaintly dated nowadays but which still retain a certain youthful freshness. Much more mature is the music of Pomono, the other ballet featured on this disc. This, too, consists of short pieces, eight in number, with Lambert still under his neo-classical and French influences but much more self-assured, his always strong sense of lyricism much more elastically developed.

The disc is beautifully produced, the sound is first rate, and the English Chamber Orchestra at the very peak of their form. You will also find much interesting information about Lambert in Richard Shead's sleeve notes, quotations from which I was reluctantly forced to omit because of space limitations. (J.R.)

BARTOK/ASHKENAZY: "Dazzling speed"

BARTOK — Piano Concertos Nos. 2 and 3. Vladimir Ashkenazy (piano) with the London Philharmonic Orchestra conducted by Sir George Solti. Decca Stereo Disc SXL 6937.

Both Ashkenazy and Solti tend to play very fast whenever the occasion offers, although without ill-treatment of the music. It was therefore with no surprise that I listened to their exuberant collaboration in the first movement of the Second Bartok Piano Concerto. Neither shows any sign of relaxation and, at a speed that threatens catastrophe in every bar, nothing — repeat nothing — untoward happens. Their brio continues unchecked.

Some of Ashkenazy's figurations go at more than a dazzling speed: dizzying would be a better word. If you want to gape with wonder, listen to his long passage of fast repeated notes at about the middle of the movement. Yet both conductor and soloist get full picturesque contrasts out of the stretches when the tempo slows down.

Both are just as expressive in the quietest and most reflective parts of the adagio, a strange movement which encloses within its ample arms a complete scherzo. Only the most sensitive of recording engineers could have captured the minute nuances in the barely audible bars of the solo part of the adagio. And the movement ends with piano and orchestra shimmering, yes, shimmering, on the border of silence. It provides an astonishing experience.

In the Finale the artists revert to their exciting first movement treatment, but here the music increases speed still more relentlessly. Everything seems to drive towards a broad, flowering like effect, a return then to the fast tempo and finally some coda-like bars that are full of surprises.

The Third Concerto is heard more often than the other two in both homes and halls. In this, the recording level seems a little higher than in the second, although without sacrificing any of the romantic elements the players bring to the Second Concerto. Despite this

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.).

"closeness" there are, in the first movement of the Third Concerto, passages that I can only describe as fairy-like.

But the Adagio, finely as it's played, does suffer a little from the above mentioned closeness. It just fails to capture all the enchantment of the nocturnal insect sounds common to so many of Bartok's slow movements. I still remember with gratitude the Katchen/Ansermet spell in this lovely movement.

But if they fail ever so slightly – and this comparatively – in this movement, the work jumps back to life in the maze of syncopations that make up the spirited finale, all of them superbly accented by Ashkenazy, even at a moment when the London Philharmonic's ensemble seems to shudder a little.

But this apart, it's a great romp and has about it a Hungarian quality in even greater measure than anywhere else in these two very Hungarian works. (J.R.)

BEETHOVEN: Symphony No. 5

"Sound is completely clean"

BEETHOVEN. Symphony No. 5 in C-Minor, Op 67. Egmont Overture, Op 84. Boston Symphony Orchestra conducted by Seiji Ozawa. Digital mastered stereo, Telarc DG-10060. [From PC Stereo PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612].

Born in China of Japanese parents, Seiji Ozawa studied both eastern and western music and graduated from Tokyo's Toho School of Music. Subsequently, with the support of Charles Munch, Herbert Von Karajan and Leonard Bernstein, he gained experience with the New York Philharmonic and the Symphony Orchestras of San Francisco, Chicago and Toronto. In 1976, he became Musical Director of the Boston Symphony and, with it, undertook successful tours of Japan, China and Europe. Last year, the orchestra celebrated the centenary of its foundation in 1881.

On a worldwide basis, the Beethoven No. 5, presented here, is high in the stakes as the most frequently played major work. Even those not familiar with it are likely to recognise the opening and often-repeated phrase of four notes which spell out the letter "V" in Morse code. Because of its association with Churchill's "V for victory" slogan in World War II, it is often referred to as the "Victory Symphony".

For a work so well known and so often played, music lovers will inevitably have their favoured performances and their own favoured interpretations, straightforward or "customised" in an effort to lend them a certain individuality.

Seiji Ozawa settles for the traditional, large orchestral approach, but one that is well balanced and expertly played.

And Telarc engineers have gone for a fulsome sound, free of technical dramatics – unless you want to count as such full use of the dynamic range which the digital system permits. But the sound is completely clean and the surface noise-free.

The fill, on side 2, "Egmont Overture" is lightweight by comparison with the major work but it is a pleasant snippet, and also well recorded.

I am not about to convince you that you need another copy of the number 5, or one from a digital source, but if your inclinations run in that direction, this one from Telarc will almost certainly bring much pleasure (W.N.W.)

Japanese Music

Classic Melodies of Japan. Isaac Stern (violin), Hozan Yamamoto (shakuhachi) "notched flute" and Ensemble Nipponia. CBS Stereo Masterworks SBR 236047.

Two things impressed me as soon as I started to play this disc – the simplicity of these Japanese classic melodies and the lack of verbal information that accompanies them. Isaac Stern figures large on the front of the sleeve but we all know that he plays the violin. Slightly smaller type adds another name, Hozan Yamamoto, though what he contributed to the making of this disc is a mystery. Provided is a description of a Japanese notched flute, the name of the accompanying body, the Ensemble Nipponai, its conductor and arranger, and nothing else but a Japanese drawing of a concubine. At least, I presume she's a concubine, for Japanese models always seem to be so described!

Strangely, the music sounds only slightly like what we have come to recognise as typical of Japanese music. It is not, for instance, a bit like "Madam Butterfly" music. Its idiom is spare and at times Stern sounds as if he might be improvising. The accompaniments are dominated by the flute, described on the sleeve as a sort of free two-part polytonality. It is all very cool and elegant. But it is all surprisingly tonal and, even when the ensemble joins in, it still all sounds very tonal.

It is very attractive although, after a while, the similarity of the 11 songs that make up the recital becomes so evident that the effect becomes soporific. Personally I found one side plenty at a sitting. (J.R.)

☆ ☆ ☆

RACHMANINOV – Symphony No. 1 in D Minor. London Symphony Orchestra conducted by Andre Previn. World Record Club Quadaphonic Disc QR 06360.

Those who go to this symphony expecting to hear the fine big romantic melodies they find elsewhere in this composer's works will be disappointed. If it doesn't measure up to even the most modest works of the later Rachmaninov, it must be remembered that it was written by a young man of 22.

At its first performance under the unfriendly Glazounov it was icily received and its press was so bad that it dissuaded Rachmaninov from composing anything else for some three years. It was never performed again during Rachmaninov's lifetime, perhaps because the manuscript disappeared – or was as is even more likely, hidden by him. It wasn't till 1944 that the original orchestral parts turned up in Leningrad, making it easy to reconstruct a score from them. Should it have been dismissed quite so callously?

I think not, for, although it is far from great, it often rises above mere mediocrity. Despite the fact that the London Symphony play it beautifully, their conductor Previn doesn't display much enthusiasm for the work. Indeed for a man usually characterised by the vigour of his conducting, his effort here is, on the whole, plain dull. And this especially so in the slow movement which literally had me yawning.

Here and there you hear hints of the composer's works to come, a natural enough characteristic of most early works. But, even in this pallid prelude, the music that is there demands the ultra-warm type of presentation called for in his most popular piano concertos. And this is where Previn fails the well-intentioned composer. Apart from an occasional tender appreciation of a phrase, Previn leaves the work to look after itself, so to speak. Where he might have enlivened things by an exciting climax he just carries placidly on. At most, he never raises the temperature more than a few degrees — Fahrenheit.

I am afraid its only appeal is likely to attract scholars who may use this symphony to compare with the composer's later — and more characteristic style. The sound is good. (J.R.)

☆ ☆ ☆

CHARPENTIER, M.A. — Te Deum. Magnificat. Three Carols. Sung by soloists of the pro Cantione Antiqua of London and the Choir of the Collegiate Church of St Mary in Warwick with the Orchestra of La Grande Ecurie et La Chambre du Roy conducted by Jean-Claude Malgoire. CBS Masterworks Stereo Disc CBS 76891.

I am afraid that shortcomings in the performance of the major work in this recital, the Te Deum, spoilt my enjoyment of an otherwise attractive and unusual disc. Just how such a sloppy, undisciplined row, faulty in intonation and ensemble, ever got itself past a quality supervisor is to me an unanswerable puzzle.

The singers are all English, or at any rate British and all are experienced at the kind of work expected of them here. The accompaniment is provided by a French combination, a small orchestra specialising in period French music under the direction of Jean-Claude Malgoire.

And seeing that the recording was made in Paris I can only assume that the buck for this shoddy exercise must stop at the conductor.

The other pieces, the Magnificat and the Three Carols, are quite delightful and this disc, with all its drawbacks, will be well worth having for that reason alone by anyone interested in this Charpentier's music. This Charpentier, by the way, is Marc-Antoine (1634-1704) and not Gustave, the 20th century composer of that delightful verismo opera, Louise. (J.R.)

☆ ☆ ☆

HAYDN — Cello Concertos No. 1 in C and No. 2 in D. Yo-Yo Ma (cello) with the English Chamber Orchestra (leader Jose-Maria Garcia). CBS Stereo Masterworks Disc SBR 236036.

The sleeve photograph shows Yo-Yo Ma as a smiling, good looking 26-year-old Chinese, born in France, educated in America. I might as well say at once that he plays like an inspired Western veteran. His very first bars advertise his assurance, but displayed without any vapid virtuosity.

His entries are superbly attacked and perfectly intoned — no mean feat on an instrument that often demands almost impossible stretching of the player's fingers. Indeed, his very first bars also prepare one for something out of the ordinary — a promise generously kept. Andone's admiration grows with the music. His phrasing is never less than elegant, his technique already that of a master and I must again emphasise the accuracy of his intonation, especially in double-stopping, which he brings off with enough apparent ease to inspire envy in the great Rostropovitch.

I might mention here that composer and performers both benefit from the impressive fidelity of the sound. Not a note is missed or even slurred in the

DAYDREAMS — "Very listenable indeed"

DAYDREAMS By Ron Cooley. Stereo, American Gramaphone SG-368. (From M.R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598.

M.R. Acoustics, who brought to light the excellent Swedish albums reviewed recently, have done it again with this American Gramaphone release. (The spelling is as per the label). There is no reference whatever to the technical side of the recording and nothing about the music either, except for a list of names and their respective contributions. Very modest!

But the fact is that the sound is notably full, well balanced and clean, while the recording itself is completely free from spurious noise in the way of hiss, crackle and pop.

And the music? Well, Ron Cooley on guitars of one type or another, is backed by other guitars, bass drums, recorders, English horn, strings, keyboards, synthesiser, etc, adding up to quite a body of sound. The items by Ron Cooley start and finish with a soft rock sound but explore a whole range of instrumental sound in between. The titles: Daydreams — Looking Out A Window — Samba These Days — Tranquility — Daze — Christine — Let's Be Friends.

It's very listenable, indeed. (W.N.W.)

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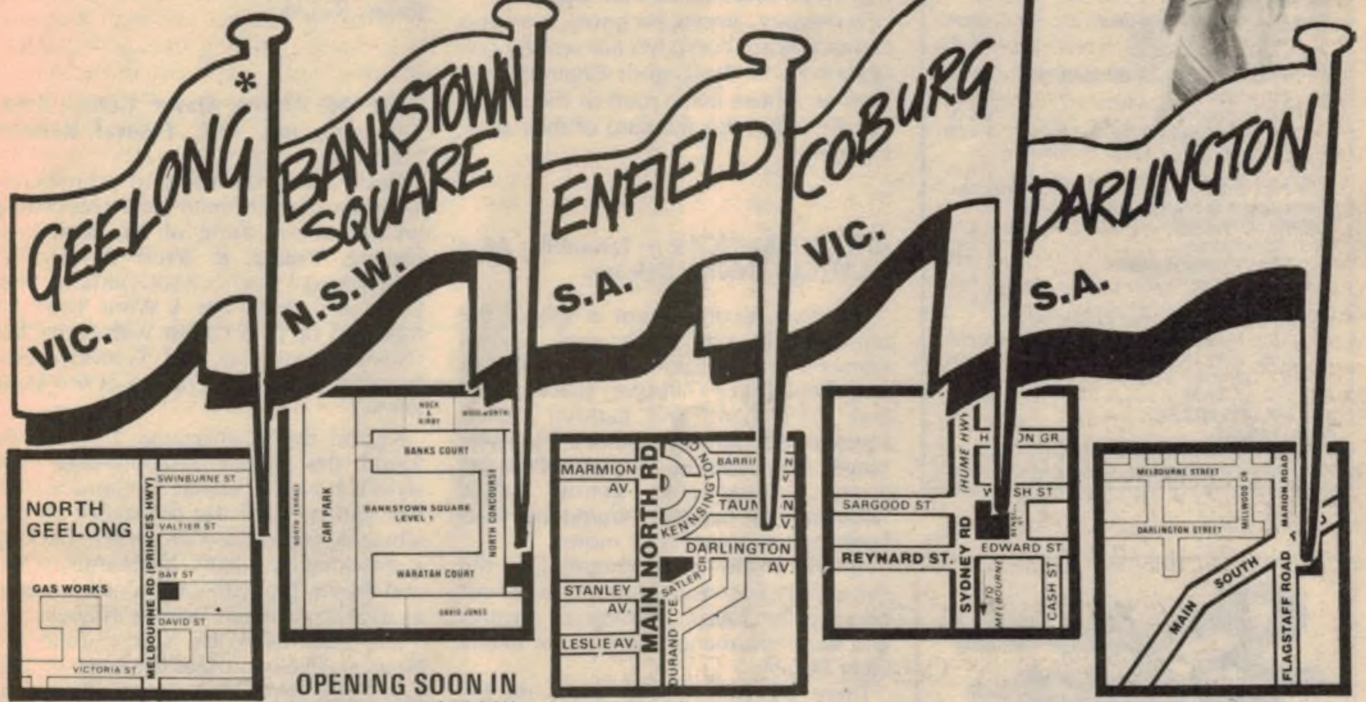

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fastest passages and at his top speed, that young cellist could successfully challenge Heifetz when he was at the height of his form.

Both concertos are extremely attractive, full of Haydnesque ingenuities, good humour and warmth. They are the only two works I have so far heard this highly talented young man play and both are presented in perfect style with just the right air of lightness. If he plays other composers just as well, there is no knowing where one's praise will stop.

By the way, among his tutors, has been Leonard Rose! Yo-Yo Ma has worthy collaborators in the English Chamber Orchestra, whose admiration of the soloist is reflected in the standard of their playing. (J.R.)

☆ ☆ ☆

CHUCK MANGIONE — Tarantella. A&M L70183/4. Festival Release.

This two record album is full of the unexpected, with such well known names as the Mangione brothers, Chuck and Gap, Dizzy Gillespie, Chick Corea and Steve Gadd and Kathryn Moses, together with about 20 others. The styles range from typical Gillespie Bopping style, through the gentle ballad "Bellavia", to fantastic drumming feats lasting seven minutes or more.

All the tracks were recorded at the Americana Rochester Hotel for a benefit concert for Italian earthquake victims and the performance went on for nearly eight hours!

There are only eleven tracks on the two records but most are fairly long: Tarantella — The 11th Commanment Suite — Legend Of The One Eyed Sailor — Bellavia — Hill Where The Lord Hides — Lake Placid Fanfare — Things To Come — Round Midnight — Manteca — My One And Only Love — All Blues.

For a live recording, the technical quality is remarkable and, except for one undeleted expletive from Dizzy Gillespie, the comments from the performers add to the enjoyment of a wide ranging display of jazz talent from some of the best jazz musicians alive today. (N.J.M.)

☆ ☆ ☆

TAKE ME NOW. David Gates. Arista Records Inc, USE. Festival Records L37633.

David Gates first came to prominence with the group "Bread" and chalked up an impressive string of hit singles, including "Make it With You", "If", "Everything I Own", "Lost Without Your Love" and "Baby I'm A Want You". He followed up as a soloist with songs like "Never Let Her Go" and "Goodbye Girl" from the Neil Simon movie of the same name.

Against that background, I personally found this album disappointing. The style is basically similar to Gates' earlier hits, but none of the ten tracks on this album is especially memorable. Backing is provided by guitars, keyboards, piano and drums, but with insufficient variation in style to maintain listener interest.

The track titles: It's You — Take Me Now — She's a Heartbreaker — This Could be Forever — Come Home for Christmas — Still in Love — Variety —

DEVOTIONAL: Popular Gospel tunes

SUNDAY EVENING FAVOURITES. An Instrumental collection. Stereo, Word WSB-8854. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

Like "Sunday Morning Memories", reviewed recently in these columns, "Evening Favourites" is a selection compiled from past Word albums which have proved popular with those who prefer restrained rather than "mod" treatment of Gospel music. There are 12 tracks on the album which can be summarised as follows:

Some Golden Daybreak (orchestral, Ralph Carmichael); When He Cometh (trombone, Bill Pearce); Softly and Tenderly (piano, Kurt Kaiser); The Father Loves You (trumpet, Phil Driscoll); Brighten The Corner (rhythm piano, Carmichael); Only A Touch (multi trumpets, The Ohmans); Jesus The Very Thought (chimes, Lew Charles); Praise My Soul (violin, Raymond Mosely); When I Kneel to Pray (piano/orch, Kurt Kaiser); Beulah Land (piano, Rudy Attwood); Down by the Riverside (trumpet/guitar, Chuck Ohman); Help Me Care (vibraharp/guitar, Bud Tutmarc).

As with the vocal selection, referred to earlier, some of the performances sound a bit dated, even to this rather conservative reviewer, but there will doubtless be many who would prefer them, any day, to the insistent beat of Gospel guitars! (W.N.W.)

DUKE ELLINGTON
"Much to enjoy"

SOPHISTICATED ELLINGTON RCA CPL2-4098 2 record set.

Ellington enthusiasts will find much to enjoy in this important re-issue from RCA, with 24 tracks dating from "Black And Tan Fantasy" and "Creole Love Call", both recorded in 1927. But there's also "Mood Indigo" and "Sophisticated Lady" (recorded in 1966), covering nearly 40 years of a career that had an enormous influence on Jazz and popular music throughout the world. The sleeve gives only the recording date, the soloist if any and the composer, but I guess most Ellington fans would know other relevant facts.

As one would imagine with such a time span there is considerable variation in quality throughout the album but RCA's engineers have done a superb job in eliminating most of the background noise. But I cannot see much advantage in simultaneously reprocessing the masters to give a stereo effect, which is barely noticeable. Some of the other tracks are:

Perdido – It Don't Mean A Thing – Solitude – I Let A Song Go Out Of My Heart – Take The 'A' Train – Dancers In Love – Caravan – Hayfoot, Strawfoot – Beale Street Blues – Don't Get Around Much Anymore.

The album gives you a cross-section of Ellington's best and most played works and, as such, has a place in any collection of Jazz music.

I wonder how many other delights are locked away in vaults to be discovered and re-released in the future? (N.J.M.)

Continued from facing page:

Ninteen on the Richter Scale – Lady Valentine – It's What You Say. Lyrics are included for all songs on a printed insert with the album.

In short, an album for dedicated David Gates fans. Recording quality is good. (G.S.)

☆ ☆ ☆

CARROL GIBBONS & THE BOYFRIENDS. "On Air For Hartley's Jam". World Record Club RO-9073.

There is an interesting story behind the 20 tracks on this album. Back in the early '30s, British firms did not have access to local radio stations, as they have now, so they used the powerful transmitters in Luxembourg and Normandie to advertise their wares – in this case Hartley's Jam!

Furthermore, in the absence of tape as a means of recording programs, they recorded the items on discs.

A great deal of music was recorded for the sessions but most of it seemed to have disappeared. However, Carroll Gibbon's widow came to light with a collection of her husband's best known discs and they were in good enough condition to serve as masters for this album.

The vocalist, Ann Lenner, has a delightful voice and adds much to the nostalgic appeal of the music with such tracks as:

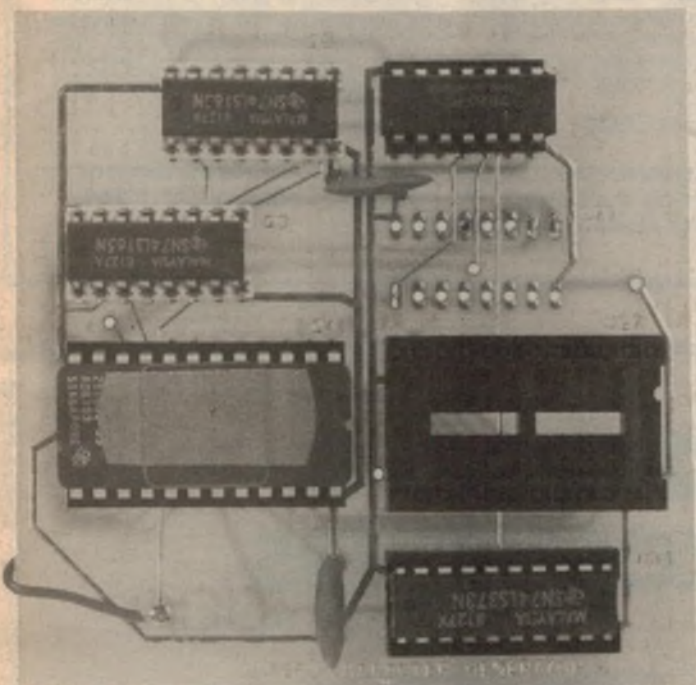
Smoke Gets In Your Eyes – I Saw Stars – I'll See You Again – Coffee In The Morning – Tea For Two – The Continental – If The Moon Turns Green – Dinah – What A Difference A Day Made – Heat Wave.

Other artists appearing are George Melachrino, Harry Jacobson, Bert Thomas, Jack Evatts and Lloyd Shakespeare. Considering the history of these items the quality is surprisingly good, with only a small amount of background noise to remind you of the age of the original recordings.

If you like dance music of the period, this record is a must. (N.J.M.)

Lower case, inverse video for Super-80 computer

Many inexpensive microcomputers provide upper case (capital letters) only. While this is OK for programming, it is a serious handicap in many applications, such as word processing. Until now the popular do-it-yourself Super-80 computer was limited in this way — although no more! Dick Smith Electronics has come up with an ingenious add-on board for the Super-80 which provides both upper and lower case characters, and, as a bonus, inverse video.



The Super Character Generator from Dick Smith Electronics provides both upper and lower case and inverse video for the Super-80 computer.

The Super Character Generator from Dick Smith Electronics is a small printed circuit board (74mm x 74mm) which is mounted in piggy-back fashion on the Super-80 computer board. Five integrated circuits on the board provide the necessary latches and decoding circuitry to substitute a 2716 EPROM for the original character generator chip.

Programmed into the EPROM are dot patterns which provide the full upper and lower case ASCII character set and punctuation symbols, with both normal (white on black) and inverse (black on white) characters available.

In conjunction with a new Monitor EPROM, the Character Generator allows lower case letters to be entered from the keyboard and printed from Basic programs. Inverse characters can also be selected for high-lighting important information on the screen.

Installation of the board takes about five minutes, and is described in the instruction sheet accompanying the unit.

Three ICs must be removed from the Super-80 board. These are U23, U27 (the original character generator chip) and U34. Pin 11 of U35 is disconnected by removing the chip from the board, carefully bending pin 11 upwards and re-inserting the chip. If sockets have been used in the original construction this is simplicity itself.

A trailing wire from the Character Generator board is soldered to pin 11 of IC 31. It is not necessary to remove U31 from the board to make this connection. Both U23 and U34 are re-inserted in the sockets provided on the new board.

Although not apparent from the photograph, the two sockets on the lower right hand side of the board are wire-wrap types, and the board is installed by inserting the long protruding pins of the wire-wrap sockets into the sockets left empty by the removal of the original character generator and ICs from the Super-80 board. Be warned that pushing the board too far down into the sockets may short out the input leads of the video modulator, resulting in loss of picture.

To use the new Character Generator a revised version of the Super-80 Monitor is required, and this is included in the price of the add-on board. Two versions will be available, a 2716 for use in systems without Basic EPROMs and a 2532 for Super-80s which are running Basic in EPROM. The Basic interpreter is being updated for use with the lower case Monitor and the new version will be available on an exchange basis from Dick Smith Electronics.

When you have installed the Character Generator Board, switch on the power and type in a few characters. The display should be in lower case. Press the shift key to get the familiar upper case (capital) letters.

Quality of the characters displayed is very good, with full descenders (the tails on the "j", "g" etc). No eyestrain here!

To fully test the Character Generator use the Monitor to enter the following program into memory:

```
06 FF       LD B FF
CD 19 C0    CALL SOUT
10 FB       DJNZ
C9          RET
```

The first line of this program loads FF into register B of the CPU. The second line calls the Monitor routine SOUT, which prints the character in the B register on the video display. The next line decrements the B register (subtracts 1) and jumps back to the previous line if the result is not zero. If the result of decrementing B is zero, the routine returns to the program which called it (in this case, the Monitor command input routine). The result is that the entire contents of the new EPROM is displayed as ASCII characters. Note that the screen will go blank as 0C and 8C are read out the EPROM, as these are control characters which clear the display. The routine is very fast, so set V equal to about 1000 for a readable display before running the program.

Micronews con't p114

DID YOU MISS THESE PROJECTS?

EXPOSURE METER

January 1980

Here is where the electronic flash exposure meter comes in very handy. Just set it up at the position of the subject to be photographed, set the moveable scale to the film ASA rating and pop the flash gun(s). Presto, the meter reads the light value and holds it for you until reset. Then you can read your exact exposure off the moveable scale.

Commercial flash exposure meters range in price from $100 up to $150 or more. Our unit can be built for less than $40. What a bargain!

Estimated cost of parts $38.

AUTODIM

January 1981

The Autodim functions as a normal light dimmer and can provide soft lighting for parties, watching TV and listening to music. With the "Autodimming" feature as well, the Autodim can automatically dim lights at an adjustable rate and to an adjustable level ideal for creating a "sunset" effect while a child is falling asleep.

Estimated cost of parts $25.

LIGHT BEAM RELAY

November 1980

The most obvious application of a light beam relay system is monitoring shop doorways, particularly where a lone operator has to divide his time between the shop and a workroom at the rear. Used with a suitable light beam across the doorway it will trigger a buzzer (and a relay) whenever the beam is broken by a customer — or a shoplifter! That's just one application — there are literally dozens of others.

Estimated cost of parts $13.

CAR BATTERY VOLTAGE MONITOR

October 1980

The battery in your car is a crucial component which can sometimes let you down at the most inopportune times. One way of lessening this possibility is to have a battery voltage monitor which can tell you the state of charge of your battery at a glance. This circuit does just that, with one IC and three LEDs.

Estimated cost of parts $6.50.

MODEM

September 1980

One of the most satisfying aspects of personal computing is writing your own programs and exchanging these programs with other computing enthusiasts. Now we have made it easier to communicate: you can send your programs over telephone lines with our acoustically-coupled modem. It is simple to build and uses just a handful of readily available economical ICs.

Estimated cost of parts $48.

QUIZ-MASTER

October 1979

You can use the gadget described in this article to play one of the quiz-type games like the familiar "Jeopardy" or "It's Academic" on TV. It "bleeps" and lights a LED to show you which of its three buttons was pressed first — and it can't be fooled. Or you can simply use it to compare the reaction times of you and your friends. Either way, you can use it to have a lot of fun.

Estimated cost of parts $20.

Complete construction details (we do not sell parts) available from: Electronics Australia, 57 Regent St, Chippendale 2008. PRICE $3.00 each project or by mail order, PO Box 163, Chippendale, 2008. PRICE $3.00 each project (includes postage). Please state project required.

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First printing 1980

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Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $5.00** OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. **PRICE $5.70.**

Microcomputer News & Products

Modifying the Casiotone musical instruments

The Casiotone M-10 and MT-30 are inexpensive, portable, battery operated musical instruments featuring eight note polyphony and four and 22 voices respectively. A new technical bulletin is now available which gives detailed instructions on how to add two octave drops, different vibrato settings, variable tuning, better high-frequency response and hold and sustain.

In addition, the M-10 gains 19 extra voices, with reduced noise and distortion. An external circuit allows the instrument to be interfaced to a computer, or to a second slave Casiotone. Pressing a key on the master causes the slave to play that note as well, which means that two completely independent voices are available.

Suggestions are also made on how to improve the larger Casiotone instruments – the CT-201, 202, 301 and 401. Most of the added features are already present in the LS1 integrated circuit which forms the heart of each instrument – the extra switches and components cost about $15 for the MT-30 and $25 for the M10, and take about 5 and 10 hours to install. Those carrying out the modifications should have some experience in digital electronics.

The 12-page technical bulletin is available from Robin Whittle, 42 Yeneda St, Nth Balwyn 3104, Melbourne, Australia, for $5 to cover printing and airmail.

Bulletin board service for CP/M systems

The CP/M Technical Bulletin Board and remote computer have come to Sydney. The service is currently operating from 6pm to 9pm most evenings and 9am to 9pm on weekends and is available to users of CP/M systems free of charge.

All programs from the CP/M user Users Group (51 disks) and SIG/M Users Group (25 disks), are available on request. Directories and abstracts of these disks are available on-line and may be transferred or searched by dialling up the service. Bulletin Board software supports directed or general audience messages, and is said to be essentially the same as the RBBS systems currently operating in the USA.

Trevor Marshall, who has recently moved from Perth, operates the service. His computer runs IOS, an enhanced version of CP/M, using a Z80 running at 5MHz. Memory available is 64K, with 2 megabytes of storage provided by 20cm disks.

The remote computer has full help facilities so new users can readily find what they are looking for. Anyone interested can log in by calling Sydney 95 5715. Connection is performed manually at present, as required by Telecom regulations. A terminal and a modem operating in the Answer mode at either 110 or 300 baud are required to use the system. Software exchange is performed by the CP/M Users Group MODEM7 protocol. If you do not have a copy of that program, simply type HELP SOFTWARE after logging in.

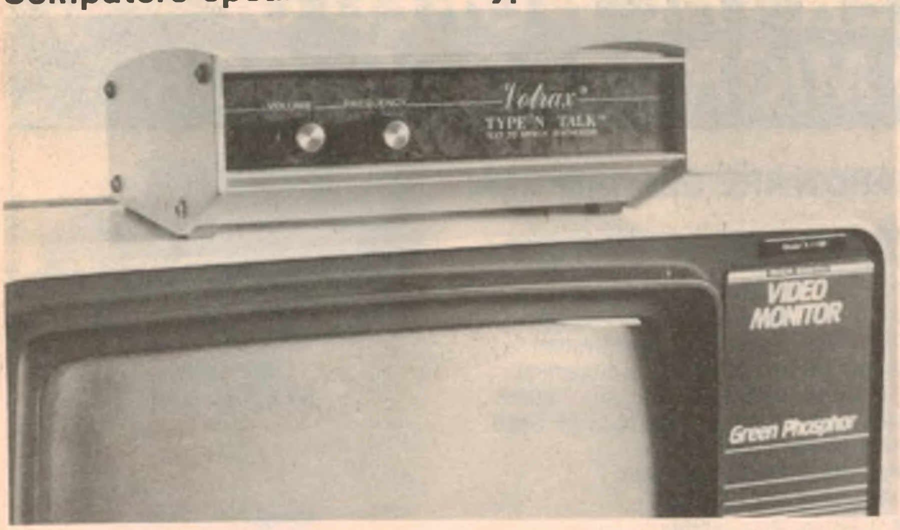
Trevor receives new programs and information regularly from Kelly Smith, the operator of the CP/M Net in the United States, and currently has copies of Kelly's newsletters on disk B. Other contributions are welcome, and selected programs will be sent to the United States for inclusion on CP/M-NET there.

For further information contact Trevor Marshall at 19 Gorman St, Willoughby, NSW, 2068, or dial 95 5715 (after business hours) to talk or to connect your computer to the network.

more micronews p116

Microcomputer News & Products

Computers speak out with Type-'N'-Talk



After some delays (see Column 80 for December, 1980), the Votrax Type-'N-Talk is now avaiable from Dick Smith Electronics.

The Type-'N-Talk speech synthesiser unit enables computers to talk – with an unlimited vocabulary. English text is automatically translated into electronic speech by typing ASCII codes which represent various phonemes (sound units). By carefully selecting phonemes an unlimited number of words can be built up by the computer.

A built-in microprocessor and a 750 character buffer in the Type-'N-Talk allows the host computer to generator strings of spoken words while continuing to run a program. No host computer time is taken up with time consuming text translation. Interface to the host is via an RS-232C Serial interface.

Speech can add a whole new role to a computer. Computers for the blind, language teaching (the Votrax can be programmed to speak in any language) and computer aided teaching with voice responses are just some of the applications. Games can really come to life with spoken warnings, threats and instructions.

The Votrax, Dick Smith Electronics Catalog No. X-3290, is supplied with a 240V power supply and a user manual. The user must supply a speaker and a cable to connect the device to their computer or terminal.

Dial-up databases on the increase

It is currently estimated that there are approximately 1500 computer data bases in Europe and 1000 in the United States. OTC recently announced that data bases in Britain and Europe will soon be added to those United States services which are already available via its MIDAS data transmission service.

With the "Australian Source" scheduled to be on line by January 30, recent reports claim that this data communications network already has around 7000 users, estimated to be a quarter of the market. Meanwhile a Sydney-based company has announced the publication of a directory which lists computer data bases throughout Australia.

(The above items are just a few of the many tit-bits contained in a newsletter issued by Commars, a Melbourne based division of Trade Data International Pty Ltd. Commars specialises in import/export information for Australian business firms. For more information, contact the firm at PO Box 299, Carlton South, Victoria 3053.)

Switching power

Switching power supplies for microcomputer systems are now available from Amtex Electronics. Recently introduced by Boschert Inc, the XL51 and XL53 switching supplies are said to be smaller, lighter, and cooler in operation than the equivalent linear supplies.

The switching power supplies are designed to eliminate the noise and interference problems associated with the use of conventional power supplies in systems using CRT displays. The XL51 provides 40W for use by "dumb" terminals, while the XL53 provides 65W, as required by full-featured terminals. Both supplies provide ±5V and ±12V, and incorporate a proprietary current controlled feedback network to achieve tight regulation and low ripple and noise.

Apart from powering CRT terminals, the supplies can be used in popular microprocessor systems such as the Apple II. They will also power floppy disk drives, cassette interfaces and small printers. Input voltage is selectable from 90 to 132VAC or from 180 to 264VAC.

Amtex Electronics is at PO Box 285, Chatswood, NSW 2067.

Copy proof programs?

For program authors concerned by the possibilities of illegal copying of their work, Bosen Electronics of the United States has announced a new method of protecting software. The Nebulock(tm) system prevents unauthorised execution of any copy of a program, while allowing the user to make back-up copies of soft-

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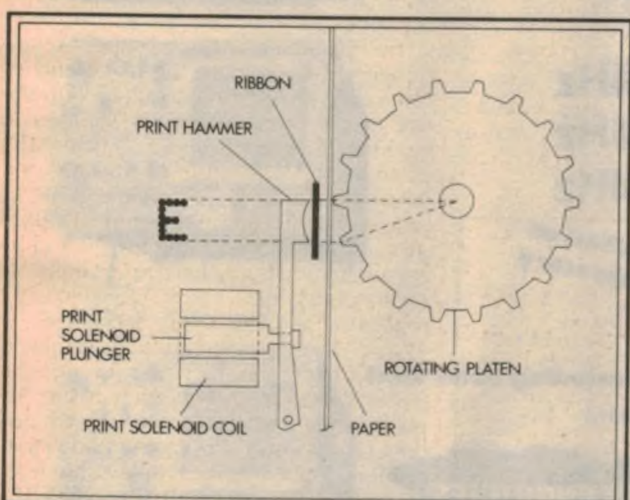

A Product of the Seiko Group

It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

How the Uni-Hammer Works

The X-3252, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

A Complete Printer

The X-3252 has features comparable to printers selling for thousands of dollars. These include upper/lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

Centronics Interface

The X-3252 DOT MATRIX PRINTER has a Centronics-type parallel data interface and is compatible with System 80, TRS-80, Sorcerer and Apple computers etc.

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Microcomputer News & Products

ware for his own use. A United States patent is pending on the process.

Nebulock can be used with disk and tape based programs. Minor modifications to the original program are required, which "usually necessitates consultation with the program author" according to Bosen. No hardware modifications are necessary, regardless of the type of computer the protected program is to run on.

Two versions of Nebulock are available. A low-cost version is said to be suitable for programs marketed for $50 or less, while the Nebulock II version is said to be cost effective for programs selling at $250 or more.

Interested readers should contact Bosen Electronics, 445 East 800 North Spanish Fork, Utah 84660, USA.

News from the clubs

- Micro User News, from the Adelaide TRS-80 and System 80 users club contains a wide range of information. A recent issue has an article on some incompatibilities between the two machines, details of a joystick interface and a mains power controller and video display save and screen print routines. You can subscribe to the newsletter for $5. Write to the group at 36 Sturt St, Adelaide, SA.

- The Microprocessor Special Interest Group (MICSIG) of the Australian Computer Society (Canberra Branch) publishes Microcomputer Journal each month. The Group is currently organising a conference on Microcomputer software, to be held from August 18 to August 20, 1982. Papers for the conference are being sought now. The address to write to for further information is MICSIG, PO Box E237, Canberra, ACT 2600.

Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

Useful information for System-80 owners

This month I have elected to forgo discussion of generalities, in favour of some down-to-earth practical information for owners of System-80 computers — the answers to some questions which we are asked repeatedly: how to enable lower-case letters when you have an expansion unit fitted, but aren't using disks, and how to flash the cursor from a BASIC program. The latter information should also interest TRS-80 owners.

To start, let's look at the lower-case letters question. System-80 Mark 1 computers which have been fitted with the X-4018 Lower Case Mod Kit and System-80 Mk 2 Business Computers (X-4100) are both capable of displaying the full upper-and-lower-case ASCII character set, but only after suitable patch routines have been added into the existing keyboard and video display driver routines. As described in the user manual, this is normally done by a "SYSTEM" call to address 12288 decimal (3000 hex), which is the start of a small "patching" routine.

Basically this patching routine simply replaces the normal video and keyboard driver routine calling addresses in the "device control block" RAM areas, with the starting addresses of the new patch routines. But in addition, it looks to see if there is a disk controller present at the usual address (37EC hex). If it finds a controller there (because you have an expansion unit connected), it assumes that the user is going to be using a DOS (disk operating system), and accordingly that the BASIC program storage area will be moved up in RAM from its non-DOS position. As a result, it allocates a small area below the new BASIC program area for use by the patch routines.

This method of enabling the routines can cause disruption of normal BASIC program operation if you have an expansion unit connected to your computer, but are not using disk drives or a DOS for some reason. What happens is that without a DOS, your BASIC programs will be stored in RAM starting at the normal "non-DOS" starting area (42E9 hex/17129 dec), so that the work area used by the lower-case routines will be inside the program area. As a result at least one line of your program (usually about the fifth or sixth line) becomes repeatedly corrupted.

One way around the problem, if you do have disk drives, is to boot up with a DOS before you load in your BASIC program. However this may not be easy if you have no disk drives!

Another approach possible, if you just want to enable the lower-case letters alone, is to patch the appropriate routine in directly from the BASIC program, and not use the "patching" routine at all (ie, it replaces "SYSTEM" and /12288). This is quite straightforward — all you need is the following pair of POKE commands:

POKE16414,(PEEK(12295)):POKE16415,(PEEK(12296))≤new line≥

These can be fed in either in direct mode, from the keyboard, or added to the start of your program. As such they are probably the simplest answer, providing you only want to enable the lower-case letters.

If you must have the other facilities as well, however, there is another approach again. This is to use the EPROM patching routine, but to avoid the instructions which test for the disk controller. To do this you have to effectively call it in two parts, and one call must be made via the USR(X) function, after POKEing in the appropriate calling address. The procedure for this approach is as follows:

1. Type in the commands
POKE 16527, 48:POKE 16526,118 ≤new line≥
2. Follow this by the command
X=USR(X) ≤new line ≥
which calls the first section of the EPROM routine, and returns to BASIC.
3. Finally type in
SYSTEM ≤new line≥
followed by /12384 ≤new line≥
which calls the second part of the routine, then returns again to BASIC. You can then load and run your programs.

As before these commands may be keyed in directly from the keyboard, in direct mode, or added to the start of BASIC programs.

Now let's look at the second commonly asked question: how you can provide your machine with a flashing cursor, when running normal Level II BASIC programs. The easiest way to do this is by using a simple subroutine, added to your program as follows.

Here is the subroutine itself, shown here for simplicity as starting at line 9000.

```
9000 C$=INKEY$:IFC$≤≥""""THEN RETURNELSEPRINT@FC, CHR$(143); :GOSUB9020
9010 PRINT@FC,'' '';:C$=INKEY$:IFC$≤≥'' ''THENRETURNELSEGOSUB9020:GOTO 9000
9020 FORI=1TO50:NEXTI:RETURN
```

Needless to say, it doesn't have to start at line 9000. You can give it any three consecutive line numbers you wish, to fit it in with your program; simply change the two GOSUBs in the first two lines, so that they call the third line correctly (the third line is a small delay, which determines the cursor flashing rate).

To call the routine, all you need to do is specify where you want the cursor to flash on the screen, by giving variable 'FC" a screen address value (from 0 to 1023). Then simply call the routine using GOSUB9000, or the equivalent.

When the subroutine is called, it will flash the cursor until one of the keyboard keys is pressed. Control will then be returned to your program, with the string variable "C$" corresponding to the key that was pressed. Your program can display this, if desired, at the position where the cursor was flashing, using the statement PRINT@FC,C$. Or it can convert C$ into the equivalent ASCII code using ASC(C$), or whatever you wish.

As you can see, the cursor flashing routine is very straightforward, and can be added to virtually any program quite easily. And it will work on any of the System-80 computers, as well as on the Tandy TRS-80 model 1.

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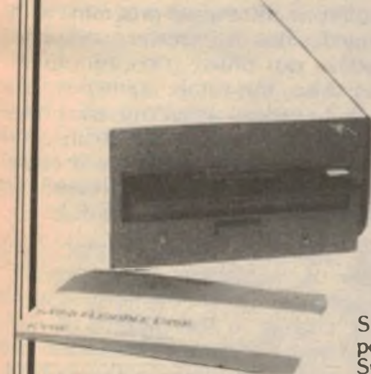

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INFORMATION CENTRE

PLAYMASTER MOSFET AMPLIFIER: I am experiencing a problem with my Playmaster Mosfet Stereo Amplifier. The problem is lack of adequate output power from both channels. Each channel only gives about 3V RMS (corresponding to only about one watt into an 8-ohm load) output before clipping occurs. Measured power supply output is approximately ±47V. Output stage quiescent current has been set to 70mA, and the output offset to 0V as specified in the original article.

All DC voltage readings are consistent with those cited on p63 of EA, February, 1981; except for the collector voltage on Q8, which is only about −7V instead of −20V. Audio frequency voltage gain is 22, as expected.

However, on investigating the internal audio levels with the aid of an oscilloscope, I found that for some reason there is no voltage gain from any of the Mosfets, in either left or right channel! Could this be my problem? If so, how do I go about checking whether these Mosfet devices are OK? Obviously I do not want to purchase four replacements if my own Mosfets are still serviceable. I would appreciate a "test procedure" for Mosfets, and would welcome any suggestions for troubleshooting my problem. (G. F., Horsham, Vic.)

● Firstly, we must point out that the Mosfets do not have voltage gain in this amplifier, since they are being used as Source followers (a similar circuit configuration to "emitter followers" with ordinary bipolar transistors). Therefore, they should be indicating unity voltage gain, which is consistent with what you have observed.

The best way to simply check Mosfets is by substitution into a circuit with known satisfactory performance. However this method cannot be used in your case, as the circuit itself is not functioning properly.

As the devices can be set to the requisite quiescent current, it is doubtful if your Mosfets are defective; and even more unlikely that all four are faulty.

Returning to your power problem, we would suggest that Q8, Q9 or Q10 is faulty. Another possibility is that there is a short between one or two of the Mosfets and the chassis.

MINI SCAMP: I have recently constructed "Mini Scamp" computer described in April 1977 and there were a few difficulties that I came across. The main problem was that I could not obtain the recommended microprocessor so I purchased an INS 8060 which is almost the same as the original.

The new processor required the following changes to the circuit:

1. The −7V supply is removed and +5V is connected to pin 40 of the CPU. OV is connected to pin 20. The 8.2kΩ resistor from BREQ goes to 5V.
2. ENIN pin 3 has become NENIN so pin 3 is now taken to the unused side of the CPU/DMA switch S1a. The 10kΩ pullup resistor is now taken to OV.
3. The CPU will not run with the old clock capacitor so I used the 1MHz clock used in the baby 2650 system.
4. I used BC548 transistors and found it would load all "1s" when in the CPU mode so I changed the 390Ω resistor from pin 4 of the 74123 to pin 3 of the 7476 to 22Ω and the associated capacitor from .0033 to .0068μF and I also changed the base pull-down resistor on the transistor buffer for the data switches to 680Ω.
5. I increased the LED limiting resistors to reduce the power consumption so it can now be run off a plug-pack.
6. I used 2114 memory chips so I removed the 74LS138 and took the CE pins to Ad11 so that whenever the LEDs or switches are addressed the memories are disabled.

This works well as long as you don't write data into any address (except LEDs and switches) above 1024.

I am planning to replace the switches with a counter and keyboard, etc.

Looking at the circuit that appeared in the CDI pages of October '78 there is a 4040 12-stage binary counter followed by 4050 buffers display drivers and interfacing for the Scamp bus, etc. What is the 4050 buffer for? Will the CMOS drive the TTL directly?

I have run Binary count and display, moving light with input, reaction time program, music test and music tune program.

The new CPU can be run up to 4MHz. Would the rest of the circuit be able to cope with the CPU running at 4MHz? (A. W., Pomonal, Vic.)

● Thank you for the details of connecting the INS 8060 microprocessor to run in the Miniscamp circuit. We are sure that quite a few readers will be interested. The 4050 is intended for buffering CMOS circuitry to drive DTL or TTL circuitry. While in some cases CMOS can be used to drive TTL directly, normal practice is to use a buffer such as the 4050.

While it is possible that the Miniscamp could be made to run at a higher speed with suitable circuit modifications, we cannot advise on this point.

PLAYMASTER TWIN 25: I have constructed the Playmaster Twin 25 stereo amplifier, and have a rather obscure (to me) problem. At switch-on, I find a bad hum in the left channel, which seems to be at about 50Hz. Naturally, I immediately blamed transformer hum. I tightened and adjusted its mounting, checked that the laminations were not excessively vibrating (they were not) and shielded the entire mains assembly completely. This had no effect whatsoever.

The obscurity comes since the hum affects all three speakers, the tweeter most annoyingly and loudly, causing very, very objectionable distortion. I have even completely moved the affected speaker and shielded its cable. Other tests prove it is not the speakers.

When the bass control is turned up fully, the hum increases. Then at maximum boost the hum suddenly affects both speakers! Then, when treble is taken to maximum boost, the hum stops completely! Also, after the amplifier has been used for three or four hours, the hum fades away!

Instability in the output was suggested by a friend, since the volume control has absolutely no effect on the hum's volume. Also, the treble control is very noisy, ie it crackles when moved. I have no way of checking for instability, and could not see why it would cause some of the above faults. Can you please help me? (P.D., North Lidcombe, NSW.)

● It is almost a certainty that your amplifier is oscillating supersonically. The pointers to this are the noisy volume control, change in the pattern of hum when varying the tone controls and the objectionable distortion in the output. The audible hum occurs because the supersonic oscillation generally causes such a heavy current drain from the power supply that the 100Hz ripple becomes excessive. You would probably also find that the output transistors also become very hot.

Operating the amplifier for any length of time in this condition is likely to burn out your tweeters, and will probably also burn out the output transistors too. If

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you must operate the amplifier under these fault conditions, at least use a dummy load. A resistor of eight to 20Ω or so, with a power rating of at least 10 watts, will suffice.

With the dummy load connected, you can check for the presence of supersonic oscillation by measuring the output of the amplifier with a multimeter switched to a low AC voltage range and connected via a capacitor of about 0.1μF (or alternatively, use the "output" connection available on some multimeters). If you are able to measure any signal at all, when ostensibly, no signal is supposed to be present, then it's kilograms to cashews that the amplifier is unstable.

Instability in the power amplifier may be due to any of the following causes: faulty 0.1μF supply bypass capacitors, faulty RLC network coupling to the load, faulty 4700μF filter capacitors, open-circuit 2200pF capacitor connected between the collector of T10 and the 0V rail, or instability in the preamplifier. Another possibility is ultrasonic oscillation in T3, an emitter follower. This can be localised by "shorting" the input to the power amplifier (base of T6) to the 0V rail. If this is the problem, increase the 47pF capacitor associated with the emitter of T3 to 3300pF.

Another possible cause of instability is untidy lead dress of connections to the output transistors and loudspeakers, ie leads unnecessarily long and possibly routed near the amplifier input connections. And yet another possibility is that the capacitors connecting the "cold" side of the loudspeaker sockets to chassis have been omitted.

CHANNEL 0 VHF: With the undoubted talent at your disposal, it should be possible to produce a project which would enable the weak signal of Channel 0 VHF to be boosted to the level of Channel 2, 7, 9 & 10 in a given area.

I visualise a preamplifier powered either by battery or from a suitable DC supply point and mounted on or in the TV itself, intended for relatively infrequent use (special programmes etc).

In my own case (and that of many other viewers in my area) sound and sync are excellent but pix is "noisy".

A switch could be included to switch in and out the preamp (which is not needed for Channels 2, 7, 9, 10 – if this were not so then a preamp only for Channel 0 is obviously not the answer).

From my discussion with others, this project would fill a long felt need. Of course when UHF becomes available it will not be necessary but that won't be for a long time yet. (C. F., Toongabbie, NSW).

● The best and only way to obtain satisfactory reception from VHF channel 0 is to use a suitable antenna. This means an antenna which is larger than your existing installation. And it is safe to say that if you presently have good reception of channel 2 in your area, then you should obtain equally good reception of channel 0.

Perhaps we should qualify that by stating that, because of the lower frequency of broadcast, channel 0 is more susceptible to interference from high voltage power lines and also because antannas are generally not so highly directional at low frequencies, channel 0 is more prone to "ghosting".

Alternatively, you could try receiving UHF channel 28 with an antenna cut for that channel. For your location though, VHF reception is probably your best bet.

EXCESSIVE BATTERY CONSUMPTION: I bought a Sony 2001 radio recently and as a radio it suits my needs exactly – complete communications bands coverage, FM and SSB and all compact. It has one major snag – it cannot be used on batteries. Ordinary heavy duty "D" cells go dead in an hour but recover in 24 hours for another 15 minutes use before polarisation occurs. This occurs for a week or so before they finally give up and I like to listen for more than 10 minute spots at 24 hour intervals.

I took this up with Union Carbide and it appears that the current drain is just too high for dry cells. Off station and volume at zero the current is 220mA, on station and at half volume it is 390mA, and a massive 600mA, at full volume. Alkaline cells are no better.

Union Carbide told me that NiCad D cells would have half the capacity of the alkaline D's so I would be recharging daily. Lead-acid batteries are 6 or 12 volts and I want 4.5V. So how can I economically make my set independent of the mains? With so many portables with big outputs, integral tape decks etc, this battery problem must be common.

I shall watch closely for any review of this model radio. I have written to SONY suggesting poor design in that two lots of three "D" cells in parallel might have been a better power supply to avoid the polarisation problem but all I got back was a circuit diagram and the name of local agents who confirmed my findings. At $599 NZ this was definitely a poor buy. (R. A., Auckland. NZ).

● As luck would have it, we have reviewed the Sony 2001 on pages 34 and 35 of this issue. We can confirm that battery consumption is high but we can see no easy solution. Your best approach would seem to be a dozen "D" size zinc/carbon or alkaline cells arranged in parallel combination to give 4.5V.

FREQUENCY METER: I recently purchased an Intersil evaluation kit using ICM 7226A, and was considering building up an RF amp as in EA Aug '78 using MC10116 and was interested to see your circuit in the December 1981 issue of EA.

I noted a few peculiarities (which were so to me with my limited knowledge of digital electronics); so I thought I would mention them: doubtless they are all not "peculiar" to your designer. The only one that seems to be a bit out is the 10MHz trimmer listed as 39pF. In application notes it is listed typically as 39pF; and so could be made up with a 15pF fixed and a 35pF trimmer in parallel as in application circuit. It is possible that 39pF trimmer might not have enough capacity to set 10MHz exactly.

I notice that you have not connected up pin four of the 7216A for the DP although the pin's five of the LEDs are linked in that board. That probably accounts for the fact that you say in the period mode it counts in 0.1 microseconds whereas with the DP it should indicate the period in micro-seconds (to 0.1 sec accuracy, seven digit instead of eight)?

I notice you have no connection of pin 16 of MC10116 to V+ as in August '78 circuit; and have changed the input to pin nine from pin 10 (Aug '78) and have altered the input resistors. (J. B., Hawthorn Vic).

● According to our information on the Intersil 7216 IC, the trimmer is shown as 39pF typical although doubtless your suggestion of a fixed capacitor and trimmer would be satisfactory.

We omitted the decimal point connection because it is difficult to switch to give correct indication on all ranges, including the period mode.

As far as the changes to the 10116 circuitry are concerned, these were possible because of accompanying changes to the FET buffer and the ECL-to-TTI conversion circuitry, ie, Q1, Q2 and Q3.

PLAYMASTER 40/40AMPLIFIER: Some time ago I sucessfully completed your well publicised Playmaster 40/40 Amplifier. It performs quite well but there are several features, I feel, that would enhance the overall professionalism of this project.

(1) when the amplifier is switched on, there is an immediate "thump" heard through the speakers. Why is this occurring? and can you please send me a circuit that would filter this disturbing phenomenon.

(2) I would like to include a loudness filter in the circuit, presumably between the preamplifier of each channel. Rather than include a compromise affair it would be preferable to use a circuit with the correct loudness compensation. Can you suggest a circuit?

Your advice on these matters will be greatly appreciated. (D. B., Fitzroy, Vic).

● Most amplifiers produce a slight thump at "switch-on" due to the charging of circuit capacitors but this is muted in most cases by the loudspeaker protection relay. You can incorporate this feature by building the loudspeaker protector published in our June 1976 issue (File No 1/SA/57). Of course, if the "thump" is loud, you may have a fault due to large DC offsets at the amplifier outputs.

We are not at all keen on loudness controls but we did incorporate this feature in the Playmaster Mosfet Stereo Amplifier described in the December 1980 and January and February 1981 issues. This circuit is directly adaptable to the Playmaster 40/40.

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Radio Pioneers continued from p20

picturegram service. Among the earliest transmissions were prints of movie frames from the newsreel coverage of an England-Australia air race. In London, these radio pictures were reconverted to movie film and screened in British cinemas the next day.

This article has merely established the guide posts for Australia's early overseas radio outreach. It should be added that not a little of the public pressure for improved communications stemmed from a vocal lobby of radio amateurs and pioneer broadcasters, to whom only passing reference has been made. Our next article will highlight the sterling work of Australia's amateurs during the 1920s, as well as sketching the origins of our broadcasting system.

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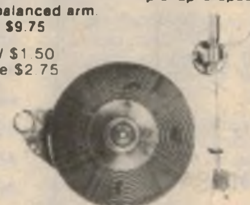

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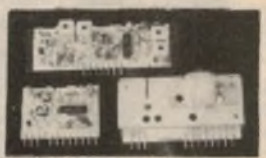

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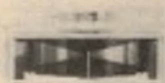

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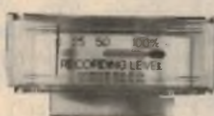

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