ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

SEPTEMBER 1981 AUST $1.80* NZ $1.90

SANYO'S TV "BLACKBOARD"

BUILD THIS:

DIGITAL CLOCK-THERMOMETER

Heavy.

Introducing another Sony only. The MDR series open-air headphones. The smallest, lightest stereo headphones available today. Or tomorrow.

With our lightest at 40 grams, you will barely know you're wearing them. Yet the sound is dynamite.

Through a remarkable new audio breakthrough, our engineers have succeeded in reducing big-headphone technology down to the size of your listening channels.

The MDR series headphones' airy spaciousness delivers absolute clarity through an ultra-small driver unit that produces more than three times the energy of conventional circuits. And a new high-compliance diaphragm accurately reproduces the 20 to 20,000Hz bandwidth and improves low-range response.

That means you can listen to the heaviest of music for hours. Lightly. And know that you're hearing every nuance of the original recording from deep bass to the highest treble.

Listen to our new MDR series headphones.
They're light.
And heavy.

STEREO HEADPHONES
MDR

AP3528

ELECTRONICS AUSTRALIA

Volume 43, No. 9
September, 1981

AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE

Digital Clock/ Thermometer

Here's a project that many readers have requested — a digital thermometer with a big, bright display. As a bonus, you also get a versatile 4-digit alarm clock. Details p42.

Fancy yourself at electronic games? "Photon Torpedo" is a low-cost alien exterminator that will keep you amused for hours! See p50.

COMING NEXT MONTH! — Find out what's coming by turning to p25.

On the cover

Entertainer Kerry Woods demonstrates Sanyo's new "Colour Television Blackboard" — a unique TV receiver that also allows the user to paint colour pictures on-screen using an electronic "brush" (details p24). Inset shows this month's feature project: an easy-to-build digital clock/thermometer. See p42 for the construction details.

FEATURES

HIFI, VIDEO AND REVIEWS

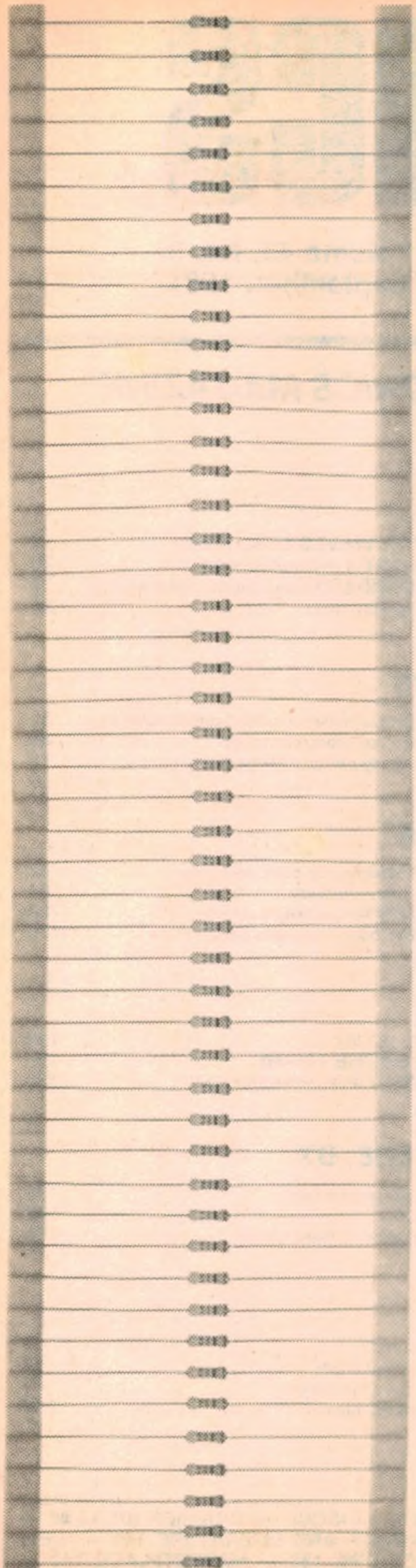
PROJECTS AND CIRCUITS

MICROCOMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS



Editorial Viewpoint

Video is on the boil!

Twelve months ago, the video scene was in a state of ho-hum. Broadcast television was a routine amenity; a few people in higher places were arguing about satellites and cable services; video discs were a technical reality but somewhere up the track commercially; VCRs were in the shops but in sufficiently low demand to produce discounting.

Then bang! VCRs (video cassette recorders) took off and, quite suddenly, they became the thing that every family must possess. A battle of words followed between the competing formats, VHS and Beta, and a battle of brands within the respective camps. Each company is now trying to outdo the other in terms of facilities offered for dollars spent.

The amazing thing, and the thing that accounts for their present acceptance, is that the modern domestic VCR works so well. With a little care and very little expertise in its use, what emerges from a VCR is virtually indistinguishable from what goes in. In a subtle way a VCR flatters the user, even though he/she has exercised no skill beyond the ability to push the right buttons at the right time.

And now, of course, proliferation of VCRs means that all those "intelligent" automatic sound/colour home video cameras will emerge from their exotic remoteness into the I-must-have-one-of-those-too class. Unlike traditional film cameras, they allow the owner to "do his thing" any time he wants to, with immediate playback and at very little extra cost.

Indeed, what prompted me to write as I do was a conversation with a professional TV engineer, who had just been looking at some of the latest optical discs from America on a professional quality video monitor. He professed to be staggered at the crispness of the pictures and the quality of the stereo sound coming off the spinning discs.

Keyed up by experiences like this, it is natural to look with greater interest at the efforts of engineers to create better projection systems, or to crack the problem of the multi-colour flat screen. We may even show quickened interest in things we're not quite sure we need, like satellite and interactive cable television.

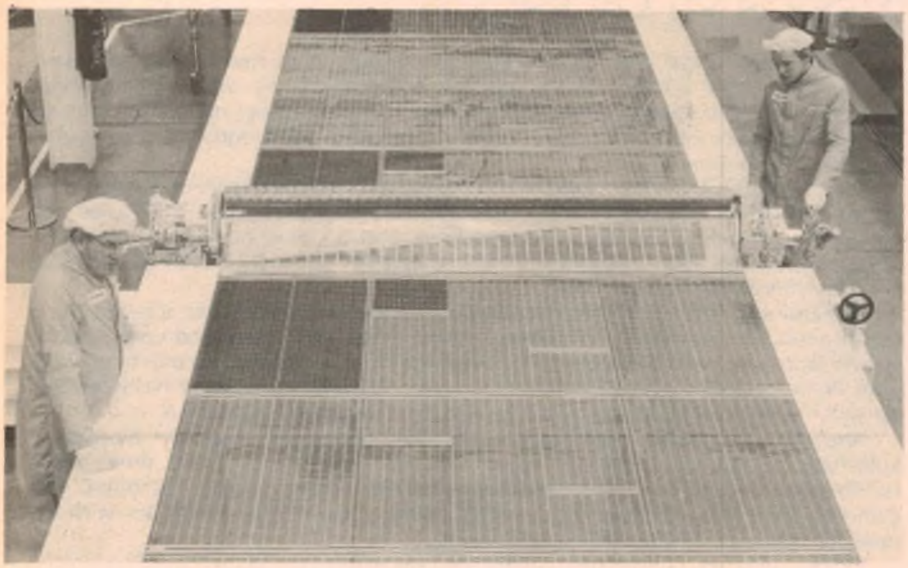
Twelve months ago, video may have been ho-hum, but no longer. There is about it the same air of technological excitement that I've sensed before in other areas of electronics.

Neville Williams

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
Editorial Office
57 Regent St, Sydney 2008
Phone (02) 699 3622 Telex 25027
Postal Address: PO Box 163, Beaconsfield 2014.
Advertising Offices
Sydney — 57 Regent St, Sydney 2008
Phone (02) 699 3622 Telex 25027.
Representative: Narciso (Chit) Pimentel
Melbourne — 392 Little Collins St, Melbourne 3000. Phone (03) 602 3033.
Representative: Mark Christian
Adelaide — Charles F. Brown & Associates Ltd, 254 Melbourne St, North Adelaide 5006
Representative: Sandy Shaw (08) 267 4433
Perth — 454 Murray Street, Perth 6000
Representative: Ashley Croft (09) 21 8217
Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001
Enquiries: Phone (02) 20944, ext 2589
Circulation Office
21 Morley Ave, Rosebery, Sydney 2018
Phone (02) 663 3911
Distribution
Distributed in NSW by Magazine Promotions, 57 Regent St, Sydney; in Victoria by Magazine Promotions, 392 Little Collins Street, Melbourne; in South Australia by Magazine Promotions, 101-105 Weymouth 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

Stowable solar cell array — power for the Space Telescope



Nearly 50,000 solar cells mounted on two flexible arrays will power the 13-metre Space Telescope due to be launched by the NASA Space Shuttle in 1985. The two arrays are being built in Britain under contract to the European Space Agency. Measuring 33 square metres, they will provide electrical power for the Space Telescope throughout its fifteen year mission.

The arrays are unique in that they are designed to operate unattended for five years and then be rolled up and stored aboard the Shuttle for return to Earth for refurbishing.

Although the Space Telescope is only half the size of the largest ground-based telescope, it will be able to see seven times further than earth-based instruments because it will be clear of distortions caused by atmospheric turbulence.

Technology challenges the forger

Quest Automation, a specialist in industrial automation, has released a new signature recognition system in the United States. Called the PI Micropad, the system not only analyses the shape of the signature, but also the way it is written. The speed and pressure of the tip of the pen are continuously recorded by a microprocessor and compared with samples of the signature held in its memory. Only five samples are required for the system to build up a forgery-proof impression of the real signature.

A second British company, Transaction Security, has a similar scheme in the works. Like the Quest Automation system it analyses the shape of the signature and the characteristic variations in writing speed and pressure as the signature is made. Says David Law, Managing Director of the firm, "The old style forger could match shapes; the modern forger will have to master speed and pressure as well. It means thinking of 16 things at once".

Both companies will sell the signature recognition equipment to manufacturers for under £1000 (about $2000). Transaction Security has already sold its system to GTE, the US operator of Telenet, a data communications network, opening the possibility of writing letters by phone – with automatic signature verification.

Talking toys turn mute!

Reports from the United States indicate that the boom is over for talking toys and games – before it ever really got off the ground. The latest word from manufacturers is that the current high price of adding speech synthesis chips to games has forced wholesale buyers away. Many suppliers now admit that they did not have a good idea of what would sell, while buyers are saying that the games cost too much for what they do.

Besides the price problem another limitation has been the poor design of many products. "Talking chips" have been added to existing games more or less as an afterthought rather than providing the basis for new designs.

As a result of the poor response from buyers many manufacturers have dropped plans for further talking games and toys, although "educational" products are still planned.

Manufacturers of speech synthesis circuits now see the major markets in industrial/telecommunications and computer areas rather than consumer products.

Gravity wave antenna for Univ. of WA

The University of Western Australia has acquired a huge bar of the rare metal niobium for use as an antenna in a research effort aimed at detecting gravitational waves. Almost three metres long and worth $200,000, the bar will be cooled to near absolute zero in a giant "thermos flask" constructed at the University's Department of Physics.

When stars die their explosive death sends a gravitational ripple through space at the speed of light. A little of the vast energy in these "gravity waves" will ring the niobium antenna like a bell – or so the theory goes. The physicists at UWA, in collaboration with others in the USA, Japan and Europe, hope that the antenna will provide evidence to support Einstein's General Theory of Relativity and also allow the development of a new type of astronomy based on the study of gravity waves.

(See story on detecting gravity waves on p12 of this issue.)

New thermal imaging system provides TV pictures in the dark!

This photograph of a Land Rover was taken in the middle of the night using a new thermal imaging system jointly developed by two British companies, Marconi Avionics and Rank Taylor Hobson. It is claimed to be the first such system to provide a normal television signal output which allows the pictures to be shown on a standard TV monitor.

Thermal imaging systems build up a picture by sensing the infrared radiation that is emitted by all objects. Images can be constructed of objects that are only a small fraction of a degree Centigrade different from one another.

When a thermal imaging system builds up a picture of a vehicle travelling at night it will show the higher temperature of the engine and the heat generated by friction caused by the contact of the tyres on the road. In one development test, pictures showed that the vehicle had a hot front wheel bearing and a hot coupling in the transmission.

Once the imaging system's detector has picked up its signals they are processed and converted into standard 625 line television format for indirect and remote viewing.

Britain's satellite for schools

A satellite that will beam words and pictures from space to schools, colleges and radio amateurs has been built at Surrey University in southern England. Dr Martin Sweeting, Project Manager for the UOSAT satellite, is seen here adjusting the tipmass mounted on top of the satellite stabiliser to ensure it always points towards earth. Inside the tipmass is a magnetometer which will measure the Earth's magnetic field.

Due for launch by NASA later this year, UOSAT is designed to transmit data, including pictures of the Earth's surface, in a form which can readily be processed and displayed on a domestic TV receiver. An on-board voice synthesiser will give information on the performance of the satellite.

Amateur radio enthusiasts will be able to tune into the satellite using stand VHF receivers and a simple fixed antenna. UOSAT will be launched into a 530km polar orbit and is expected to function for five years.

Heard about the travelling salesman?

Portable computer terminals may soon replace the travelling salesman's traditional order book, according to a British report. Hand-held computer terminals, once considered topics of science fiction, are now manufactured by a number of suppliers, and their use is increasing.

One company, the US-based MSI Corporation, claims to have sold more than 150,000 portable terminals worldwide. Its latest product, the "Route Manager", is housed in a small briefcase, and allows the salesman to record sales and order information on the spot, to access customer and product information stored in the terminal's own memory, and to print out delivery notes, invoices and sales reports.

Communication can be in both directions. Information required by each salesman can be transmitted to the terminal either by a direct connection or by a modem and telephone line and held in the terminal's 32K memory.

MSI maintains that apart from cutting the salesman's accounting time, allowing him to spend more time selling, the portable terminal system will also reduce expensive delivery and invoicing errors. In addition the reporting facilities of the terminal allow sales trends and patterns to be determined more quickly and appropriate action taken.

Computer will cut ANU power bill!

An Ohio Scientific computer system will save the Australian National University in Canberra more than $50,000 a year – 20% of its annual power bill. The computer has been programmed to manage energy conservation within the university campus by "averaging" peak power usage.

Power users are charged by supply authorities according to their individual peak usage rating, based on the amount of electricity required for heating, lighting, air-conditioning, fans, ovens and furnaces on a 24-hour basis. The computer system reduces this peak usage rating by shutting down non-critical equipment automatically.

The computer can control a telemetry network of up to 6000 power consumption points. Building floor plans can be entered and stored on disk for retrieval and display to show the location of critical points and the status of power consumption points. Time and calendar schdules can also be stored to allow automatic control of heating, cooling and lighting.

The system reduces energy costs, controls various appliances, provides a security system, allows direct response to critical problems, and produces a status report on a colour graphics display.

Coal mining by remote control

Scientists at NASA and the Georgia Institute of Technology have jointly developed a system which uses radar to automate coal mining operations. Using a 35GHz radar with an output of 100W, the system would be mounted on remotely controlled coal mining equipment and used to develop a pseudo three-dimensional display of the coal face and the underlying rock to a depth of several metres.

The use of such equipment would allow tracking of coal veins and the detection of voids in the rock by an operator at some distance from the rock face, making coal mining both safer and more efficient.

NEWS HIGHLIGHTS

Advanced new optical telescope at a bargain basement price

Australian astronomers will soon have at their command one of the most advanced optical telescopes in the world — at a "bargain price".

The new telescope, to be erected on Siding Spring Mountain near Coonabarabran, NSW, will be by no means the largest in the world, or even in Australia. The Anglo-Australian telescope, commissioned at Siding Spring in 1973, is considerably larger, but the "Advanced Technology Telescope", to give it its official name, will contain so many new features that its completion in 1982 will be a major event in modern astronomy.

The new features have enabled the telescope to be built for only one tenth of the cost of a similar sized instrument built with conventional methods. Advanced techniques provide other advantages besides cost. Astronomers will be able to point the telescope so accurately that it can be used in the day time, when the stars needed for guidance cannot be seen. Light detectors attached to the telescope will be the most sensitive ever used.

Evidence of the new design approach can be found right at the heart of the telescope, in the 2.4 metre diameter curved mirror that gathers light from distant stars and focuses that light onto detecting instruments. The mirror is made of a special ceramic material that is not distorted by changes in temperature, and is only one third as thick as the mirror in a conventional instrument of the same size. This means a large saving in weight, both in the mirror itself and in the machinery that must move and support it.

The mounting of the telescope is also a departure from previous designs. It will not be the traditional massive "equatorial" design, but a relatively lightweight "alt-azimuth" design. In the past the difficulties of accurately controlling and guiding such mountings has prevented their use, but the use of a computer to direct the telescope has eliminated that problem. The mounting and computer controls will give the telescope the highest pointing accuracy in the world, around one second of arc — equivalent to distinguishing between two points separated by the width of a five cent piece seen at a distance of one kilometre!

The skies over Australia contain many sights of great fascination to astronomers, including the centre of our own Milky Way galaxy, the twin Clouds of Magellan (the galaxies nearest our own), and the Vela pulsar, the remnants of a star which exploded around 8000 years ago. The new telescope will make important contributions to Australia's position as a leader in astronomy.

Japanese IC plant for California

Nippon Electric Company recently announced plans to built a $100 million integrated circuit plant in Roseville, near Sacramento, California. The new plant will use the most advanced wafer fabrication, assembly and test equipment and will have a throughput of 75,000 to 80,000 wafers per month when it becomes fully operational in 1985. NEC says that it will make very large scale integrated circuits, including 64K dynamic RAMs and advanced microprocessors at the plant.

Initially the plant will produce circuits based on three micron size rules. By 1985 however, feature sizes of integrated circuits will be brought down still further, to 1.5 microns, as required for the production of 256K dynamic RAM chips and 256K ROMs.

The Roseville plant will be highly automated. Automatic aligning and focussing equipment will control the imprinting of circuits on to the wafers, and each of the chemical and electrical processes that the wafers go through will be controlled by microcomputers. The traditional bottleneck of IC production, assembly of the finished chips into their packages, will be eliminated by new automatic equipment.

The NEC plant will be the first major semiconductor factory to be built in the US by a Japanese company, but probably not the last. Hitachi and Fujitsu are both believed to be planning major expansions of their existing US facilities, and others may follow. Many observers see the move as a response to the growing demands for import quotas on Japanese electronics products brought into the United States. By having their own production facilities in the United States the Japanese manufacturers could circumvent any such moves.

Open house at the CSIRO

The CSIRO National Measurement Laboratory will be holding Open Days on 23 and 24 September, with displays by the Division of Applied Physics and the Division of Mathematics and Statistics. The Division of Applied Physics undertakes research related to problems in industry and the community and is active in areas including basic physical measurement, electronics, optics and radiometry, acoustics, solar physics, superconducting and cryogenic devices and temperature measurement.

Approximately 45 laboratories will be open for inspection, representing the Division's activities in research, test and calibration services, and the maintenance of Australia's physical measurement standards.

Times for inspection of the Laboratory are from 2.00pm-5.00pm and 6.45pm to 9.30pm on Wednesday, September 23, and 2.00pm-5.00pm on Thursday, September 24. The address is Bradfield Rd, Lindfield, Sydney. (Phone 467 6329.)

New laser trims hybrid ICs

A British company, DEK Printing Machines Ltd, has designed and developed what is said to be the world's first fully automated production line to print 50mm × 50mm thick-film hybrid circuits. In the photograph above, an engineer uses closed circuit television to check the operation of a laser trimmer which is used to adjust resistors in the circuit to their correct values.

The machine has an output of about 1200 substrates an hour, depending on the number of components in the circuit. The basic technique is a very highly developed form of screen printing which deposits conductor tracks on ceramic plates. Resistors are printed in the same way and trimmed to their correct value by the laser. A further printing process deposits solder paste at points on the circuit where components such as transistors are required. Components are placed in position automatically, and a heat treatment then flows the solder to connect the components into the circuit.

What's new from SCOPE

PROFESSIONAL P.C.B. IRON . . . The Improved Model TC60

OFFERS THE ECONOMY OF DIRECT 240V MAINS OPERATION AND THE SOLDERING MUSCLE OF 60 WATTS.

COMPARE THESE FEATURES:

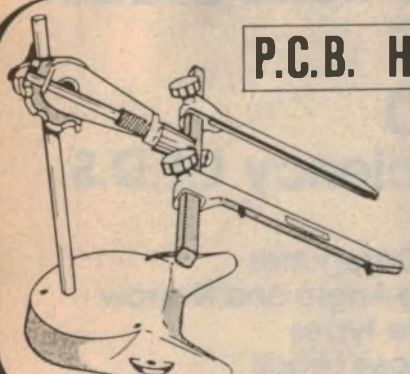
- AVOIDS THE COST AND WEIGHT of a 24V Transformer and offers greater portability.
- REDUCES SWITCHING PROBLEMS of contact wear and R.F. discharge. Mains voltage ensures 8 to 10 times less current to be interrupted.
- STEPLESS TEMP. ADJUSTMENT 20°-400°C. — no need to change tips to vary temperature.

Plus These Improvements:

(Compared with previous Model)

- 15% THINNER POWER LEAD — lighter & more flexible.
- LONGER TIP LIFE — new aluminium coating of iron plated copper, cuts heat and flux damage.

P.C.B. HOLDER — Rotates, Tilts & Locks



Scope Panavise — Model 333

COMPARE THESE FEATURES:

FIRM — NO SLIP WORK ANGLES.

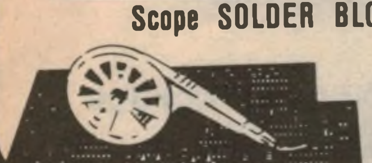
- Choose from 4 pre set angles of tilt and 8 axial positions at 45° increments.

FLEXIBLE CAPACITY

- Holds single or multiple boards to 750mm. (using extra arms and longer bars) yet allows full rotation.

SOLDER REMOVER — Without Burnt Fingers

Scope SOLDER BLOTTER in a metal tipped dispenser



COMPARE THESE FEATURES:

- Keeps your finger tip away from heat, yet places braid precisely.
- Pull braid to dispense — rotate pack to re roll surplus braid.

SIDECUTTERS

High Speed

NEW 'SHEAR' CONCEPT CUTS FATIGUE

Scope Flushcutters

COMPARE THESE FEATURES:

- LOW EFFORT CUTTING ACTION aids speed.
  Radical 'shear' action needs about 50% less force than traditional 'crush' method.
- CUSHION GRIP extends further to protect finger and thumb tip.
- OPERATIVES CAN SUSTAIN SPEED due to Spring Loading & low mass (43 gm.).

FOR FURTHER INFORMATION — CONTACT OUR AGENTS LISTED BELOW:

SYDNEY, N.S.W. (02) 548-6144
ADELAIDE, S.A. (08) 223-2261
BRISBANE, QLD (07) 52-5231
TOWNSVILLE, QLD. (077) 71-3448
ROCKHAMPTON, QLD. (079) 27-3370
HOBART, TAS (002) 34-2811
LAUNCESTON, TAS (003) 31-5545
PERTH, W.A. (09) 381-4155
WELLINGTON, N.Z. 85-9578
AUCKLAND, N.Z. 57-4037
PORT MORESBY, P.N.G. 25-7796
LAE, P.N.G 42-2172

SCOPE
BOX 63 NIDDRIE,
VIC., 3042
TEL.: (03) 338-1566
TLX: AA38318

The Official Line

— from the Department of Communications

Why monitor the airwaves?

DX fans who spend a few minutes twiddling a radio knob on the medium frequency broadcast band on any winter's evening are assailed by an onslaught of noise from stations in Australia and overseas. They will be broadcasting anything from sermons to punk music, and all of them will be struggling to grab and hold the listener's attention.

Nothing else demonstrates more convincingly the need for countries to co-ordinate and control the allocation of radio frequencies and to specify criteria for licensing radio services. But for these measures the broadcasting situation in Australia and abroad would be intolerable. Because of this, the monitoring of radio bands, or using the scientific term, the electromagnetic spectrum, is an essential part of radio frequency management.

Australia, as a signatory nation to the International Telecommunications Convention, is committed to radio frequency management. Under Article 13 it is obliged to continue the development of monitoring facilities at a national level, and to support international monitoring programs.

Monitoring can consist of many functions, although in most national communications administrations the following are basic: Aural and visual observation of the entire spectrum; of the field strength of signals and associated harmonics and spurii; measurement and recording of depths of modulation and band widths; direction finding; and frequency checks.

The results of such monitoring in Australia are vital to the Department of Communications in its attempts to trace and eliminate sources of harmful interference, prevent unauthorised use of frequencies, and identify unused and under-utilised frequencies.

Radio monitoring in Australia has traditionally been performed with fixed, manned stations. Experience in densely populated, developed countries is being used as a guide in planning the future of monitoring and radio frequency management in Australia. Pressure of demand for mobile radio services has caused administrations overseas to review and streamline their monitoring, frequency allocations and licensing procedures. Those of more advanced and economy-conscious countries are planning semi-automated computer-based systems, with the aim of making mobile radio licences available upon application.

Overseas and local experience shows the need for regular monitoring and recording of the occupancy of mobile bands in large cities. Band-occupancy data derived from monitoring procedures practised abroad consist of records of frequency utilisation, time, date and district. This data can be recorded and transferred using magnetic tape, or transmitted by land-line directly to an administration's central processor. The data is stored there and processed on a time schedule against future applications for licences.

The results are presented on visual display units at the local radio inspector's office in the form of frequency availability, by districts. Records are updated directly from the VDU keyboards and licences can be printed immediately on payment of a fee.

Such an operation involves sophisticated monitoring, and the experience overseas is that larger cities require to be covered by networks of three or more stations strategically located at high sites. The stations are under microprocessor control and unattended, but with remote intervention. Their inventory of equipment includes scanning receivers, spectrum analyser, directional rotatable antennas, switching matrices, timecode generator, recorder and interface units.

Such networks suffer blind spots and these are covered using mobile monitoring units only slightly less sophisticated than those at fixed stations. The mobile units are also available for regular monitoring in large country centres. The Department of Communications already employs a number of software programs in support of its frequency allocation and licensing roles. Plans for the future involve their integration into a large frequency management software system and the development of prototype fixed and mobile monitoring units such as those indicated above. Following the proving of monitoring units a program of construction and installation will be implemented with the aim of providing Australian radio frequency users with a faster, more responsive service.

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

Favourable reaction to satellite specification

The Australian telecommunications industry has reacted favourably to the Federal Government's satellite tender specifications released late last year. Mr Bruce Goddard, Chairman of the Telecommunications and Defence Division of the Australian Electronics Industry Association (AEIA) stated that canvassing of the Association member companies has shown a general belief that local industry stands to benefit significantly from the satellite undertaking.

A large number of companies intend responding to the call for tenders in the belief that there was plenty of scope for both local engineering design and manufacturing involvement in the project. The project can be divided into two segments — a space part and an earth station part.

Australian industry can expect only limited opportunities for local contributions to the space segment, as it requires technology which is possessed by only a handful of companies across the world. Under the Australian Government's Offset scheme however, prime contractors are expected to place some orders with Australian manufacturers.

The earth station segment is expected to provide even more opportunities. Requirements for this part of the project will be a battery of satellite earth stations including major city systems, regional TV/sound receiving systems, and small stations for outback homesteads and remote communities.

The expected launch date of the Australian domestic satellite is the last quarter of 1985 or the first quarter of 1986.

Philips win $1 million solar cell contract

Philips Industries Australia has won a $1 million contract from the Industrial Research and Development Incentives Board to develop photovoltaic solar cells at its semiconductor plant in Hendon, South Australia.

Philips has been involved for some time in the development and manufacture of special solar cells and systems at Hendon. Previous contracts have included a rugged, lightweight solar cell system for the Department of Defence which resulted in inquiries from military specialists around the world.

The emphasis of the new contract is on the development of processes which will result in long life and reliability and yet lead to reductions in the cost of manufacture of solar cells.

We can offer a career- not just a job!

Enjoy electronics as a hobby?
Why not make it your career
At Dick Smith Electronics, hundreds of electronics enthusiasts just like you have found satisfying and rewarding positions.
We're expanding - and we need more people. In all facets of our operation. The following positions are vacant NOW. if you'd like to work with us, why not give us a call!

TRAINEE MANAGERS:

We need managers for the new stores we're opening right around Australia - and overseas. What better way to prepare for this than by training in a current Dick Smith Store. If you're between 18 and 30, have a hobby background in electronics and retail experience, give us a call. We'll probably place you in a store close to home (we have 21 stores - in most states).

Contact Mr Bob Johnson, Retail Supervisor (02) 888 3200 or ask your local store manager.

TECHNICAL SALES STAFF/ SPECIALISTS:

You could join our young sales team - or even be a specialist salesman if you have a particular interest. (Amateur Radio, Computers, etc). You'll be trained thoroughly in being a sales professional, and you'll be dealing with interesting people involved in electronics: just like you are at the moment!

Contact your local store manager.

SERVICE TECHNICIANS:

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

Contact: Gary Crapp, National Service Manager (02) 888 3200

DISTRIBUTION CENTRE STAFF:

Think you'd like to have a go at one of the above positions - but haven't got the knowledge yet? Why not work for us anyway and learn 'on the job'. Our national distribution centre at North Ryde needs electronics enthusiasts to prepare goods for despatch to our stores and re-sellers. It's a great way to prepare yourself for a career in electronics in ANY of the sections of the organisation.

Contact: Ray Richards, Distribution Centre Manager (02) 888 3200

PRODUCTION ASSEMBLER:

We offer a number of challenging positions for young electronic enthusiasts. Initially setting up production lines in the Kit dept., the position could lead to stock controller, quality control of computers or production storeman. If you have electronic component knowledge, are eager to show your ability and are between the ages of 17 to 25.

Contact: Mike Rogers, Kit Centre Manager (02) 888 3200

AND MORE . . .

If you'd like to work for us, but don't really fit into one of the categories above, drop us a line anyway. We have vacancies occuring in almost all our departments from time to time .... advertising, purchasing, administration, production ..... etc etc. If you'd like to consider when a vacancy occurs, your name may be kept on file and you can be contacted.

Write to: the Personnel Manager, PO Box 321 NORTH RYDE 2113

LOWEST PRICED LCD MULTIMETER IN AUSTRALIA

LOOK AT THESE FEATURES!

● 13 ranges, ● Large shrouded 4mm input sockets, ● Probes have high voltage shield, ● Bonus carrying case and probe case, ● Expensive LCD not LED

We are really pleased to announce the availability of this fantastic budget priced multimeter. Ideal for the hobbyist and professional. Makes an ideal addition to any tool box.

LOOK AT THIS PRICE $49.50 NOT $79.00 FANTASTIC!

Q-1445

KNOW THE TIME-ANYWHERE IN THE WORLD!

YAESU WORLD CLOCK

The fantastic Yaesu 24hr ham clock shows you the time all over the world at a glance. Ideal for keeping those 'skeds'. Uses one 'C' cell that should last for one year.

ONLY $49.50

Y-1055

GET THE HEALTHY BENEFITS OF NEGATIVE IONS!

You've heard the claims now find out if they work for you (Was selling for $89.00). This is a limited offer.

ONLY $72.00

Y-9000

MINI HIFI

AMAZING POWERFUL MINI SPEAKERS

These are the most amazing speakers to come on to the market for a long, long time! Can be hooked up to your hi fi system or even in your car - they will give the most superg sound. Beautifully presented in a washable finish, they come with brackets for those who wish to mount them on the wall, in the car, or just about anywhere. With 35W input & freq response 35Hz to 20,000Hz.

8 OHM WAS $99.50 ONLY $75.00 PAIR

TOP VALUE HI FI STAND

What better way to show off your system. Finished in simulated walnut vinyl veneer.

ONLY $69.50

Cat. A-0105

THREE WAY "FLUORO LANTERN"

The ideal portable lamp for the camper, or fisherman, in the home or car, in fact wherever you need light and do not have the benefit of AC mains.

ONLY $12.50

WAS $14.95

Y-1084

HUGE SAVINGS

Centre loaded whip antenna

WAS $14.50 ONLY $7.95

D-9013

Y-1041

QUARTZ ACCURACY IN A STOPWATCH!

This stopwatch/clock is quartz controlled for accuracy. Use it as a clock or at a press of a button use it as a stopwatch: lap timing can be started & stopped without reset ting. Brilliant!

WAS $39.50 ONLY $29.50

THE AFFORDABLE ANSWER

BUDGET ANSWERING MACHINE

This exciting machine connects to your telephone & comes with power supply. You can use pre-recorded messages supplied - or make your own messages up - this unit also has a built-in microphone. Tape can handle up to 30 calls.

AND ONLY $99.50

Y-2100

NOT TELECOM APPROVED

CHEAP WINTER INSURANCE!

WAS OVER $20.00

MR CHARGE

M-9801

We've all had flat batteries one time or another - DON'T BE CAUGHT AGAIN. Just plug it into your cigarette lighter & charge your battery overnight.

ONLY $9.95

NOW OPEN IN COBURG

260 SYDNEY RD. COBURG VIC. Ph: 383 4455.

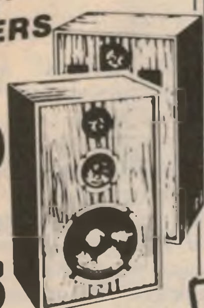
WATCH THIS SPACE
To see what you missed out on!

Did you miss out on our BELOW COST SPECIAL?
LAST MONTH:
LIGHT DIMMER
for only $4.27 norm $7.90
SAVING YOU $3.63
NEXT MONTH:
?????

STEREO WHEREVER YOU GO!

Cat. A-4055
WALKIE STEREO CASSETTE
The ideal compact stereo cassette player unit. You can listen to your favorite pre-recorded tapes with supplied headphones wherever you go.
ONLY $89
WAS $99.00

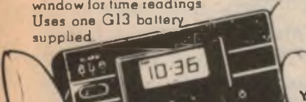
SAVE UP TO $40! ON THESE SPEAKERS



10 inch ONLY $299 Cat. A-2362
12 inch ONLY $345 Cat. A-2364
Amazing value for such incredibly popular speakers. Your choice of 250 or 300mm sizes (that's 10 & 12 inch for the old school!) completely built-up and ready to go. Simply superb!

Travel alarm clock

This miniature alarm clock is easy to use & even has an in-built light for night use. Comes complete with vinyl pouch with a clear window for time readings. Uses one G13 battery supplied.
$19.95
WAS $29.00



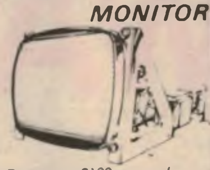
Y-1042

SAVE 30%

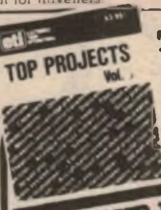
THE FANTASTIC CHESS MASTER

Play chess? Want to improve your game? Then try this: it's a superb 7 level electronic chess problem poser! You have to work out how to solve problems in the least number of moves. Supplied with detailed operators manual for all levels. Great for travellers!
Y-1257
ONLY $25
WAS $35.00

IN STOCK
TOP VALUE
GREEN SCREEN MONITOR



Don't pay $100s more for a green screen! Look at our price elsewhere! Ideal for the hobbyist, etc. build it into a console - make a simple wrap-around case & save a fortune!!!!
ONLY $175
X-1199



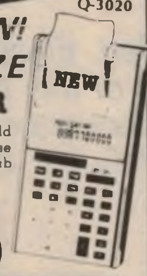
TOP PROJECTS VOL.7

Another great book packed with fantastic projects you can build.
From ETI magazine
$3.95
B-3650

GOT YOUR DICK SMITH MAILER

Our direct import mailer can save you a fortune. If you didn't call into one of our stores.

Q-3020
NOW!
A POCKET SIZE
PRINTER/CALCULATOR



Yes! Here it is - the fantastic hand-held miniature calculator printer. Check these features: ● Percentage, Square Root, Tab (floating decimal point) keys. ● 10 digit LCD display. ● Print/No print function etc etc. Outstanding!
ONLY $65
Paper to suit 60¢ (Q-3021).

SCOOP PURCHASE

CRADLE RELAY
Due to our scoop purchase of these fantastic quality relays, we're proud to offer you a saving of $2.00 - they normally sell for $6.50. You reap the benefit.
ONLY $4.95
S-7017

TREAT YOURSELF TO A LCD WATCH

Ladies enjoy the benefits of quartz crystal accuracy at a realistic price. 2 colors: Gold (Y-1049), Silver (Y-1048).
All the features of expensive models without the expensive price tag. An ideal gift. Y-1044.
ONLY $29.50 EA.

WAY BELOW MANUF. COST!

STILL TIME TO TAKE ADVANTAGE OF THIS
CRAIG TRANSLATOR

This brilliant language translator is a must for the businessman & overseas traveller. A great way to learn a second language! Has normal calculator functions, plus metric conversions as well. (Was selling for $250).
ONLY $69.50
Y-1340
MODULES: French Y-1341, Japanese Y-1342, German Y-1343, Italian Y-1344, Bar & Wine Counter Y-1346, guide Y-1345, Calorie
$12 EA.

MAJOR DICK SMITH RE-SELLERS

These re-sellers stock a large range of our products. However we cannot guarantee they will have all items in stock, or at the prices we advertise.

ATHERTON, QLD: Jue Sue's Radio Service
55 Main St Phone 911 208
BENDIGO, Vic: Sumner Electronics
95 Mitchell Street Phone 431 977
BALLINA, NSW: A. Cummings & Co.
91-93 River St. Phone: 862 285.
BLACKHEATH, NSW: Goodwin Electronics
123 Station Street Phone 878 379
BROKEN HILL, NSW: Crystal TV Rentals
66 Crystal Street Phone 6897
CAIRNS, QLD: Thompson Instrument Services
79-81 McLeod Street Phone 512 404
COFFS HARBOUR, NSW: Coffs Harbour Electronics
3 Coffs Harbour Plaza, Park Ave Phone 525 684
DARWIN, NT: Kent Electronics
42 Stuart Highway Phone 814 749
DUBBO, NSW: Dubbo Electronic Services
157 Brisbane St Phone 829 355
EAST MAITLAND, NSW: East Maitland Electronics
Cnr Lawes & High Streets. 337 327
FAIRY MEADOW, NSW: Trilogy Wholesale Elect.
40 Princes Hwy Phone 831 219
GERALDTON, WA: KB Electronics & Marine
361 Main Terrace Phone 212 176
GOSFORD, NSW: Tomorrow's Electronics & Hi Fi
68 William Street Phone 247 246
HOBART, TAS: Aero Electronics
123a Bathurst Street Phone 348 232
KINGSTON, TAS: Kingston Electronics & Records
Channel Court Phone 296 802
LAUNCESTON, TAS: Advanced Electronics
5a The Quadrant Phone 317 075
LISMORE, NSW: Decro Electric
Magellan St & Bruxner Hwy Phone 214 137
MACKAY, QLD: Stevens Electronics
42 Victoria Street Phone 511 723
MARYBOROUGH, QLD: Keller Electronics
218 Adelaide Street Phone 214 559
MORUYA, NSW: Coastal Electronics
43 Vulcan Street Phone 742 545
MT GAMBIER, SA: Hutchesson's Communications
5 Elizabeth Street Phone 256 404
MUSWELLBROOK, NSW: Silicon Chip Electronics
Suite 3, 98 Bridge Street Phone 43 1096
NAMBOUR, QLD: Nambour Electronic Shop
Shop 4, Lowan House, Ann St Phone 411 604
NEWCASTLE, NSW: Elektron 2000
181 Wharf Road Phone 262 644
ORANGE, NSW: M&W Electronics
48 McNamara Street Phone 626 491
ROCKHAMPTON, QLD: Purely Electronics
15 East Street Phone 21 058
SOUTHPORT, QLD: Amateur's Paradise
121 Nerang Street Phone 322 644
TAMWORTH, NSW: Sound Components
78 Brisbane Street Phone 661 363
TOOWOOMBA, QLD: Hunts Electronics
18 Neil Street Phone 326 944
TOWNSVILLE, Qld: Tropical TV
49 Fulham Rd, Vincent Village Phone 791 421
TRARALGON, VIC: Power'N'Sound
147 Argyle Street Phone 743 638
WAGGA, NSW: Wagga Wholesale Electronics
82 Forsyth Street
WODONGA, VIC: A & M Electronics
78a High Street Phone 244 588
WHYALLA NORRIE, SA: Mellor Enterprises
Shop 2, Forsythe Street Phone 454 764

Dear Customer:
Quite often, the products we advertise are so popular they run out within a few days. Or, unforseen circumstances might hold up goods so that advertised lines are not in the store by the time the advert appears. Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world or even locate a shipment that has gone astray. What we are trying to say is that, if you are about to drive across town to pick up a particular line at a Dick Smith Store, why not give the store a ring first (addresses/phone numbers below) ... just in case! Thanks.
Dick Smith & Staff.

MAIL ORDER CUSTOMERS

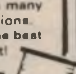
SORRY - WE CAN'T HELP IT!
DON'T FORGET TO ALLOW FOR INCREASED POSTAL CHARGES.
(See details in our address panel.)

BUILDING A SUPER 80
OR WANT A QUALITY SOLDERING STATION?

Weller soldering station

This superb soldering station is transformer powered, complete with a low voltage temperature controlled soldering pencil. Fantastic!
(T 1000)
ONLY $62.50

FINE GAUGE SOLDER
Used in many applications. Want the best this is it!
$4.95



N-1623

DSE 025RB

DICK SMITH Electronics

MAIL ORDER CENTRE: P.O. Box 321 North Ryde, NSW 2113. Ph. (02) 888 3200

NSW: 145 Parramatta Rd **Auburn** 648 0558. 613 Princes Hwy **Blakehurst** 546 7744. 818 George St **Broadway** 211 3777. 531 Pittwater Rd **Brookvale** 93 0441. 147 Hume Hwy **Chullora** 642 8922. 162 Pacific Hwy **Gore Hill** 439 5311. 30 Grose St **Parramatta** 683 1133. 125 York St **Sydney** 290 3377. 173 Maitland Rd **Tighes Hill** 61 1896. 263 Keira St **Wollongong** 28 3800.

ACT: 96 Gladstone St **Fyshwick** 80 4944. **QLD:** 166 Logan Rd **Buranda** 391 6233. 842 Gympie Rd **Chermside** 59 6255. **SA:** 60 Wright St **Adelaide** 212 1962. **VIC:** 399 Lonsdale St **Melbourne** 67 9834. 656 Bridge Rd **Richmond** 428 1614. Cnr Dandenong & Springvale Rds **Springvale** 547 0522. 260 Sydney Rd **Coburg** 383 4455. **WA:** Cnr Wharf St & Albany Hwy **Cannington** 451 8666. 414 William St **Perth** 328 69 44.

Order Value	Charges
$5-$9.99	$1.20
$10-$24.99	$2.20
$25-$49.99	$3.30
$50-$99.99	$4.40
$100 or more	$6.00

These charges for goods sent by Post in Australia only — Not airmail overseas or road freight.

THE TANTALISING QUEST FOR GRAVITY WAVES

Although still being tested, Einstein's theory of general relativity remains untoppled. Out of this theory comes one of the most fascinating challenges facing scientists today — the detection of gravity waves. When they do, it will open a new era in astronomy.

By ARTHUR FISHER

In the vast reaches of the cosmos, cataclysms are a commonplace: something momentous is always happening. Perhaps the blazing death of an exhausted sun, or the collision of two black holes, or a warble deep inside a neutron star. Such an event spews out a torrent of radiation bearing huge amounts of energy. The energy rushes through space, blankets our solar system, sweeps through the Earth . . . and no one notices.

But there is a small band of experimenters, perhaps 20 groups worldwide, scattered from California to Canton, determined that some day they will notice. Pushed to the edge of contemporary technology and beyond, battling the apparent limits of natural law itself, they are developing what will be the most sensitive antennas ever built. And eventually, they are sure, they will detect these maddeningly intangible phenomena – gravity waves.

Even though gravity waves (more formally called gravitational radiation) have never been directly detected, virtually the entire scientific community is convinced they exist. This assurance stems, in part, from the bedrock on which gravity-wave notions are founded: Albert Einstein's theory of general relativity, which, though still being tested, remains untoppled. Says Caltech astrophysicist Kip Thorne, "I don't know of any respectable expert in gravitational theory who has any doubt that gravity waves exist. The only way we could be mistaken would be if Einstein's general relativity theory were wrong and if all the competing theories were also wrong, because they also predict gravity waves."

In 1916, Einstein predicted that when matter accelerated in a suitable way, the moving mass would launch ripples in the invisible mesh of space-time, tugging momentarily at each point in the universal sea as they passed by. The ripples – gravity waves – would carry energy and travel at the speed of light. Unlike dipole electromagnetic radiation, gravitational radiation is quadrupole (see drawing).

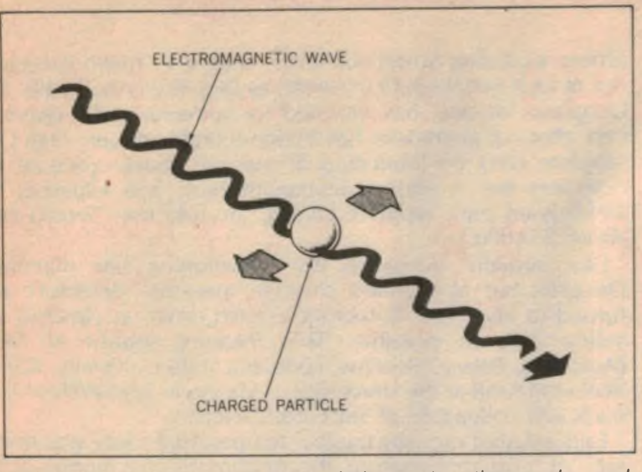
If a gravity wave generated, for example, by a supernova in our galaxy passed through the page you are now reading, the quadrupole effect would first make the length expand and the width contract (or vice versa), and then the reverse. But the amount of energy deposited in the page would be so infinitesimal that the change in dimension would be less than the diameter of a proton. Trying to detect a gravity wave, then, is like standing in the surf at Big Sur and listening for a kiss blown across the Pacific.

As for generating detectable waves on Earth, a la Hertz, theoreticians long ago dismissed the possibility. "Sure, you make gravity waves every time you wave your fist," says Rainer Weiss, a professor of physics at MIT. "But anything you will ever be able to detect must be made by massive bodies moving very fast. That means events in space." Astrophysicists have worked up a whole catalogue of such events, each associated with gravity waves of different energy, different characteristic frequencies, and different probabilities of occurrence. They include the supposed continuous background gravitational radiation of the "big bang" that began the universe, and periodic events like the regular pulses of radiation emitted by pulsars and binary systems consisting of superdense objects. And then there are the singular events: the births of black holes in globular clusters, galactic nuclei, and quasars; neutron-star quakes; and supernovas.

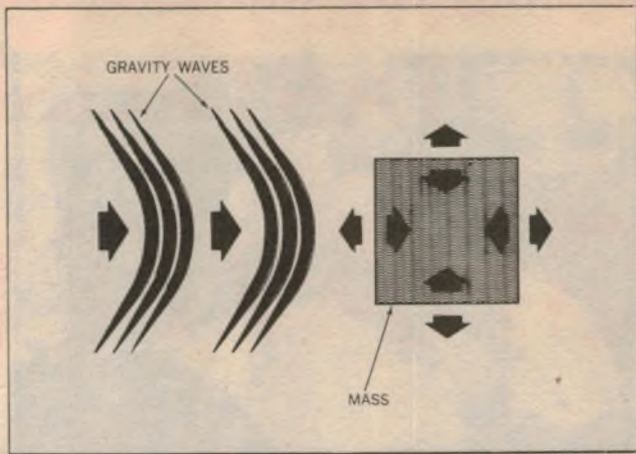
Probably the prime candidate for detection is what William Fairbank, professor of physics at Stanford University, calls "the most dramatic event in the history of the universe" – a supernova. As a star such as our sun ages, it converts parts of its mass into nuclear energy, perhaps one percent in five billion years. "The only reason a large star like the sun doesn't collapse," explains Fairbank, "is because the very high temperature in its core generates enough pressure to withstand gravitational forces. But as it cools from burning its fuel, the gravitational forces begin to overcome the electrical forces that keep its particles apart. It collapses faster and faster, and if it's a supernova, the star's outer shell blasts off. In the last thousandth of a second, it collapses to a neutron star, and if the original star exceeded three solar masses, maybe to a black hole."

One way of characterising the energy of a gravity wave is the strain it induces in any matter it impinges on. If the mass has a dimension of a given length, then the strain equals the change in that length (produced by the gravity wave) divided by the length. Gravity waves have very, very tiny strains. A supernova occurring in our galaxy might produce a strain on Earth that would shrink or elongate a 100cm-long detector only one one-hundredth the diameter of an atomic nucleus. (That is 10^{-15}cm, and physicists would label the strain as 10^{-17}.) To the credit of tireless experimenters, there are detectors capable of sensing that iota of a minimum of a scruple.

Dipole electromagnetic waves and quadrupole gravity waves

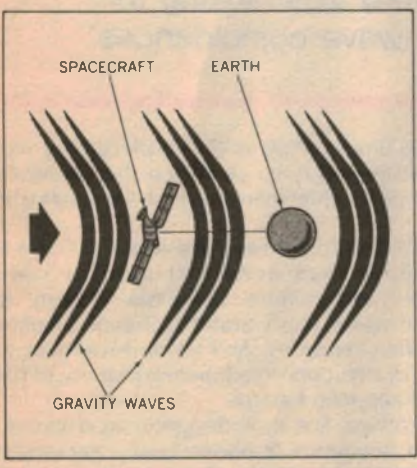


When electromagnetic wave (light, etc) strikes a charged particle, the particle oscillates in a simple, back-and-forth dipole mode, perpendicular to the direction of the wave.

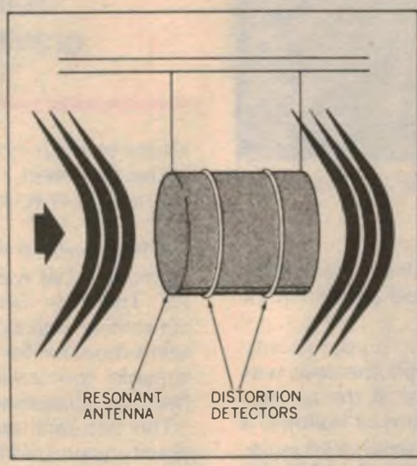


When gravity wave strikes mass, one dimension will contract, the other expand, in a plane perpendicular to direction of the wave. These quadrupole motions reverse on next half-cycle.

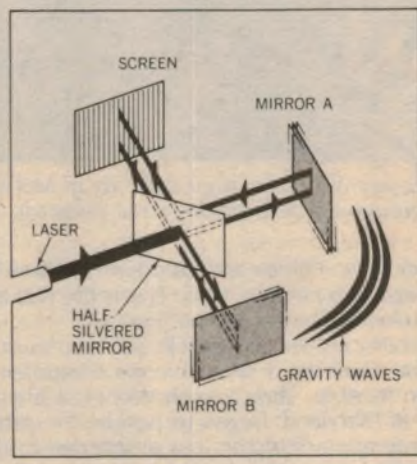
Three kinds of gravity-wave detectors



Doppler tracking uses radio signal between spacecraft and Earth. When gravity wave passes, distance between them changes, introducing Doppler shift.



Bar detector changes length when gravity wave passes. Ultrasensitive transducers along or at ends of bar translate minute motion to electrical signals.



Laser interferometer bounces light beam between mirrors mounted on masses. Gravity wave changes distance between mirrors, producing interference pattern.

But there is a catch: based on observations of other galaxies, a supernova can be expected to occur in the dense centre of any given galaxy roughly about once 30 years. That is a depressingly long interval. Over and over again, the scientists I spoke to despaired of doing meaningful work if it had to depend on such a rare avis. Professor David Douglass of the University of Rochester told me: "To build an experiment to detect an event once in every 30 years – maybe – is not a very satisfying occupation. It's hardly a very good PhD project for a graduate assistant; it's not even a good career project – you might be unlucky."

Gravity waves: powerful astronomical tools?

What if we don't confine ourselves to events in our own galaxy, but look farther afield? Instead of the "hopelessly rare" (in the words of one researcher) supernova in our galaxy, what if we looked for them in a really large arena – the Virgo cluster, which has some 2500 galaxies, where supernovas ought to be popping from once every few days to once a month or so? That's Catch 22. The Virgo cluster is about 1000 times farther away than the centre of our own galaxy. So a supernova event from the cluster would dispatch gravity waves whose effect on Earth would be some million times weaker (1000 times 1000, according to the inverse-square law governing all radiative energy). And that means building a detector a million times more sensitive. "There is no field of science," says Ronald Drever of Caltech and the University of Glasgow, Scotland, "where such enormous increases in sensitivity are needed as they are here, in gravity-wave detection." Trying to detect a supernova in a distant galaxy means having to measure a displacement one-millionth the size of an atomic nucleus.

Paradoxically, it is this very quality that gives gravity waves the ability to be, as Kip Thorne says, "a very powerful tool for astronomy. True, they go through a gravity-wave detector with impunity. But that means the gravity waves generated during the birth of a black hole can also get away through all the surrounding matter with impunity". And neither light, nor gamma rays, nor radio waves can. During a supernova we can see the exploding shell via showers of electromagnetic radiation, but only hours or days after the initial massive implosion – the gravitational collapse. During the collapse, while a neutron star or black hole is being formed, nothing but gravity waves (and, theoretically, neutrons) can escape.

"We've opened, at least partially, all the electromagnetic windows onto the universe," says Thorne. "With gravity-wave astronomy, we will open a unique new window onto fascinating, explosive events that cannot be well studied any

Battling the limits of modern technology

Dr Joseph Weber of the University of Maryland at work on his invention, the first gravity wave detector.

other way – births and collisions of black holes, star quakes, collapses to neutron stars. This is the real bread and butter of modern high-energy astrophysics."

But first, as the cookbooks say, you must catch your gravity wave. Until the 1950's, no one presumed that the task was even feasible. Then Joseph Weber, a physicist at the University of Maryland, began to ponder the problem of building a gravity-wave detector, and proceeded to do so. It is no exaggeration to say that he fathered the entire field. By 1967, he and his assistants had built the first operating gravity-wave detector – a massive aluminium bar, isolated as well as possible from external vibrations and girdled by piezoelectric crystal sensors, which translated changes in the bar's dimensions into electrical signals. Weber reported a number of events recorded on this and a twin detector at Argonne that he concluded were gravity waves. His report stimulated a host of other experimenters to build their own detectors. Designed by such investigators as J. A. Tyson at Bell Labs and David Douglass at Rochester, the detectors followed the same principles as Weber's pioneering bar detector, but with greater sensitivity. These and subsequent experimenters were unable to confirm Weber's findings; in fact, at the level Weber's bar was capable of, theoreticians believe it was impossible to have detected gravity waves. "Either Joe Weber was wrong," one told me, "or the whole universe is cockeyed."

Today, three basic kinds of gravity-wave detectors are being developed. One is basically a Weber resonant-bar antenna, much refined; the second is the laser interferometer; and the third is a space-based system called Doppler tracking. Each has its advantages, and each its own devilish engineering problems.

Farthest along is the resonant bar, mostly because it has been in the works longest. The more massive such a bar is, the better (because it will respond to a gravity wave better).And its worth depends on the quality of resonating, or "ringing", for a time after it has been struck by the wave. The longer it rings, the better an experimenter is able to pick out the effect of the wave. That quality is measured by the value called "Q" – the higher the Q, the better. For awhile David Douglass and others, including Soviet scientists, sought to make detectors out of such very-high-Q materials as sapphire-crystal balls. But Douglass, for one, has returned to aluminium. The reasons: new alloys of aluminium have been found with very high Q's; sapphire can't be fabricated in massive chunks (one of his detectors has a six-ton aluminium bar); and expense: "A 28-kilogram pure sapphire crystal," he told me, "would cost about $50,000".

Like virtually everyone else developing bar antennas, Douglass has abandoned room-temperature detectors and turned to cryogenic detectors, cooled down as close to absolute zero as possible. That includes groups at Perth (Australia), Tokyo, Moscow, Louisiana State University, Rome, Weber himself at the University of Maryland, and William Fairbank and colleagues at Stanford University.

Fairbank told me why the low-temperature route was essential: "At room temperature, the random thermal motion of the

> "a Rome-Perth-Baton Rouge-Stanford axis looking for gravity-wave coincidences"

atoms in a bar is 300 times as big as the displacement we're trying to detect. The only way to approach the sensitivities we're after is to get rid of that thermal noise by cooling the bar."

When I visited the Stanford campus, the detector's five-ton aluminium bar was sealed inside its cryostat, a kind of oversized Thermos bottle. The whole assembly looked like something you could use if you wanted to freeze Frankenstein's monster for a few centuries. And the environment was suitable, too: a vast, drafty, concrete building that could have been an abandoned zeppelin hangar.

This antenna, and others like it, is designed to respond to gravity waves with a frequency of about 1kHz, characteristic of supernova radiation. Obviously the antenna must be isolated as far as possible from any external vibration at or around that frequency. This the Stanford group does by suspending the cylinder with special springs, consisting of alternating iron and rubber bars in what is called an isolation stack. "Otherwise, with our sensitivity," Fairbank says, "this detector would make a dandy seismograph – just what we

A cryogenic bar detector at the University of Rochester. The aluminium cylinder is sealed inside a windowed shield, here shown rolled out of the cooling system.

KITS! KITS! JAYCAR

Call in to our showroom to see the great new EA "Lyrebird" 73 note touch sensitive piano kit!!

JAYCAR TOUCH SENSITIVE ELECTRONIC PIANO KIT

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

Freight $15

ONLY $589.00 COMPLETE

- Full 88 Note Keyboard!
- Touch sensitive. The harder you play it, the louder it gets.
- Realistic sustain and soft pedals.
- Mellow, normal and bright piano as well as harpsichord sound.
- All timberwork done for you.
- Compact and lightweight.
- Power Amp can be built in.

The piano kit comes complete with a magnificent 32-page assembly manual which includes comprehensive circuit descriptions, component overlays and parts check lists!
This unit is remarkable for its tonal similarity to an acoustic piano. If you don't believe us send $5 for a copy of the demo tape!!
And no, you don't have to be a carpenter. All timberwork is cut and jig assembled. You do need to do some soldering though!

SEND S.A.E. FOR MORE INFORMATION

STRING SYNTHESISER

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

Freight $10

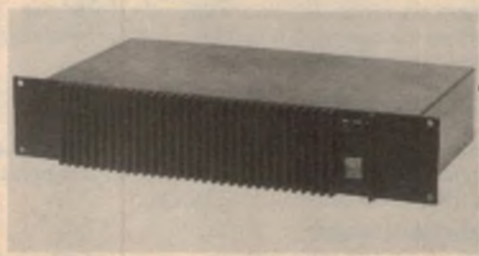
$445

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

THE ETI 5000 AMPLIFIER STORY

A CASE OF BOMB — PROOF POWER!!!

The ETI 5000 is the outstanding kit project of the decade. Using Power MOS-FETs, the output stage produces 100 + 100 watts (RMS) at less than 0.0005% distortion.
The Power MOS-FETs are practically "Bomb-Proof" as they don't need nasty distortion-inducing protection circuits, or as some people coyly call them "Thermal Overload Protection".
Our MOS-FETs don't suffer from thermal runaway or secondary breakdown as ordinary transistors do. It has been said that money can't buy a better 100W amplifier. It is virtually the maximum performance that can be obtained with current technology i.e. "State of the Art".
Incidentally, valve amp affectionado's should try this amp - it has that sweet "Valve Sound".
Call in and listen to the 5000 amp.



ONLY $289

You can have a Jaycar quality 5000 amp kit in your home for only $289 plus $15 freight anywhere in Australia. (Includes standard ETI front panel heatsink)
And whilst we're on the subject - DON'T compare our amp with INFERIOR substitutes!

SuperFinish **The Jaycar Front Panel**

ONLY $49.50

After feedback from customers we decided to produce our own version of the castheatsink front panel as originally supplied by ETI.
The Jaycar SuperFinish cast panel has a much finer finish and has a considerable amount of machining done to the fine grain casting before receiving its tough baked black enamel finish. It is thoroughly inspected at all stages of manufacture and is supplied completely drilled and tapped. It mates with the special heatsink brackets as supplied with our MOSFET Modules.
You can have a SuperFinish front panel for your amp for only $49.50 or just $10 on top of our regular kit price of $289 – $299 total.

PARTS AVAILABLE SEPARATELY

PF4361/1 Power Transformers to suit	$34.50
MOSFET Module inc. heatsink bracket and prewound coil	$59.00
8000/75V Electrolytics (new compact type	$9.75
"SuperFinish" Cast Front Panel	$49.50
NE 5534 N Op Amps $1.50 each NE 5534 AN's	$1.98
Peak Reading Power Meter Kits REDUCED WERE $37.50 NOW ONLY	$29.50

THE 5000 PREAMP

A case of "it was worth waiting for". We are pleased to say that we have this kit now in stock. The complete kit including 1¾" x 19" rack cabinet, linished, anodised and silkscreened front and rear panels with specially imported knobs costs an amazingly low $245.00.
It, like the power amp is about as good as you can make a preamp at the moment – ask Dave Tillbrook!

FEATURES
- Moving Magnet Inputs x 2
- Moving Coil Input
- Aux Inputs x 2
- "Low" and "High" Inputs
- Tape Inputs x 2
- 400Hz Calibration Oscillator
- Input Level Control
- Dubbing Facilities to Tape 1 & Tape 2
- Peak/Average Level Meters

$245

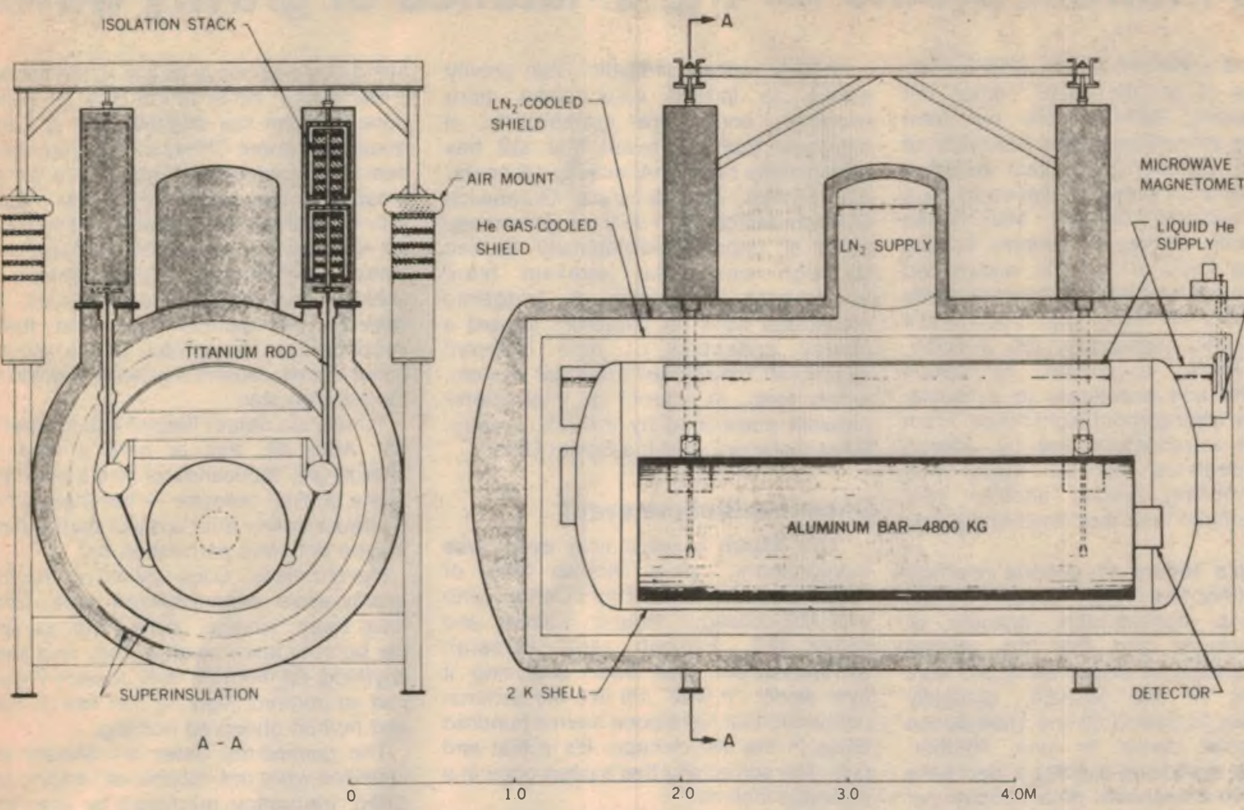
Jaycar

NOTE! NEW
SHOP HOURS
Mon-Sat 9am-5.30pm
Sun- 10am to 2pm
Open Thursday night
until 8pm

380 Sussex St Sydney 2000

Ph. 2646688 Telex 72293 Mail Orders To: Box K-39 Haymarket 2000

DON'T FORGET OUR FREE REGISTER OFFER — SEE EA/ETI JULY



A resonant bar gravity wave detector. Cooled to near absolute zero by liquid nitrogen and helium, the 4.8 tonne aluminium bar is suspended with springs and mechanical filters to isolate it from external noise. A gravity wave will change the length of the bar by a fraction of the diameter of an atomic nucleus. Super-conducting sensor devices can detect this change.

don't want in California." The Stanford suspension system attenuates outside noise by a factor of 10^{10}, enough so that you could drop a safe in its vicinity without disturbing the detector.

At LSU, William Hamilton, who is building an antenna very similar to Stanford's (eventually it will become part of a Rome-Perth-Baton Rouge-Stanford axis looking for gravity-wave coincidences), takes another route toward seismic isolation. The very low temperature of the device allows him to levitate the bar magnetically; it is coated with a thin film of niobium-tin alloy, a material that becomes super-conducting near absolute zero. If electromagnets are placed under the bar, the persistent currents running through its coating will interact with the magnetic field so that the bar literally floats in air.

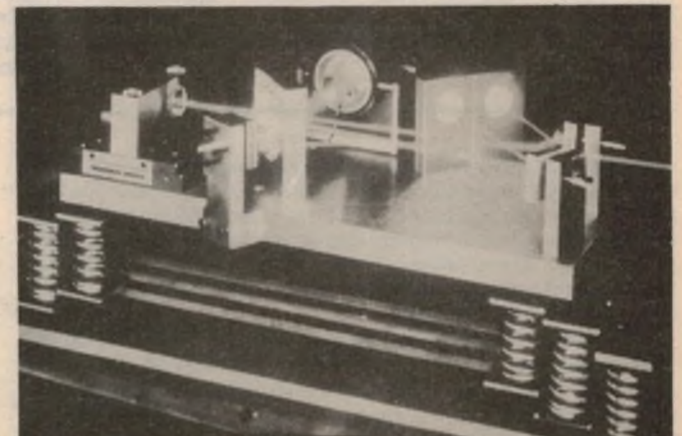
Superconductivity is also the key to one of the most perplexing of all engineering problems: designing a transducer capable of sensing the tiny displacements of these antennas and converting them to a useful voltage that can be amplified and measured. "You can't buy such things," says David Douglass, "you have to make them, and go beyond the state of the art." Both Douglass and Fairbank use superconducting devices whose elegant design makes them extremely sensitive – orders of magnitude more than the piezoelectric crystals originally used – although their approaches differ in details.

Superconducting devices may also one day – a day far in the future – allow gravity-wave astronomers to perform a feat of legerdemain called "quantum non-demolition". To oversimplify, this means evading a fundamental limit for all resonant detectors, one that is imposed by the laws of quantum mechanics as the displacements become ever smaller. That problem will have to be faced if bar antennas are ever to be sensitive enough to detect gravity waves from supernovas in the Virgo cluster.

An alternative: laser interferometers

"One of the reasons we're turning to laser detectors," says Ronald Drever, "is to avoid the quantum-limit problem. Because we can make measurements over a much larger region of space, we effectively see a much larger signal. We don't have to look for such minute changes as in a bar antenna."

Laser interferometers bounce an argon-ion laser beam back and forth many times between two mirrors. (A generalised approach to the scheme appears in the drawing.) As a gravity



Experimental low-noise laser interferometer built in 1972 had an effective length of eight metres. Plans now call for laser detectors more than a kilometre long.

Two indirect proofs for the existence of gravity waves

The first evidence of any kind for the existence of gravity waves comes not from sensing them directly but from observing their effect on the behaviour of a bizarre astronomical object called a binary pulsar. A pulsar, believed to be a rapidly spinning neutron star, emits strong radio signals in periodic beeps. But pulsar PSR 1913 + 16, discovered by a team of University of Massachusetts astronomers in 1974 with the world's largest radio telescope (at Arecibo, Puerto Rico), is unique. Its beeps decelerate and accelerate in a regular sequence lasting about eight hours. From this, the astronomers, led by Joseph Taylor, deduced that the pulsar was rapidly orbiting around another very massive object - perhaps another neutron star.

Einstein's theory of general relativity predicts that this binary system should produce a considerable quantity of gravity waves, and that the energy radiated should be slowly extracted from the orbit of the system, gradually decreasing its period as the superdense stars spiral closer to one another. Einstein's equations predict a decrease of one ten-thousandth of a second per year for a pulsar like PSR 1913 + 16. And after four years of observations Taylor's team announced, in late 1978, that ultraprecise measurements of the radio signals gave a value almost exactly that amount. The closeness of the match not only provides good — even though indirect — evidence of the existence of gravity waves, but also further bolsters Einstein's theory of gravity against some competing theories.

As Taylor said of what he called "an accidental discovery originally," the astronomers had an ideal situation for testing the relativity theory — a moving clock (the pulsar) with a very precise rate of ticking and a high velocity — some 300 kilometres per second. "It's almost as if we had designed the system ourselves and put it out there just to do this measurement."

Another indirect indication that gravity waves do indeed exist came more recently, and more dramatically. It stemmed from an event that still has astronomers reeling. At exactly 15 hours, 52 minutes, five seconds, Greenwich time on March 5, 1979, a gamma-ray burst of unparalleled intensity flashed through our solar system from somewhere in space. It triggered monstrous blips on detectors aboard a motley collection of nine different spacecraft throughout the solar system, which form, in effect, an international network maintained by the US, France, West Germany, and the Soviet Union.

Once-in-a-lifetime event

"This March 5 gamma-ray event was extraordinary," says Thomas Cline of NASA Goddard Space Flight Center, who with his colleague Reuven Ramaty and other US, French, and Russian astrophysicists, has been analysing it ever since. "It was not like the gamma-ray bursts that have been seen a hundred times in the last decade. It's a first and only, like something that's seen once in a scientific lifetime."

Because the surge of gamma rays was detected by so many satellites separated in space, astronomers were able to triangulate the position of its source and identify it with a visible object — the first time for such a feat. The object was a supernova remnant dubbed N49 in the Large Magellanic Cloud (LMC), a neighbouring galaxy - roughly 150,000 light-years away.

Ramaty, Cline, and colleagues posit that the genesis of the gamma-ray burst was a quivering neutron star — the ultradense, ultracompact object that many theorists believe is left over from a supernova explosion. "We believe," Cline told me, "that a neutron star can undergo a transformation analogous to an avalanche. Snow falls on a mountain until there's a slide. Similarly, dust and other material collect on a neutron star until it can't stand being as heavy as it is. Then there's a star quake, either in the crust or in the core, and the star shakes itself at a frequency of about 3kHz, a note you could hear if you were listening to it in an atmosphere. The surface of the star — only 8 to 16 kilometres in diameter - is heaving up and down several feet, thousands of times a second. Its magnetosphere is shaken, and that's what produces, indirectly, the gamma rays. But that's secondary, in our model, to the gravitational waves caused by the oscillation of the neutron star.

"Could we detect these? The answer is no. After all, this is only a kind of aftergurgle, thousands of years after the star's original collapse — the supernova. It's like a tremor after a major earthquake, maybe only one percent as big."

Nevertheless, Cline called all the US gravity-wave experimenters who could have been "on-line" during the gamma-ray burst to learn whether they had seen anything. Of them all, only Joseph Weber had an antenna working that March day, and he had observed nothing.

The gamma-ray detectors aboard the satellites were not capable of sensing the 3KHz frequency predicted by the star-quake model. If they had, says Cline, it would have been "a very direct link" to the existence of gravitational radiation.

But the star-quake model makes another prediction: the gravity waves generated should carry off an enormous amount of energy, far more than that in the gamma rays, and thus snuff out the star's vibration very quickly. "The nice thing," says Goddard's Reuven Ramaty, "is that the damping time predicted for gravity waves in this event exactly corresponds to what we observed: The main part of the burst lasted just 15 hundredths of a second, and that's what we calculate from our model. So we now have for the second time indirect evidence of the existence of gravity waves. But both have problems, as do all indirect checks. They won't replace direct evidence." — A.F.

---

wave ripples between the mirrors, the length of the light path changes, resulting in a change in the interference patterns that appear in photodetectors. Numbers of such detectors are in the planning and building stages, including ones at MIT, designed by Rainer Weiss, a pioneer in the field; at the Max Planck Institute of Astrophysics in Germany; at the University of Glasgow; and at Caltech.

"The one in Glasgow has 10-metre arms," Drever told me, "and is working now. The one we're working on at Caltech also has 10-metre arms, but will be stretched to 40 metres as soon as a building for it is ready. This will serve as a prototype for a much larger version – a kilometre to several kilometres long."

Of course, laser interferometers have engineering problems, too, problems that become exacerbated as they grow larger. The laser beams must travel through vacuum pipes, and isolating pipes a kilometre long will not be simple. But Drever is convinced it can be done. "Maybe we'll put it in a mine, or in the desert," he says. This device may be ready by 1986, and has, Drever thinks, a chance of eventually detecting supernovas in the Virgo cluster.

One additional advantage of such laser detectors is that they are not restricted to a narrow frequency range, as are the resonant antennas, but would be sensitive to a broad band of frequencies from a few hertz to a thousand hertz. They could therefore detect some massive black-hole events, which have lower frequencies than gravity waves from supernovas. To detect gravity waves with much lower frequencies, such as those from binary systems, you need very long baselines. "In abouot 15 years," says Rainer Weiss, "we will want big, space-based laser systems, using, say, a 10-kilometre frame in space. That way we could avoid all seismic noise."

Laser interferometer in space

Proposed free-space laser antenna, shown here in an artist's impression, is designed to detect gravity waves from the Crab Nebula. The central satellite of a group of three carries the laser and beam splitting mirror. Two outer spacecraft carry reflectors. Changing interference patterns will show the occurence of gravity waves.

The third kind of gravity-wave detector already exists in space, after a fashion. It has been used for spacecraft navigation for 20 years. It is called Doppler tracking, and is very simple – in theory. Here's how it's described by Richard Davies, program leader for space physics and astrophysics at Jet Propulsion Laboratory in Pasadena, Calif: "You send a radio signal from Earth to a spacecraft, and a transponder aboard the craft sends the signal back to you. If a gravity wave passes through the solar system, it alters the distance between the two, and when you compare the frequency of the signal you sent out to the one you get back, you see that they are different – the Doppler shift. However, the contribution of the gravity wave to this shift is minute compared to that of the spacecraft's own velocity.

"We want to detect gravity waves with very low frequencies, maybe a thousandth of a hertz, using interplanetary spacecraft and the Deep Space Net that is used to track them. Such waves could be emitted from a collapsing system with a mass of a million to ten million suns, or from double stars that orbit each other in hours."

A gravity-wave experiment had been planned for the International Solar Polar Mission. But, according to MIT's Irwin Shapiro, who chaired the Committee on Gravitational Physics of the National Academy of Science's Space Science Board, the experiment was dropped by NASA because of budget cuts.

Which of these methods will yield the first direct evidence of gravity waves? And when will that first contact come? No one really knows, and the gravity-wave seekers themselves are extremely diffident about making claims and predictions. But some time within the decade seems at least plausible.

In the meantime, gravity-wave research is paying unexpected dividends. "It has opened up," says Kip Thorne, "a modest new chapter in quantum electronics. Because it is pushing so hard against the bounds of modern technology, it is inventing new techniques that will have fallout elsewhere; for example, a new way to make laser frequencies more stable than ever. This will be useful in both physics and chemistry research."

In the long run, however, the search for gravity waves is propelled by the basic drive of all scientists, and all mankind: to see a little farther, to understand a little more than we have ever done before.

Britain looks to robot technology

Economic pressures in Britain make increasing automation of the factory inevitable. Already, robots have replaced numbers of human workers on automobile assembly lines, and research is continuing on ways of making robots more versatile and more intelligent.

by BRIAN DANCE

The rising cost of human labour has made it much more attractive to use industrial machines on the production line wherever possible instead of people. In general, suitable machines can lift heavier loads than a man, can work for longer periods without stopping and do not join trade unions or go out on strike! However the performance of the simpler machines is limited by their inability (or very limited ability) to make intelligent decisions which a human can make with ease.

In Europe, as elsewhere, there is a great drive to perfect microprocessor controlled industrial machines can make "intelligent" decisions and which are therefore usually known as "robots". Although readers of fiction may well imagine robots in a domestic situation, it is in industry where they are so vital. Indeed, it has been said that "Britain will not go broke if the domestic robot does not emerge, but it will if the industrial robot does not". This is also likely to apply in most other countries – at least to some extent. Apart from normal industrial fabrication work, think of the use of robots for such difficult and dirty jobs as coal mining!

Microprocessors

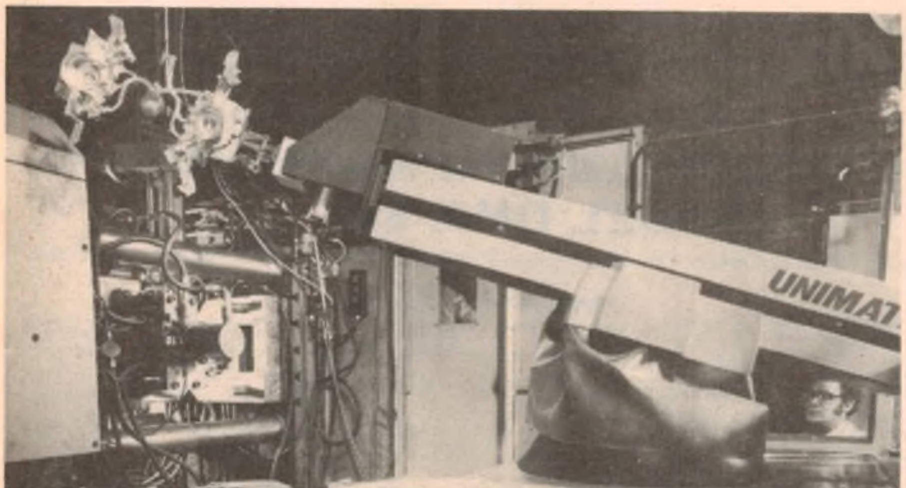
The modern intelligent industrial robot uses a suitably programmed microprocessor system to provide it with the required intelligence. Much development work remains to be done on fast-acting tactile, visual and aural sensory systems, the modular construction of robots, better, cheaper and lighter actuators and on robot dynamics and safety.

Many of the technical problems to be faced are those common to the general computer field, such as pattern recognition, analysis and data processing, data communications, graphics and displays, etc. Above all robots must be reliable in use, but it seems they must also become considerably cheaper before they will become more widely used in factories.

Some robots are designed for specific tasks and use dedicated tooling. Other types use re-programmable devices for greater versatility. Many robot devices used in factories are of the fixed arm type, but there is also considerable interest in mobile robots which can move to wherever they are required – even to disable a terrorist's bomb without danger to human life!

Apart from heavy robots able to handle large loads, there is also a need for smaller robots able to perform extremely accurate work. For example, Unimation's PUMA (Programmable Universal Manipulator for Assembly) can position objects with an accuracy of ±0.1mm – little greater than the diameter of a human hair. The PUMA occupies little more space than a human worker and has five axes of motion corresponding to a human being's waist, shoulder and elbow rotation together with wrist and hand movements. It has a lifting capacity of 3.5kg and a maximum velocity of just over one metre per second under maximum load conditions. The arm is positioned by microprocessor controlled servo motors.

The robot is taught by a program using either a teach module or an optional computer terminal, although both methods may be used together when appropriate.



Watched by a human operator from behind a screen of safety glass, a Unimate Series 2000 robot removes a casting from an automatic diecasting machine.

Automotive industry

There are about 10,000 industrial robots in use throughout the world, but it is rather remarkable that over half of these machines are in use in the automotive industry where their intrinsic flexibility is hardly used, since the production runs are so long. British Leyland

"Many robots make light work" – a robot welding line produces the new British Leyland Metro.

has recently commenced production of a new car, known as the "Metro", in which robots are used extensively on the 110-metre long automated body assembly lines at Longbridge (near Birmingham, England).

Building the Metro has involved the combination of some of the most advanced robot and multi-welding technology in the world with the long experience of the company in small car manufacture. At the first station on the automated body framing line, each body skeleton is clamped into an accurate shape and 72 key spot welds are made. After the roof has been added at an intermediate stage, two further multi-welding stations apply about another 140 spot welds.

The body is now a secure structure which passes into a station which checks it in detail. Instruments check 24 critical dimensions and display the results on a panel, while an automatic printout is provided for inspection. If any body shell fails to pass the tests or to meet the required tolerances, the production line stops so that the body does not proceed to further robot lines.

Each body shell now moves to a group of 14 welding robot systems, the equipment being flexible enough to enable two of these machines to be available to cover any breakdowns. These machines perform a further 250 welds on the body shell of the car in a welding cycle time which averages only 23 seconds. Each robot is, of course, programmed and electronically synchronised to repeat the same operation on each of the body shells on the line.

The largest multi-welding systems are two Kuka machines which build the main Metro under-frame. Each is eight metres high and covers an area of some 1,300 square metres. They are designed to produce 72 car units per hour. The complex sequence of operations performed is controlled by programmable logic controllers (PLCs). The PLCs are also used for the rapid location and diagnosis of faults in the system.

In the major multi-welding areas, the system automatically monitors the parameters of each of the welds. For example, the Kuka systems monitor more than 600 welds in each car body for positional accuracy and strength.

Robot technology is also employed in sub-assembly manufacture to achieve a high standard of weld reliability in this important safety area. The sub-assemblies include such parts as doors, bonnets, etc. Some of the "hands" of the robots used in sub-asembly work can move distances of up to eight metres and can carry loads of up to 25kg.

The Kuka machines require only 13 men as compared with the 80 required for similar operations on conventional assembly lines.

The surfacer paint on the Metro production lines is applied by equipment which is designed so that the spray guns follow the curves of the car bodies as they pass through the spraying booths. In more conventional systems the spraying guns move only in straight lines so that the paint film thickness varies, paint is wasted and many areas of each car body have to be painted in by hand. However, the microprocessor controlled system paints the whole of each car body with a film of very constant thickness so that very little paint is wasted. Some 85% of the sprayed paint is usefully used.

The paint spraying equipment is pre-programmed so that just the optimum amount of paint is used no matter whether it is being applied to a broad area such as the car bonnet or to a narrow area requiring much less paint such as the door pillars. The paint is actually applied electrostatically, the highly charged paint particles being attracted to the earthed car body. From the moment a car body trips a series of switches as it is moved into the spraying booth, the whole sequence of events is pre-programmed, including the movements of the sray guns, the supply of paint, the air in the the atomisers and the rates of flow of both air and paint. However, the interior is still sprayed by hand – although eventually it is intended to automate this operation too.

Ford is reported to be much less enthusiastic about the use of robots in Britain. Although it is using many robot welders for the assembly of its Escort vehicles, it states that its robots are still being evaluated. The 37 robot welders have cost Ford some £25 million (A$50.4

million) out of a total of just over £200 million ($A403 million) spent on the new Escort production line, etc. The robot welders automatically check their own performance. The line produces about one Ford Escort per minute and it is claimed that the productivity matches German and Japanese manufacturers.

Ford state their production lines are still labour-intensive rather than robot-intensive (some 14000 people are employed, as compared with about 40 robots), the robots being used for welding only. Ford is reported as having told its employees that it had no choice but to start automation if it is to be competitive, but the employees were assured that this new technology would not lead to any redundancies, since displaced people could be absorbed by "natural wastage".

Unimate Series 2000 robot assists in moulding glass for radar equipment.

Diecasting

Metal Castings of Worcester, England employ seven Unimate robots for the automation of diecasting. One robot serves a 600 ton diecasting machine, extracting the finished castings and initiating operations such as the automatic lubrication of the die cavity and recycling procedures. The machine concerned produces oil pump housings for manufacturing industry, but it will be programmed for other components when required.

Metal Castings have stated that stoppages and downtime have been reduced by the introduction of the robots. In addition, they enable a consistent casting to be produced in each cycle.

Another role for the robot is in the glass moulding industry where it is competing with one of the most ancient of all industrial skills. Robot systems at the glass works of Chance Brothers (near Birmingham) help to produce radar cones and screens in a wide variety of shapes and sizes for sophisticated defence equipment.

In the past an operator lifted the molten glass on the end of a 2.5 metre long gathering arm from a high temperature furnace; he rotated and manipulated the glass until he knew by experience of his hand and eye that it was the right shape and texture for delivery to the mould. As all of the experienced workmen were reaching their late fifties, the task of lifting the heavy glass at up to 1200°C was becoming too much for them. It takes eight years to train for this work and few people were interested in it.

However, a robot was installed and, after much experimentation, it was taught to follow closely the skilled ritual of the manual method. It took nearly two years before the robot became operationally successful, but now it works continuously over two shifts producing lead glass cones and screens. The quality of the robot-produced product is better than that of the man-made one. The men were glad to be able to abandon the work, owing to the extreme heat which allowed them to work only about two hours in every four hours.

The robot initiates the cycle by thrusting a refractory ball into the molten glass, accelerating and slowing the speed of rotation so that the correct weight of glass is obtained. After revolving the glass to form the desired shape it drops the molten glass into the press mould as quickly as possible. The cooler the glass, the more difficult it is to press it into its final shape. The robot must drop the glass so that no air bubbles are formed in it.

This type of robot is understood to be the only example in the world where the extension to its "wrist" is raised to such high temperatures.

Underwater Vehicles

At a meeting of the Institute of Mechanical Engineers and the British Robots Association, Dr G. Russell of the Heriot Watt University described his Argus submersible vehicle which can swim at a depth of 300 metres. It carries equipment such as television cameras, temperature sensors and other transducers and has a considerable potential for working alongside the driver inspecting wrecks or carrying out underwater experiments.

Overall control of the Argus is achieved using a DEC LSI 11/02 computer which supports the input-output peripherals. Data from the transducers is collected by a Motorola M6800. The latter acts as an intelligent multiplexer for the transmission via an umbilical cord of tasks which are carried out by the computer.

Physical propulsion of the Argus is achieved by three induction motors, controlled by two of the 11/02 analog outputs. However, many computing problems have to be overcome in order to take into account the effects of currents, buoyancy and streamlining characteristics.

Initially the Argus project was started in 1971 as an educational exercise for students, but it is now believed that it will be commercially viable. For example, oil companies are making enquiries into the possibility of using such vehicles for the inspection of rigs, etc, but for this application the use of an umbilical cord must be avoided.

More research

In order to ensure that industry can take full advantage of the intelligent robot, Britain's Science Research Council has launched a major new research initiative in industrial robotics in selected universities and poly-technics. Funded at a minimum of £0.5 million ($A1.007 million) per year and co-ordinated from the Rutherford and Appleton Laboratories, it aims to provide the results needed to place Britain in the forefront of the field.

Year	Total value (Millions of dollars)	Total number of robots
1980	28-32	2400
1985	65-90	7500
1990	160-220	over 20,000

Table 1. Estimated market growth for industrial robots in Western Europe.

The writer is indebted to The Science Research Council of Great Britain and to the international robot manufacturer, Unimation, for the photographs used in this article and for information they have kindly provided.

Sanyo's Colour Television Blackboard

VIDEO GRAPHICS FOR EVERYONE!

At a recent dealer and press conference at Sydney's Airport Hilton Hotel, Sanyo Australia Pty Ltd unveiled a comprehensive new range of products. But amongst all the products and one of the most ambitious-ever audio visuals to be staged in Australia, one particular item caught our eye and our imagination — Sanyo's "Colour Television Blackboard".

Free from the stand and the placecards, the TV Blackboard might be mistaken for just another 63cm top-of-the-range TV console. And that's basically what the new model 26-DAP is – as capable of receiving "Cop Shop" or "A Town Like Alice" as any other domestic TV set.

But whereas some other top-end receivers may have additional functions like provision for Teletext, the 26-DAP has in-built circuitry which, at the touch of a button, gives it a near unique capacity for on-screen graphics – not the computer-controlled kind but freehand, using an electronic "brush". Sanyo say that the picture tube is a high resolution type, appropriate for the dual role.

In graphics mode, the screen of the 26-DAP comes up fully illuminated, in the manner of a sketch pad. But along the bottom edge is a strip containing about eight basic colours and several graphics symbols, making up 18 functions in all.

The hand-held wand or "brush" is connected to the receiver by a cord, and contains both optical sensing and a contact switch in the tip. It can sense a colour or code when applied to the instruction strip and can interact with the scanning spot as it sweeps across the screen. Effective vertical definition is quoted as 365 lines.

The "BG" instruction allows the user to nominate the background colour and to wipe it across the screen.

"CC," indicating colour change, is invoked to change the colour in which the pen "writes".

Singer Kerry Woods demonstrates Sanyo's new electronic "blackboard".

Other codes allow the pen to write in thin, medium or thick lines, with provision to draw a pattern of lines automatically.

The actual colours available range from white through to clear (no illumination). Included are red, yellow, green, cyan, blue and magenta.

A white cursor line under each square indicates the function for which the pen is currently set.

When we first noticed the Colour TV Blackboard, Sanyo girl for the day, singer/dancer Kerry Woods, was using it to play noughts and crosses. Then someone else grabbed the light pen and came up with the nautical scene as illustrated on the front cover.

Then, not liking the white sails, they changed them to magenta by implementing a "change white to magenta" instruction.

For the younger members of a family who are at the paper, crayon (and mess) stage, a Sanyo 26-DAP receiver would provide endless fascination – plus maybe endless argument as to whose turn it was with the pen!

But Sanyo also sees it as having many possible applications for teaching and lecturing, graphic design situations, art studios, advertising agencies, etc. They point out that, in addition to the facilities already mentioned, it has provision for partial enlargement and reduction.

In addition, the TV blackboard can be used in conjunction with an external microcomputer to process a wide variety of graphics and images. If desired, the on-screen image can be recorded on floppy disc for future reference.

It can also be coupled to Sanyo's colour ink-jet printer, which has four separate ink-jet printing heads, carrying the four subtractive primary colours. This can produce hard colour copies of the on-screen image.

At this stage, Sanyo is manufacturing the Colour TV Blackboard only to order. It should be available on order, to Australian standards, next year. Sanyo Australia has no plans to hold a stock, above orders unless the demand warrants this further step.

[Sanyo Australia Pty Ltd is at 225 Miller St, Nth Sydney 2060. Phone (02) 436 1122.]

NEXT MONTH...***

Lyrebird PIANO

The Lyrebird is a full 73-note electronic piano with true touch sensitivity — the harder you hit the notes, the louder it plays. It has sustain and soft pedals, four piano voices and "honky-tonk", tremolo and "phasing" effects. It also has a headphone socket so you can play in privacy. A really exciting project, beginning in October. Don't miss it.

ALSO FEATURING:

* SIMPLE WIND SPEED INDICATOR

* 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.

ELECTRONICS AUSTRALIA

Our October issue will be on sale Wednesday, Oct 7th

50 & 25 YEARS AGO

Wireless Weekly

September, 1931

According to Martin Codel radio publicist, 17 experimental television stations are now on the air in USA, and the erection of six more has been authorised. "This does not mean that practical home television is at hand, but rather that many stations have been built or are building for the purpose of broadcasting images to be picked up on televisors in the hands of amateurs and professionals now estimated to number around 10,000 in the United States".

☆ ☆ ☆

A new RCA television development remains shrouded in secrecy, though it is known to do away with the commonly used scanning disc and employs a cathode ray tube that eliminates all moving parts. The RCA will introduce the new system in the ultra-short wave transmitting station which the Radio Commission last week authorised the National Broadcasting Company to build atop the new Empire State Building, the world's tallest building. The RCA will license Columbia and others who desire to use that system, once it proves practicable, has been promised the industry. Thus some existing systems are doomed.

☆ ☆ ☆

Having severed his connection with the De Forest Radio Co, of Passale, NJ, Dr Lee De Forest, renowned as the father of radio because his invention of the vacuum tube made modern radio and its kindred arts possible, is now affiliated with the American Television Laboratories Ltd. An application for authority to erect a new 10,000-watt television transmitter at Los Angeles, using the visual wavelengths between 2000 and 2100 kilocycles, has been made to the Federated Radio Commission and will be the subject of a hearing before a commission examiner next autumn. The application states that the system being developed in California is a De Forrest scanning system, using 20 frames per second, 75 lines per frame. The scanning is horizontal clockwise, using both film and direct pick-up.

☆ ☆ ☆

Police radio spreading: Forty-five police squad cars are equipped with radios in Los Angeles. The radio despatches the policemen immediately to the scene of a reported crime. More and more cities are installing police radio systems, latest records showing about 40 such systems in operation.

A telephone conversation recorder, a device by which both sides of conversations on the wire or radio is recorded on a magnetic steel wire in such manner that the voices can be reproduced at any later time, will soon be made available to the public by the International Telephone and Telegraph Corp, through subsidiary companies. Rights to the device were obtained when ITT recently affiliated with the Echophon-Maschinen A.G., of Germany, which developed it. One of the features of the wire is that the message can be obliterated so that the wire can be used again.

☆ ☆ ☆

Dr Bradfield on the air: The first of an extensive series of talks on the Sydney Harbour Bridge by Dr J.J.C. Bradfield will be given from 2BL on Wednesday next. The talks will cover every aspect of the history and construction of the bridge.

☆ ☆ ☆

M. Gaston Doumergue, retiring President of France, has one favourite hobby – radio. He is a DX-fan on the long, short, and intermediate wavelengths alike. He is always seen at all technical radio exhibitions in France, and he speaks the language of the radio men there, showing a remarkable grasp of technical radio.

RADIO TELEVISION AND HOBBIES

September, 1956

Making a TV tube for colour: At the present time, the USA is the only country in the world in which regular colour TV programs may be seen. This is so largely because of RCA's tri-colour picture tube, now in mass production. During my recent visit to America I was a guest of the company at its Lancaster plant, where 20,000 colour tubes are being produced each week.

That it has been possible to advance the manufacture of this tube to such a point represents an engineering triumph of the first magnitude. Only a year or two ago it was considered a near impossibility.

For some years prior to 1950, RCA and CBS had been indulging in keen rivalry to produce a colour system good enough for commercial use. Each was intent on impressing the FCC, the American authority controlling communications, that its method should be adopted as a standard.

It was in 1950 that public hearings were held to decide the matter. As a result, the CBS system was thought to provide the most satisfactory pictures, and was adopted pro tem.

But it was a mechanical system, using a rotating colour wheel not essentially different from the early mechanical methods for black and white TV. RCA was convinced that its electronic system must prevail. Moreover, RCA's tube when perfected would allow a compatible TV system, that is, a colour program could also be received on an existing black-and-white set, and vice versa. The CBS system was not compatible, which fact placed it at a serious disadvantage.

Out of a rumpus in which many powerful organisations figured, and which raged with great bitterness with a rich prize at stake, the National Television System Committee, a body set up by the industry to work out a system of colour standards, finally produced an answer which was accepted by the FCC, an answer in which the CBS also concurred. Thus ended for ever the short reign of the mechanical system, for the new standards pre-supposed an electronic picture tube.

☆ ☆ ☆

New observatory: The British and Australian Governments have built a modern meteorological observatory in a remote part of Western Australia.

The observatory is near the little-known Rawlinson Ranges, 140 miles due west of Ayers Rock, in Central Australia,

According to the Minister for the Interior (Mr Fairhall) the primary purpose of the observatory is to provide weather data to help atomic tests at Maralinga and weapon tests at Woomera.

The British and Australian Governments will hold atomic tests at Maralinga, in the South Australian desert, later this year.

Mr Fairhall said the observatory would benefit Australian weather forecasting generally.

Britain would contribute £75,000 toward the cost of the observatory and would supply special radar equipment.

☆ ☆ ☆

The first big radio-mirror telescope in West Germany is now being built on top of the 1450ft Stockert Mountain near Munstereifel. It will belong to the University of Bonn. The telescope will have a parabolic mirror made of light metals weighing 20 tons and a diameter of 83ft. The mirror, fitted to a 50ft high concrete tower, will be able to move in a full circle to follow every movement of the stars. This Bonn telescope is especially designed to examine the expanded dark clouds of hydrogen which fill the sphere between the stars. These observations will bring to light new aspects of the spiral-like arrangements of the star system in the Milky Way, in which our sun has a place.

FORUM

Conducted by Neville Williams

IDEAS EXCHANGE: dynamics, amplifiers, copyright

Every now and again, I need to take time out from major topics to bring together various loose ends from earlier issues. This is one such month. Let's begin with a further reference to the subject of hifi dynamic range, as discussed in July "Forum" and mentioned in Julian Russell's record reviews in the same issue.

I had expected a chorus of protest at our collective suggestion that ideas and ambitions to do with dynamic range were often exaggerated; that the "nice round figure" of 100dB could realistically be reduced by at least 10dB (a ten times reduction in power ratio) without placing any undesirable restriction on either concert hall or domestic hifi listening.

Sparesness of protest to date could mean that few people actually read the article, or their letters had been delayed by the mail strike, or they had come to agree with what we said!

If the latter, they may well have been influenced by some of the latest audiophile recordings. Once soft passages have sunk into the noise ambient of the home (as they can) or loud passages have evoked protest from the family or neighbours, the urge to seek even greater dynamic range melts magically away.

Indeed, it becomes plainly evident as a potential source of embarrassment.

If the jacket notes are to be believed, many of the current audiophile recordings are made without compression of any kind, yet they fall within a dynamic window of 90dB at most. Hence our adoption of this figure as a more realistic guide to what is desirable and practical.

"Enough is enough," we said.

As we pointed out in the July issue, there can be no argument against having the greatest possible capacity for dynamic range, so as to stay well clear of background noise or peak overload . . . "but the ability to eliminate noise and accommodate the sudden transient is a quite different thing from stretching the pianissimos and the fortissimos all the way from the inaudible to the unbearable!"

It was following publication of this remark that someone drew to my attention an article on audiophile recordings in the December 1980 issue of "Stereo Review" magazine. It contains the comments of ten prominent men in the US hifi industry. Here are a few snippets:

ROBERT BERKOVITZ, Director of Research, Teledyne Acoustic Research, Norwood, Mass: Most of us live in sound fields that almost never drop below 30 to 35dB (A-weighted) during waking hours. Unless one plays music louder than reason and medical prudence suggest, this leaves a useful dynamic range of 80dB, from which a few more dB may even be chipped away by other factors.

JEROME E. RUZICKA, Vice President dbx Inc, Newton, Mass: The rise in dynamic range from 60 to 90dB in home music systems is an extraordinary accomplishment, the benefits of which can be immediately appreciated and enjoyed by everyone. The "weakest link" is now somewhere else, for it is no longer the software.

TOMLINSON HOLMAN, DANNY KUMIN, respectively Director and Sales Manager of Apt Corp, Cambridge, Mass: The fact is that the range between the acoustic noise "floor" of a typical room and the 105dB peak sound pressure level of a Wagnerian ensemble is at best a depressing 65 or 70dB. Even Symphony Hall in Boston can't do much better – 75 or 80dB with a full house . . . It still seems pretty clear that audiophiles who wish to exploit a digital playback system fully will have to undertake some serious sound insulation projects at home, both to keep environmental noises out and high-level music in!

ROBERT SCHULEIN, Chief Developmental Engineer, Acoustics, Shure Bothers Inc, Evanstown, Ill: Many listening environments cannot support realistic dynamic-range material, for the low level portions can simply be lost in the ambient noise of the listening room. In addition, one is not always in a mood for an "audiophile" listening experience. User-adjustable compressors may become necessary or at least desirable.

In settling for about 80dB maximum as the dynamic "window" applicable to present-day listening conditions, Robert Berkovitch points out that many beautiful recordings of the past decade may still find a place – without apology – in the forthcoming digital libraries.

He offers this as a comforting thought to those who fear that treasured performances could be ignored and forgotten in the preoccupation with new technology.

He's probably right. By getting back to the original multi-track masters and converting directly to digital, the sound could be remixed and transferred to a PCM consumer recording virtually without further distortion, noise, wow,

Sansui "super feedforward" amplifier

Sansui's AU-D9 is a top quality amplifier offering 95+95W with not more than 0.005% distortion. Yet its "feedforward" system has its roots in a patent dated 1925!

flutter or loss of frequency response. And, for the optical format at least, the recording would be wear-free.

Dare I also suggest that, in the process, a small degree of linear expansion could possibly counter any possible inhibitions that may have affected the original performance?

Looking at the other side of the coin, several of those quoted in "Stereo Review" referred to the demands which wider dynamic range makes on the domestic amplifier system itself. We mentioned this briefly in the July issue: "I am assuming that the amplifiers and loudspeakers are equal to the task – and that's quite an assumption in itself."

ROBERT CARVER, President of Carver Corp (Woodinville, Wash), says that present day 120-200W amplifiers can deliver a lot of measurable power and make a lot of noise but they can too easily be driven into clipping by high-level transients, when called upon to drive typical low-efficiency loudspeakers, like those in current use.

He suggests that the optimum amplifier for today's audiophile should have a continuous power rating of 200W per channel, but a peak power capability or up to 1000W per channel to cope with transients: this, hopefully, without getting involved in massive components and massive costs.

Carver's ideas fly in the face of the currently accepted rating system and express the philosophy which is apparent in his own commercial designs. But they make sense, nevertheless, if the ambition is to handle without clipping, those glass-hard transients that can be captured in a true, wide-open record/replay system.

DAVID HAFLER, President of David Hafler Co, Pennsauken, NJ, would presumably like to see more acoustically efficient loudspeaker systems and, on that basis, talks in terms of at least 125W per channel, also with the capability for high peak power.

But, whether we are talking about 125W-plus per channel or 200W-plus per channel, the significance of extra decibels at the top end of the dynamic range scale will be all too apparent. They certainly can't be added lightly. Add 3dB and you've doubled the power requirement: add 6dB and you've quadrupled it; add 10db and you've multiplied it by a massive 10 times!

As other commentators pointed out, this also has vital implications for loudspeaker design, if voice coils and cone assemblies are not be wrecked in the long term by high sustained power, or ripped apart by sudden massive transients.

And here the industry faces a real design and marketing problem. Consumer pressure has been for loudspeaker systems of modest overall dimensions but extended bass response – and these qualities have been achieved at the expense of sensitivity. Reduced sensitivity has been offset by the release of higher power amplifiers, but there is a practical limit to the power ratings of domestic style amplifiers, and to the power levels which compact loudspeaker systems can absorb.

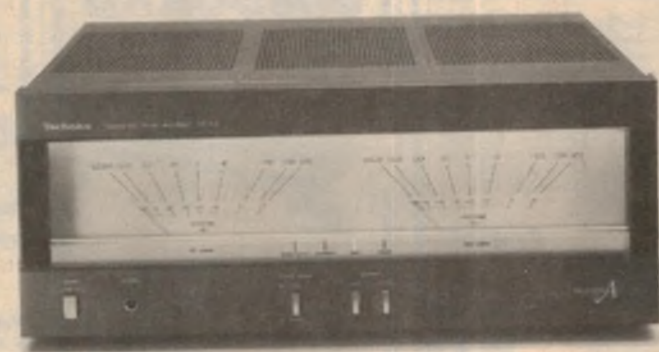
The formula can be re-balanced by designing loudspeakers for a higher acoustic efficiency, but this can mean greater overall dimensions, if bass response is to be preserved. It is therefore strange but true that, when designing to certain size and price parameters, the demands of extended dynamics and extended bass may be in conflict.

Two other points are worthy of mention. One was made by Robert Schulein, as quoted earlier. On the basis that one is not always in a mood for an "audiophile" listening experience, a demand could arise for user-adjustable compressor units to limit the dynamic range of the new generation of recordings.

On the surface, this sounds like heresy of the worst kind, but it makes sense, and it is technically quite feasible. One could object that, if a person wants to listen to mood music, that's what they should buy,

But why? If their preference is for concert classics, they should hardly be denied them because of a constricted environment. And I can assure you that, under such conditions, even 2:1 dbx encoded compression is perfectly listenable.

Another new/old circuit application:



This new Technics SE-A5 power amplifier is rated at 160+160W with not more than 0.003% distortion. The makers credit the use of "linear feedback", which dates back at least into the '40s.

DIRECT IMPORT

NEW ZEALANDERS

TAKE ADVANTAGE OF DICK'S LOW PRICES

DIRECT IMPORT

INCREDIBLE

SYSTEM 80

We're proud to offer this exceptional computer to our New Zealand customers. These are just some of the features: 16K memory, S-100 expandable, compatible with almost all level II programs, works with any standard TV set, has built-in cassette deck level control. Quite simply it represents outstanding value for money.

NEW LOWER PRICE! $NZ ONLY $1050

X-4005 P&P $5.50

WE HAVE BUSINESS, & EDUCATIONAL & GAMES SOFTWARE IN CASSETTE OR DISK FORM - SYSTEM 80 /TRS 80.

Here is a small part of our range

GENERAL LEDGER: There are many general ledger systems around, but few designed with the small businessman in mind. We believe it to be far superior to any other on the market today. X-3752 $499

WORP-9: An incredibly versatile word processor that provides a host of features including unlimited text insertion - ability to print mailing labels & merge name & address file with a standard form letter. X-3761 $499.

TYPING TUTOR: An interactive program that teaches you to touch type. Claimed to teach typing skills faster than any other method. X-3682 $33.50

SPEED READING: 4 programs, 2 cassettes, designed to help readers of all ages improve reading skills. Reading speed can be set as high as 9.1 seconds per line. X-3692 $33.50.

SIMUTEK PACKAGE ONE: Five fantastic space fantasy games in one. Outstanding value! X-3685 $29.95

DIRECT IMPORT

3.5 DIGIT LCD DIGITAL MULTIMETER

This 20 range multimeter offers exceptional performance, together with a highly legible liquid crystal display for very low power consumption. And unlike other digital multimeters on the market, this model has overload protection. It's very easy to use, and will give years of service. A must for the hobbyists, technician or engineer.

ONLY $NZ $95

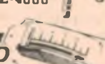
Q-1450 P&P $4.00

FANTASTIC FLASHING LED

ONLY $1.95

Amazing! This 5mm RED LED can be used in dozens of applications where a flashing warning is needed. Z-4000 P&P $1.00

GRADUATED EDGE METER



32(W) X 10(h)mm. Is ideal for fine level adjustments. $NZ $4.95

Q-2110 P&P $1.00

DIRECT IMPORT

Hobbyists & experimenters- highly versatile

BIMBOARD

The modern way to build up circuits without resorting to PCB or tag strip. Over 500 sockets that will accept component leads of 0.25 to 0.85mm, spaced 2.54mm. Designed to carry up to 1 amp. The board is even supplied with a component mounting panel for pots etc. They can be connected together to make up larger units.

ONLY $NZ $29.95

P-4612 P&P $3.00

TURN YOUR OWN TV INTO A CRO!

This remarkable kit turns any surplus B&W (or color) TV into a 30kHz audio oscilloscope. It is ideal for Hi-Fi and audio display applications.

ONLY $NZ $37.95

K-3060 P&P $3.00

DIRECT IMPORT

BUILD YOURSELF CAPACITOR DISCHARGE IGNITION

One of our most popular kits we've ever sold! This unit fits on any conventional ignition system. Results other customers have obtained: engine stays in tune much longer, plugs & points last longer, car is much easier to start.

ONLY $NZ $47.50

K-3280 P&P $3.00

COMPARE OUR PRICES FOR QUALITY COMPONENTS

¼W metal film resistors 1% tol any value - all one price.	6c ea.
¼W carbon film resistors any value - all one price.	4c ea.
½W carbon film resistors any value - all one price	5c ea.
1W carbon film resistors any value - all one price	8c ea.

SAVE ON DICK'S BULK PACKS!

RESISTOR PACK: 300 computer selected ¼W types worth $20.00 (R-7010)	$7.50
ELECTROLYTIC PACK: 55 electros, at least $16.00 value. (R-7030)	$8.50
CAPACITOR PACK: 60 Greencaps, at least $13.00 value (R-7040)	$8.50

DICK SMITH ELECTRONICS

96-98 Carlton Gore Rd. Newmarket
Auckland 1. Ph. (Auckland) 50 4408 50 4409

MAIL ORDER CENTRE: Address as above.
STORE HOURS: Monday to Friday 8.30am to 5pm.

Call into our store and collect your copy of our catalogue!

FORUM — continued

On the other side of the coin, I was told by a certain distributor that they were ready to release a new automotive stereo system with provision for dbx expansion in-built — this with a great deal of enthusiasm! In-built dbx! Why in the name of common sense would you need dynamic range expansion in a motor vehicle, of all places? Having in mind the noise floor in a motor vehicle under average conditions, and the practical and advisable limitations on maximum sound level, the real dynamic window would be a lot less than in a lounge room.

Compression would be more appropriate!

NEW/OLD IDEAS

Still on the subject of audio-hifi, writer Barry Fox in the British journal "Hi-Fi News and Record Review" has been having a go at some of the "innovations" in Japanese amplifier design which are variously over-emphasised or are reincarnations of old ideas. In the latter case, some are acknowledged as such, others are not.

One company that has acknowledged an innovation with a "past" is Sansui, with their much-publicised feed-forward system.

The idea is to sample the difference (distortion content) between the input and output of the power stage, phase invert the difference and feed it to the load (loudspeaker) in such a way that it exactly cancels the original difference. Whereas traditional negative feedback can only reduce the distortion content, the feed-forward system (conceptually, at least) can cancel it completely.

Curiously, the feed-forward concept pre-dated negative feedback, having been researched by Harold Black while with Western Electric — the manufacturing wing of Bell Labs in the USA — and patented in February 1925. Black subsequently researched negative feedback, leading to a series of patents from August 1928 onwards.

While negative feedback has been widely used ever since, the feed-forward system proved much more difficult to apply effectively. An important contribution to feed-forward technology was published, free of copyright, in "Wireless World" in October 1974, and QUAD applied the technique commercially and successfully in their "current dumping" model 405 in 1975. So Sansui's current series comes as a climax to 50 years of effort to really make the idea work!

Barry Fox discusses a number of other new/old aspects of amplifier design such as no negative feedback, multi-loop negative feedback, non-magnetic construction, ultra-wide frequency response and the "straight wire with gain" concept.

But what really hit me was his reference to a new series of Technics amplifiers which have just been introduced to the Australian market. Designed to follow upon their popular "New Class-A" series, these new ones feature a "linear feedback" system.

I must confess that, when I saw these amplifiers at a press conference a few weeks ago, and heard the reference to linear feedback, I didn't get all that excited. An explanatory slide indicated a feedback loop within a feedback loop, with one of the stages shown as having infinite gain.

But Barry Fox had ascertained that the inner loop involved positive feedback and the outer loop negative. The basic idea is that positive feedback can be used to achieve enormous gain from a voltage amplifier stage, with little penalty in the way of distortion, provided the stage has minimal distortion before feedback is applied. But when this "infinite" gain is available inside a negative feedback loop around the output stage, it makes the negative feedback vastly more effective.

I gather that Technics see vastly more effective negative feedback as a more manageable technique than the feed-forward system, in the quest for near-zero distortion.

But what caught my eye was Barry Fox's statement that the concept of using positive feedback inside a negative feedback loop dates back at least to the "Radiotron Designers Handbook" published by the Amalgamated Wireless Valve Company. He quotes 1934 but this is a mis-reading of the title page. The reference and diagram appears on pages 314-315 of the fourth edition, first published in 1952.

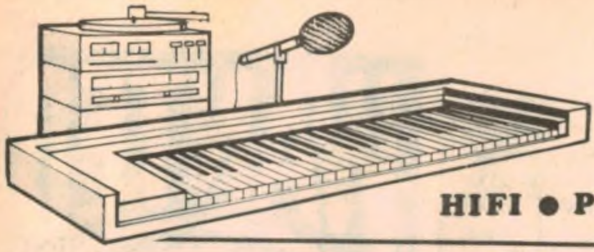
How do I know?

Because I was involved in the preparation of the book, in its early stages and almost certainly drew that particular diagram, sometime before I joined this magazine in late 1941. It took 40 years to encounter the circuit again, by courtesy of Technics' "linear feedback"!

AND ON COPYRIGHT:

During the month, there was an hour-long panel discussion on the ABC's Sydney "Morning Extra" session on the subject of audio-visual copying and copyright. The discussion, involving advocates for the different interests, reflected all the uncertainties and contrary interpretations discussed in our June "Forum". In fact, it was quoted on this point.

But we also learned that one media personality's home had been raided by five Commonwealth police (not just one as per our cover). His private collection of tapes was seized but, as the session went to air, there was no hint of prosecution. Funny about that!



PEPPER STUDIOS: Modern facilities, period setting

Two charming old buildings in Adelaide house what is claimed to be the "most aesthetically pleasing" recording facility in Australia. Opened earlier in the year by former South Australian Premier and patron of the Arts, Don Dunstan QC, the studios have since been working at top pressure.

Pepper Studios are at 64 North Terrace, Adelaide, South Australia.

The new studios represent the culmination of a dream for well known film and sound man, Max Pepper; one that involved two and a half years in planning and construction and the outlay of around three-quarters of a million dollars.

The buildings which house the studios served earlier as a theological college – an office building which dates from the Victorian era and a chapel which was built around 1930. Both buildings have been extensively renovated (with Gothic arches and stained glass windows restored), landscaped and air conditioned to provide an atmosphere which is both pleasant and "creative".

Behind the enterprise is Max Pepper's conviction that a contributing factor to many good bands leaving South Australia for the Eastern States was the lack of recording facilities. The facilities now exist, on the spot, in the relaxing atmosphere of the South Australian capital.

The studios have stained glass windows overlooking a courtyard and swimming pool, exclusively for use by clients. They are fully air-conditioned and lighting has been designed to create an aesthetically pleasing atmosphere. Last but not least, the ambience noise level in both studios and control room is NR12, making it one of the quietest facilities in Australia.

Technically, the studios are designed around the Near Field Monitoring System, following the latest overseas trends.

Studio A, the main music studio, features the latest equipment available. John McDiarmid, Studio Manager, lists the major items:

"The console is a Harrison 4032 – computerised and featuring 40 inputs and 32 outputs. The multi-track is a 3M M79 24-track. Other gear includes an Audio Kinetics XT24 interlocator with six memory functions for controlling the 24-track, a Studer two-track mastering machine, Revox and Otari two-pack machines, four Kepex II units, Lexicon prime time DDL, EMT noise filter and gates, two Pultec equalisers, Urei 813 monitors and BGW 750 Power amps.

"The studio also has an ARG BX20 stereo reverb system and an EMT stereo plate. Microphones include Neumann, Sennheiser, AKG, PZM, and Beyer."

There are actually two studios within the Studio A facility – a Rhythm room and a String room. A unique feature of the String room is the acoustics – tunable from .4 seconds to 2.7 seconds. The Rhythm room has a reverb time of .3 of a second.

Studio B is both a voice over and music studio. It is equipped with a Midas 16-track console (16 input, 16 output), feeding to a 3M M79 16-track Revox and Otari two-tracks, Neumann mikes, ADR limiter compressor-expanders and Pultec equalisers.

Studio B is also a "two studio" facility, featuring a "Dead" room and a "Live"

The Harrison 4032 console, serving the main music studio, can cope with 40 inputs and 32 outputs but provision is available to interlock both studios for complex tasks.

RARE ADDITIONS FROM MARANTZ. SLIMLINE AMPLIFIERS.

Rare: very valuable.

Additions: the things added.

Marantz: a range of ultra-high performance Slimline and three-quarter size Amplifiers which blend state-of-the-art engineering with operational versatility.

Although all units in a hi-fi system must be compatible in order to achieve optimum sound quality, there is no question that their final standard of performance relates directly to the main amplifier. It is the heart of the system and the point at which distortion is most likely to be introduced.

Marantz engineers have developed special techniques for reducing the various forms of distortion to miniscule levels. This is achieved by the use of a highly efficient negative feedback system and operation in class AB, with the careful selection of "shortest path" wiring to avoid interaction between different stages in circuitry and with the other channel.

The more powerful models are equipped with a heat-loop cooling system for the output stage transistors. This NASA invention enables the heat dissipated at high power levels to be rapidly removed so that a considerably improved power-to-size ratio is obtained.

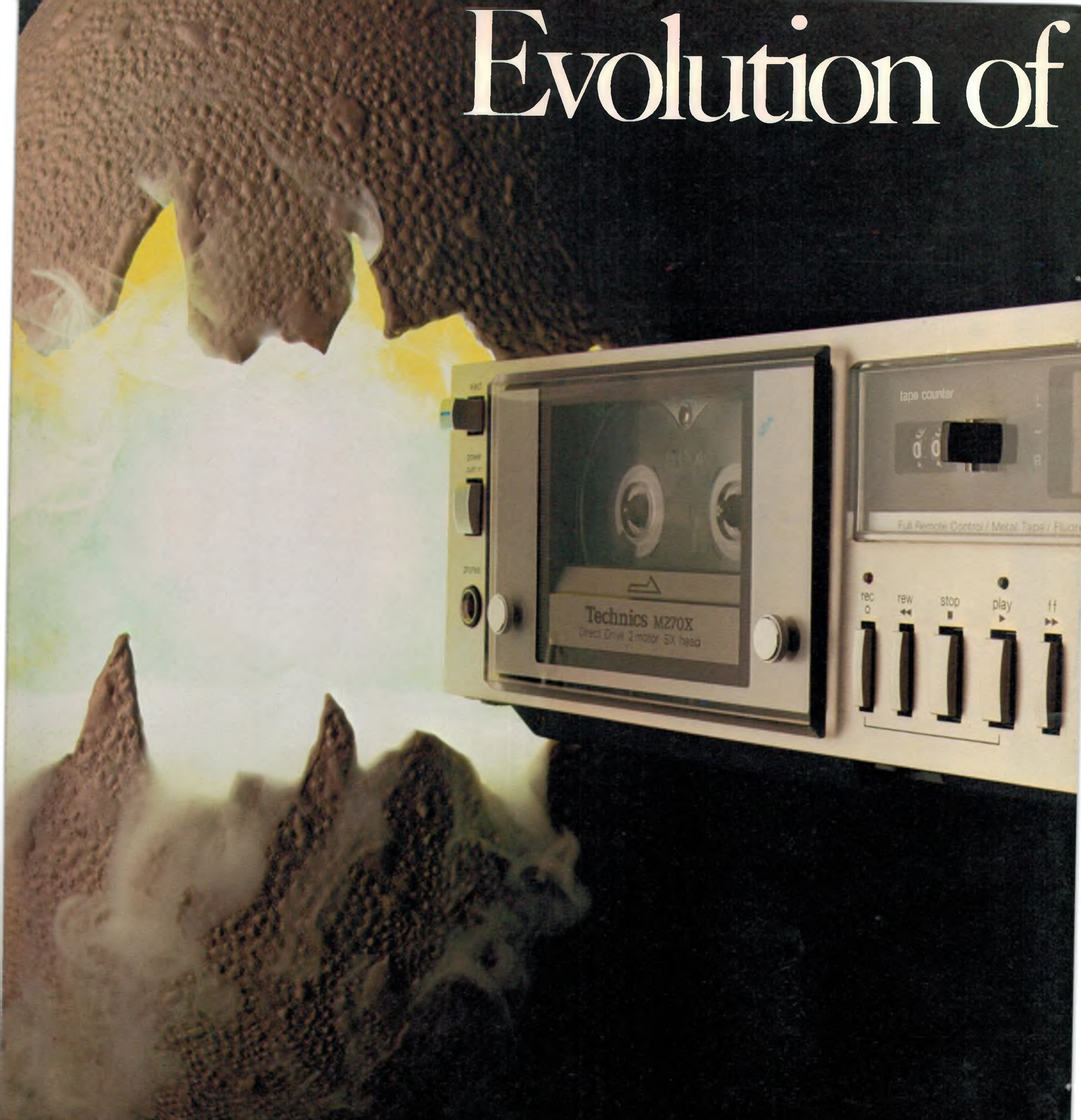
If you see your hi-fi as an investment and, if you demand critical performance standards as well as the best value for money, listen to the future.

Listen to Marantz.

marantz.
Now you're listening.

Distributed by MARANTZ (AUST) PTY. LTD.
19 Chard Road, Brookvale, N.S.W. 2100
Telephone (02) 939 1900. Telex AA24121
Melbourne (03) 544 2011. Brisbane (07) 44 6478
Adelaide (08) 223 2699. Perth (09) 279 9706

Evolution of



Cassette decks have come a long way to reach their current high standards of performance.

Now, Technics take them to an even more advanced stage of their evolution with a range of cassette decks featuring built-in 'dbx' dynamic range expansion.

At last you can enjoy cassette performance with a full dynamic musical range rivalling that of most reel-to-reel machines.

The 'dbx' system also functions as a very effective noise reduction system that cuts tape hiss by as much as 30db. To your ears that means tape hiss is virtually eliminated.

the species.

The benefits are not limited to cassette tapes either.

With a 'dbx'-equipped cassette deck like the superb RS-M270X you can also use your present system to play 'dbx'-encoded records as well.

All this plus many other advanced features: metal tape facility, feather-touch controls, 2-colour FL meters and much more.

Ask for a demonstration of Technics' new breed of 'dbx' cassette decks at a better hi-fi stockist soon. And join the evolution yourself.

Technics
National Panasonic (Australia) Pty Ltd

Expanding the music experience.

AGFA-GEVAERT

Sound safe.

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

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

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

In addition, Agfa SUPERFERRO cassettes feature a special mechanism for improved running properties.
Agfa SUPERFERRO– the sound safe you can bank on for outstanding performance.

Agfa*

*Registered trademark of AGFA-GEVAERT Antwerp/Leverkusen.

AGFA-GEVAERT FOR STILL CAMERAS, FLASHGUNS, COLOUR FILM FOR SLIDES, PRINTS AND MOVIES, MAGNETIC TAPES. E314 room. The "Dead" studio has a reverb time of 0.3 of a second and the "Live" studio a reverb time of 2.9 seconds.

Studios A and B are interlocked to video using SMPTE time code. Additionally, both studios can be locked together to create a 40 channel facility — ideal for film music or complex album work. The necessity for this ability was realised by Pepper's involvement with the film "Breaker Morant".

While on the subject of recording . . .

Yes, while on the subject of recording, Technics have just announced the release of their AV-P100 digital stereo audio cassette recorder, based on the use of VHS format video cassettes and offering the kind of performance specifications expected of digital systems.

PCM audio recording on video tapes is not new, of course. Back in 1979, we reported at some length on a demonstration by Sony engineers of audio recorded on video recorders, including their then current Betamax model. The sound, as heard, was very impressive and also — as I recall it — extremely loud! But, while the system worked well enough, the combination of video decks and adaptors appeared not to be very marketable at the time.

The Technics SV-P100, carries the process a further logical step. Instead of relying on a standard video recorder and external signal processing, SV-P100 combines the PCM signal processing and a video style tape mechanism in a single housing so that it becomes, in effect, a self-contained digital two-track audio recorder.

As such, it can be bought and used at an amateur or professional level by an enthusiast, just like any other tape deck — except that it can offer an order of performance way ahead of any analog machine to date. Tape economy is also very good, with a playing time of two hours being available from a standard T120E cassette.

The Technics SV-P100 digital stereo recorder. Mic and phone jacks, remote socket and power are on the front lip, tape controls and fader on the sloping section. Other controls and LED indicators are to the upper right.

Information on the exact signal processing procedure is sketchy but the literature available stresses that the signal seen by the "video" section conforms precisely to NTSC standards. It would appear, in fact, that their signal can be externally patched into any standard NTSC video cassette recorder (VHS format), if so desired, and replayed back through the video/audio convertor SV-P100.

Within the SV-P100, the signal fed to the tape has standard line and frame sync pulses, internally generated, plus a normal tape control track and (it would appear) a direct split from the analog audio ports for the regular analog TV

"Good Life" information cassettes

As a welcome change from the catalogues of overseas fare being offered on pre-recorded cassettes, the Good Life Video Cassette Library has announced the first six "video books" on subjects of special interest to Australian viewers. More precisely, they are 30-minute (approx) cassettes dealing with subjects that might otherwise be covered in book or magazine form.

The cassettes (VHS or Beta, as required) are packaged in what would pass for a book on a library shelf. The first batch of titles include the following:

- Peter Doyle, of restaurant fame, explains the preparation of Australian seafood.
- Allan Seale, well known Sydney horticulturist, shares his knowledge of indoor gardening.
- Graham Yen demonstrates Cantonese delicacies for aspiring Chinese chefs.
- Chuck Maverty, a leading gym instructor, combines a 30-minute exercise routine with disco music.
- Advice for the home handyman from Bob Short.
- Secrets of cooking Australian beef explained by Zachary Stollsnow.
- Dr James Wright and what to do in emergencies around the home.

Coincident with the release, we had the opportunity to sample a couple of the cassettes on VHS. As expected, the Dr Wright on cassette is the same doctor-cum-comedian that we've come to know on television but the what-to-do information gets through, just the same.

Zachary Stollsnow is much more the straight man, intent on imparting information. If your mouth is not watering by the time he's finished, you're a vegetarian!

Technically, the cassettes posed no problem, with normal resolution, colour and sound. Presumably, the others would be the same, as also the Beta versions.

Good Life cassettes are being distributed by Cassette Programming International, 275 Alfred Street, North Sydney 2060. Phone (02) 92 4762 or 438 4886. The cassettes are priced at $34.99 and will be sold through major retail stores. Additional titles will be added each few weeks.

The guarantee on our tape is useless.

Because you'll probably never have to use it.

If, however, anything ever goes wrong with any Maxell cassette you buy, through normal use, we'll replace it. Free.

Of course, we would not make an unconditional offer like that if we thought you'd ever have to take us up on it.

You see, before we sell you a Maxell cassette, we make it so it won't fall apart, warp, jam or stick.

Then there is the tape itself. Maxell is recognised by most critics as the finest recording tape money can buy.

If it wasn't, our guarantee would be very useful indeed.

maxell®

MX0033/FMMH For further information on Maxell Tapes write to Maxell Advisory Service, Private Bag P.O. Kingsgrove 2208 or Phone: (02) 750 3777.

AUDIO-VIDEO ELECTRONICS — cont

sound track.

Instead of the video signal, however, each line contains the basic and parity information for six audio samples: three each, interleaved, for the left and right channels. On the basis of about 490 active lines and 30 frames per second, this accounts for the stated sampling rate per channel of 44,056kHz and a theoretical upper limit to the retrievable audio frequency of 22kHz.

It is apparent that the signal processing system must contain memory and delay provisions such that samples, clocked in at this precise frequency, can be fitted into the video information sequence. On replay, they have to be marshalled and clocked out again at the same sampling frequency.

According to Technics, two new LSI chips are at the heart of the circuitry. The MN 6601, containing the equivalent of about 10,000 transistors, accepts the converted (analog to digital) data, adds the error detection and correction code, and converts it to video data.

The MN 6602, equivalent to 15,000 transistors, reconstructs the PCM digital signal from the "video" information, performs the error correction routines, and presents the signal for normal D/A conversion.

The two chips together, according to Technics, are equivalent to about 500 regular logic ICs!

Quantization is quoted as 14-bit linear. Frequency response is 2Hz to 20kHz (+0, −2.5dB) and harmonic distortion less than 0.01%. Wow and flutter is not mentioned but, consistent with other PCM recorders, this could be expected to be "unmeasurable".

Inputs provided include analog line (80mV, 50kΩ), analog mic (1.5mV/600Ω), and digital input, video format (1Vp-p/75Ω).

Outputs include analog line (400mV) and digital, video format (1Vp-p/75Ω).

By way of operator convenience, the SV-P100 has full logic control and provision for remote control of the cassette mechanism, with an eight-times fast forward facility for cueing.

It also has "Jump" and "Search" provisions. By pressing a lever during replay, the user can impose on the control track a "Jump" signal which will mute the audio and cause the cassette to spool at eight-times normal speed for the duration of the jump signal. However, the jump signal can be erased at any time, if so desired.

The "Search" button imposes an erasable magnetic cue on the tape and, on command, the deck will cycle forwards or backwards, as indicated, to locate the next cue. If so programmed, it will immediately begin playing at that point.

A further facility, operating in conjunc-

THE MICROCASSETTE: Making its run?

The Technics RS-M212 can copy compact cassettes (left) to the micro format (right).

Three new products, unveiled recently by National Panasonic, would suggest that the microcassette is now ready to make its bid for a place in the scheme of things. Introduced originally as a kind of audio notebook, the microcassette format has benefited from the enormous progress in tape technology, so evident in the compact cassette and video cassette.

Illustrated at the top is the Technics RS-M212, which makes it possible for the user to make their own quality microcassette versions of compact cassette recordings. The source cassettes can be ferric, chromium or metal and the microcassette copies can be on normal or metal tape at either 2.4 or 1.2cm/sec. Provision is made for Dolby NR and input can also be taken from line (stereo) or microphone (mono).

With the RS-M212, the user can build up his/her own library of top quality pre-recorded microcassettes.

On the right is the new National Panasonic ultra compact personal microcassette stereo player. It can play ordinary or metal tapes at either of two speeds, weighs 185 grams and measures 59mm(W) x 130mm(H) x 16mm(D).

RN-GZ7 personal player, micro style.

Also under the National Panasonic brand, the RN-Z600 portable combines a microcassette player with AM/FM-stereo radio. It measures 270 x 89 x 54mm and weighs 1kg without batteries. An "ambience sound" feature increases the apparent audio spread.

Compact and light, the RN-Z6000 combines AM and FM-stereo radio with microcassette music.

Electronic Agencies have a huge range of separate loudspeakers, including models made by Foster, Coral, Philips and Motorola's unique piezo horn tweeters. To assist customers in making a choice, midrange and tweeter units have been mounted on baffle boards and provided with switching to facilitate direct comparison. For further information, contact Bill Edge, Electronic Agencies, 115-117 Parramatta Rd, Concord, NSW, 2137. Phone (02) 745 3077.

tion with the tape counter, provides a "locate" function.

For further information about the Technics SV-P100, contact National Panasonic Pty Ltd, 95-99 Epping Rd, North Ryde, NSW 2113. Phone (02) 887 0144.

In brief

"PARTICIPATIVE DISC" is the description of Optical Programming Associate's new "First National Kidisc". Designed for use on Magnavox and Pioneer optical players, it takes full advantage of the system's facilities for random access, stop motion, frame advance, reverse, and dual sound tracks. The disc can be played straight through in 27 minutes but that is not what is intended. It is packed with things to do on a rainy day: how to do an Irish Jig; on-screen jokes and riddles to be worked through at the child's own pace; hobby activities; an aeroplane ride which can be stopped speeded up or experienced in reverse, and so on; 25 sequences in all. Retail price is $19.95.

AUDIOSOUND ELECTRONIC SERVICES is one of the few Australian companies

TDK (Australia) Pty Ltd have recently announced two new tapes for the professional and semi-professional markets, which supersede the existing S, L and LB tapes. TDK claims that their new GX Studio Mastering series is the finest 6.35mm (¼in) open-reel tape on the market, with ultra-fine gamma ferric oxide particles, a newly developed binder and a graphite/carbon back coating to minimise friction and electrostatic charges. At this stage, the GX tape is only available in Australia in a 555m (1800ft) length. The LX series is also of very high quality but is much less expensive and is available in lengths from 367m to 1110m. TDK (Australia) Pty Ltd, 4 Dowling St, Woolloomooloo, NSW, 2011. Phone (02) 358 1877.

designing and manufacturing hifi components in this country. Recently, their Linz 8066 loudspeaker system was selected by the ABC for studio monitoring in the new studios being constructed in Brisbane for the 1982 Commonwealth Games. A small but high quality bass driver and computer-aided design has enabled gratifying and smooth response to be obtained from the necessarily compact enclosures. Close attention has also been paid to the cross-over network feeding and the mid-range and high frequency drivers. Audiosound Electronic Services are at 148 Pitt Rd, North Curl Curl NSW 2099. Phone (02) 938 2068.

DECCA TV, latterly almost as distinctly British as EMI, is another ultimate victim of the country's electronic industry malaise. Despite a takeover by Racal and severe "rationalisation", Decca continued to lose money in large lumps. Decca TV has now been taken over by Tatung of Taiwan, who have guaranteed to provide work for a minimum of 5000 employees for at least a year. They probably don't mind this, because the purchase has given Tatung a firm base in the European market, prior to setting up the corporation under their own name.

THE MARANTZ/EA HIFI CONTEST

The lucky winners:

A record number of entries was received to the Marantz/Electronics Australia competition, announced in our May issue, surpassing even the response to the earlier Cunningham/Sennheiser contest. But, whereas NSW readers scooped the pool on that occasion, the Marantz prizes both ended up in Victoria.

Neville Williams (left), Ted Fawle (right) and Carman Rossi (centre), National Marketing Manager of Marantz (Aust) Pty Ltd.

Readers were required to complete a hifi crossword and to submit their solution in the form provided. Anticipating a large number of correct entries, provision was made to select the ultimate winners by drawing two such entries at random from a large container. The actual drawing was done by Mr Ted Fawle, Managing Director of Marantz (Aust) Pty Ltd, under the supervision of the Editor-in-Chief of Electronics Australia, Neville Williams.

The lucky winners, in the order drawn, were:

- Peter Demetris, 7 Corandirk Place, Yallambie 3085.
- L. J. Bird, 20 Lesney St, Richmond 3121.

Each will have the choice of a Marantz SD 5010 Cassette deck (retail value $359) or a Marantz ST 510 AM/FM tuner (retail value $349). Marantz Australia have assumed the responsibility of contacting the two winners and arranging for them to receive the prizes of their choice.

We congratulate the winners and thank Marantz (Aust) Pty Ltd for making the contest possible.

FOOTNOTE: The drawing, as pictured, took place in the new Marantz premises at 19 Chard Rd, Brookvale, NSW. The building, in blonde brick, has two levels, with rooftop parking. On the ground floor is the main showroom, service department, spare parts and bulk store. Upstairs are the administration and marketing offices. The present scale of enterprise, the eye appeal of the equipment offered and the amount of stock in the bulk store, all emphasise the upsurge of the Marantz name in Australia during the last couple of years. And this takes no account of the stocks and facilities in the various state branches.

More than that, Managing Director Ted Fawle has a firm eye on the future, with the Marantz name prominent in video and the up-and-coming PCM audio disc technology.

LENCOLAMP: see your player in a new light!

When a hifi turntable is placed on shelving or in a utility cabinet, poor lighting is a frequent problem, with the ever-attendant danger that a record or the mechanism itself could be damaged by inadvertent mishandling.

Soundring Pty Ltd have come up with a very neat answer to the problem in the form of the Swiss made "Lencolamp". Moulded in black plastic, the unit is intended to clip to the underside of the typical perspex dust cover, the major requirement being that the wall thickness be from 2 to 4mm and the inside clearance height not less than 58mm. No fixing screws are necessary; it simply clips into place.

An external cord is intended to plug into any 240V outlet and powers a 7W lamp via a mercury gravity switch. In normal playing mode, the lamp remains off but comes on automatically when the perspex cover is lifted to gain access to the turntable. The lamp is not bright but is sufficient to save having to fumble in the dark!

One small problem is that the thickness of the clamp tends to prop one side of the cover above the surface of the deck. Ideally a shallow rebate should be filed in the lower edge of the lid to accept the clamp. Alternatively it may be possible to readjust the rear hinges or to provide a couple of small felt or rubber buffers to stabilise the front edge of the cover.

The Lencolamp needs to be fitted with a normal 240V 3-pin plug and if necessary, replacement lamps should be available from some specialist lighting stores. However Soundring plan to carry the lamp themselves, as a replacement item.

The Lencolamp, in a blister pack, as illustrated, is being sold through major retailers and hifi/music stores. The suggested retail price is $34.75 but the average over-the-counter price may well be below this. The Lencolamp is being distributed in Australia by Soundring Pty Ltd, Suite 1, 514 Miller St, Cammeray, NSW 2062. Phone (02) 92 1990.

Two Cartridges from Ortofon

Just over two years ago, Ortofon released their integral low-mass phono cartridge and headshell, naming it the "Concorde" because of its visual resemblance to that aircraft. We have just had the opportunity to evaluate their most recent addition to the Concorde range; and in addition to test their MC20 MkII moving-coil cartridge.

Ortofon has been the leading proponent and manufacturer of moving coil cartridges since the end of World War II, introducing their first such cartridge – a monophonic model – in 1948. This received acclaim from the hifi fraternity, so that the Ortofon name was well-established by the time they released their first stereo version (type SPU) in 1959 – only months after the commercial introduction of the world's first 45/45 stereo discs.

It was not until 1969 that Ortofon introduced their variant of the moving magnet (MM) principle – the M15 – which is based on a variable magnetic shunt (VMS) system. In this design the magnet is actually stationary, and the stylus cantilever moves an armature within the magnetic field. As the armature moves magnetic flux changes occur which induce small signal voltages in stationary coils, which are also located in the field of the magnet. The Concorde versions feature the latest developments of Ortofon's VMS system.

Whilst the VMS models are compatible with other MM cartridges, Ortofon have simultaneously pursued their development of their moving coil designs, culminating in the current "MC" series. Of these the MC30 is top of the range, whilst the MC10 MkII is aimed at the enthusiast on a limited budget. Our review sample was the MC20 MkII which is intermediate between the two above. We were most impressed with its performance.

Turning to our sample Concorde, its designation is STD, and it is intended as a "plug-in" replacement for any standard MM cartridge/headshell combination. The original Concorde releases (30, 20 and 10) featured ultra-lightweight construction, with the total mass being only 6.5g. Whilst this assists in raising the low-frequency resonance of the arm/cartridge combination, resulting in improved sound quality should that frequency have been 6Hz or less, some users found difficulty in balancing their arms even though Ortofon supplied substitute low-mass counterweights with the cartridges.

The new Concorde STD has a mass of 15g – approximately the same as a conventional cartridge and headshell – so no counterbalancing problems should arise. Its stylus is elliptical, and the recommended tracking force is 2.0g. Apparently it has been "ruggedised", and Ortofon say that "back-cueing" is permissible. This makes it an interesting proposition for professional applications such as broadcasting stations and recording studios, where back-cueing is a requirement.

Quoted inductance is 500mH with a winding resistance of 600Ω, which is typical of the majority of similar cartridges. Notwithstanding this relatively high inductance, the recommended load capacitance is 400pF, paralleled with a termination of 47kΩ. On test, the frequency response was within ±2dB between 20Hz and 18kHz, and only 3dB down at 20kHz. The STD exhibited the usual mid high frequency droop in response, being −2dB at six and 8kHz. This was reflected in the anticipated "skewing" of sinusoidal waveform above 5kHz – albeit not as severe as we have observed with some other designs.

This is the Ortofon Concorde, so-named because of its similarity to that famous plane. Note that the integral headshell construction does not permit adjustment of stylus overhang.

Interchannel separation was of the order of 25dB for frequencies between 200Hz and 10kHz, falling to 15dB at 15kHz and 10dB at 20kHz – an above average performance. 1kHz output voltage was exactly on spec, being 1mV/cm/sec, a desirable high sensitivity in the interest of sustaining a good signal-to-noise ratio. Square wave response at 1kHz was also above average – a 15% overshoot followed by a "ring" of only three cycles to revert to zero. The "ring" frequency was of the order of 18 to 20kHz.

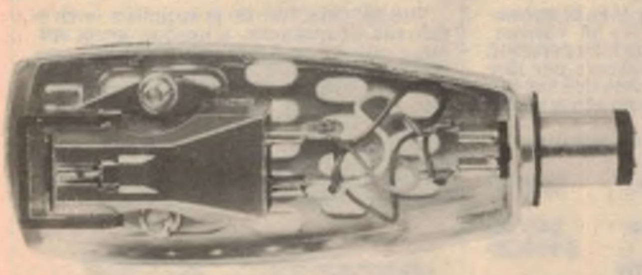
Evaluation of tracking on CBS STR110 found the Concorde STD easily coping with the highest levels (+18dB lateral, +12dB vertical) at the recommended 2g stylus force. It also easily tracked the +12dB drum test track on W & G 25/S2434, although it was on the verge of mistracking on the +16dB track. Sound quality of the STD was clean and well-balanced; and it certainly deserves to be near the top of the list amongst similarly priced cartridges (and headshells). One minor irritation to this reviewer is that the plastic stylus guard is removable and not of the flip-up variety.

This comment certainly cannot be levelled against the moving coil cartridges, since they are equipped with flip-up stylus guards. All moving coil models are of conventional construction, being intended for mounting in a standard headshell. The MC20 MkII has a mass of 7gms (a shade above average) and is supplied with a nude "fine-line" diamond stylus. Although we are not sure of the exact contour of the Ortofon "fine-line" styli, it appears as if they are similar to the Shibata CD4 stylus; since in plan they are basically elliptical, but make vertical contact with the groove walls over a greater area than either an elliptical or spherical stylus. Recommended tracking force is 1.7g.

Being of moving coil configuration its inductive reactance at audio frequencies is negligible, and its DC resistance is 3Ω. Recommended load is 10Ω or more; and quoted 1kHz output level is 18μV/cm/sec. With such a low output voltage some means of increasing this level is required prior to application to the (MM) input of a conventional amplifier (a few of the latest generation of amplifiers/receivers incorporate MC inputs). A voltage gain of approximately 30dB is required, and this can be obtained from either a step-up transformer or a preamp. A high quality transformer is probably the better way to achieve the step-up, since the combination results in an improved signal-to-noise ratio; but it must be a very good transformer indeed – and this is reflected in its high cost.

We chose to test the MC20 MkII with a preamp, as this obviated any frequency response errors, and introduced no "ringing" as may occur with a less than perfect transformer. Our first test was to check its tracking performance at the recommended 1.7g stylus force. It easily tracked all levels of the vertical and lateral tone test tracks on CBS STR110, and also the +12dB drum test track on W&G 25/S2434. Like the Concorde STD it also mistracked slightly on the +16dB track. A good performance.

Our next task was to check the square wave response at 1kHz. An overshoot of about 15%, damped out within less than one cycle! And the frequency? Difficult to accurately measure, but in the region of 30 to 40kHz! This is as good as, perhaps even better, than any cartridge we have previously tested (this includes the Stanton 881 and Shure V15 MkIII). We then checked the sinusoidal waveform at high frequencies. No skewing; only a slight deterioration at the top of one half-cycle at frequencies above 10kHz. This effect is inverted on the other channel, ie on the upper half-cycle on one channel, on the lower half-cycle on the other. A very good performance indeed.



Shown above is the Ortofon MC20 MkII moving cartridge fitted into a headshell (normally not supplied). The MC20 has a flip-down stylus guard but the stylus assembly is not removeable.

We were a little puzzled with the results we obtained in our checks of frequency response. One channel was excellent, almost never deviating more than ±1dB over the range to 20kHz; the other was similar to nine or 10kHz, then rose to be +3 to +4dB in the region of 13 to 19kHz. Whether our sample MC20 MkII had a slight defect, or whether this is a typical result we are unable to state. Pity, because the "good" channel was equally as good as any cartridge we have previously tested. Interchannel separation figures were also in the excellent class – 28dB at 1kHz, 25dB at 10kHz and a very good 18dB at 20kHz.

So where does this place the MC20 MkII? If it were not for the peculiarity in frequency response we would rate this cartridge as equal to the best we have ever tested. Listening to music selections the sound quality was very well balanced with good stereo spread; and whilst – in common with other topline cartridges – it exhibited no "sound" of its own, there was a certain "transparency" uncommon to most other cartridges. This was most apparent when listening to tuttis in orchestral music when the individual groups of instruments seemed to be more clearly defined. A top cartridge.

At the same time, the low output of the MC20, even by moving coil standards, does mean that a preamplifier with a good S/N ratio is a necessity if noise is not to intrude.

As for the Concorde, we found its sound quality very satisfying with very good tracking. For the price it must be classed as a very good cartridge.

Recommended retail price of the "moving magnet" Concorde STD is $65; and of the moving coil MC20 MkII is $239. Further details can be obtained from high fidelity retailers, or the distributors – Harman Australia Pty Ltd, 6-8 Byfield St, North Ryde, NSW 2113.

APPLIED TECHNOLOGY PTY. LTD.

Office/Showroom 1a Pattison Avenue, Waitara 2077
Hours: 9-5 Monday to Saturday Telephone: (02) 487 2711
Mail orders to: PO Box 355, Hornsby 2077
Please add $2.00 per order to cover packing and postage
Prices correct and goods in stock at time of going to press.

A REAL COMPUTER FOR $399

With the NEW SUPER INSTRUCTOR 80 we offer you the finest take-off point in personal computing today. If you need a machine which offers unparalleled facilities for learning computer basics and the ability to expand as your needs and interests grow, then the INSTRUCTOR 80 is for you. The INSTRUCTOR 80 is a complete Z80 computer, fully expandable on the S100 bus, backed a wide range of powerful software now available.

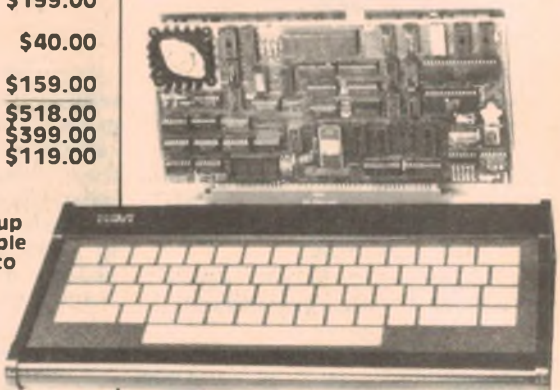
Compare the INSTRUCTOR 80 with virtually any similarly priced machine and there really isn't any comparison. The heart of the computer is the incredibly powerful DGZ80 single card S100 CPU. It gives you on-board RAM, a brilliant monitor program in EPROM, an 8-bit input port, two programmable 8-bit input/output ports, power-on-jump and of course uses the powerful Z80 microprocessor at 2MHz or more. No wonder the DGZ80 has become Australia's fastest selling Z80/S100 computer! In the video department, the INSTRUCTOR 80 is no slouch either. The MW640 S100 video display unit (VDU) gives you the full set of upper and lower case characters with true descenders with a crisp display of 64 characters wide and 16 lines on the screen and as a further bonus, the MW640 offers user programmable graphics in a 128 x 64 format. Watch out for cheap imitations offering upper case only, 32 characters per line and 'flickering' displays: they are far too restrictive for today's demanding world of computers.

The Super INSTRUCTOR 80 includes

***RCA touch keyboard with audible feedback**	**$89.50**
***4 slot motherboard with two S100 sockets**	**$45.00**
DGZ80 CPU card kit	**$199.00**
DGOS monitor ROM with manual	**$40.00**
***New improved MW640 VDU (Built and tested)**	**$159.00**
Normal full price:	**$518.00**
Package deal price:	**$399.00**
Save:	**$119.00**

To get your INSTRUCTOR 80 up and running you need a simple 8 volt/2A power supply and to connect it to a TV monitor. An optional 8V/2A power supply and a modulator are available if required.

The INSTRUCTOR 80 is supplied with a full set of manuals, a unique programming course and our full technical and warranty support. We won't let you fail! Most of the INSTRUCTOR 80 is prebuilt and tested and the assembly of the DGZ80 computer board is a breeze because sockets are supplied for every IC and a top quality, solder masked and plated through PCB will ensure a perfect job every time.

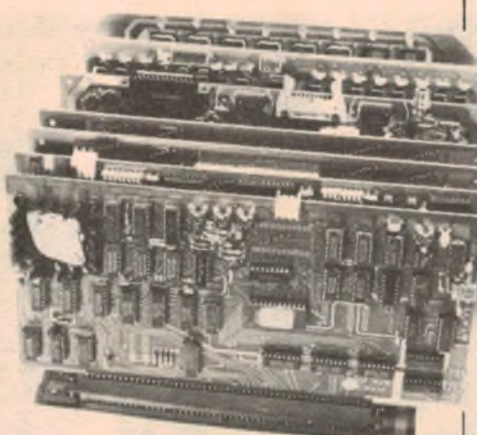


INSTANT PLUG IN EXPANSION ON THE S100 BUS.

One of the strongest reasons for buying our machine is that it gives you proven S100 expandability from the word 'GO' at no extra cost. We supply a full motherboard and S100 sockets—not just 100 holes in a PCB board! All our boards just plug into the S100 mother board. If you need a printer just plug one into the DGZ80 powerful PIO port. There are no hidden costs in expanding your Super INSTRUCTOR 80 and the APPLIED TECHNOLOGY wide range of cost-effective S100 cards make for exciting and painless expansion.

NEED MORE MEMORY? . . . Just plug in up to 64K of super reliable STATIC RAM. Choose from AT16K block locatable RAM at $199 (assembled and tested) or TCT16K 4 x 4K independently locatable blocks at $209 (kit form). The MW2516 S100 ROM card stores programs permanently in up to 16K of low cost 2516 EPROMS. Built and tested the MW2516 costs $99 or $160 complete with MICROWORLD BASIC in EPROMS.

NEED HIGH RESOLUTION GRAPHICS? . . . You need our TCTPCG (programmable character generator) which expands your graphics to a fantastic 512 x 256 bit resolution! You can produce graphs, bar charts and even develop your own TV games! The board comes with extensive documentation, joystick interfaces and controls and even 2 game programs on cassette. Kit price is $140.



INPUT/OUTPUT . . . The powerful DG750 I/O card is now available. This connects 3 further programmable 8-bit ports, 2 serial ports and on-board baud rate generation. Kit price $195.

SERIAL TERMINAL . . . If you need a remote terminal then use the SCVT100 as described in EA Oct 1980. This board offers a serial input and output, keyboard port, cassette interface and RS232 on one board for $190 (kit form).

MISCELLANEOUS CARDS . . . Other cards available include 2650SBC (see ETI Sept 81), Extender card and wire wrap cards and the newly released DIGITALKER card to give your computer a voice for $149.50 (kit form).

EVERYTHING COMPLETE

APPLIED TECHNOLOGY'S commitment to its products means that once you get started, you can get all the extras you need from us. One stop computer shopping is here.

- USCI CASSETTE INTERFACE ... Designed for trouble free operation with the DGZ80, this interface is supplied tested and ready to go, complete with test tape. Just plug into port B and connect to your tape recorder. A built in relay controls the motor. $30.00
- MW1550 10 SLOT MOTHER BOARD ... If you intend expanding to a big system this is a wise investment. Quality plated through hole PCB with solder mask and easy access terminals for power and reset ensure that this is a quiet and trouble free mother board. $49.50
- MS S100 CARD CAGE ... This high quality card frame accepts the MW1550 mother board and MW S100 POWER SUPPLY to produce a solid support for your system with excellent air circulation. $49.50
- MW EURO STYLE DESK TOP CABINET ... Newly released, this top quality cabinet houses your system and matches any commercial computer on the market. Stocks are expected on September 22. The MW EURO STYLE Cabinet costs $189.00 complete with quality anodized front panel.

GIVE YOUR COMPUTER A VOICE FOR $150

Give your computer a voice for less than $150!! Why pay over $300 to experiment with the latest speech synthesis technology?

The MICROWORLD DIGITALKER is based on a speech processing unit and encoded ROMs from NATIONAL SEMICONDUCTOR. Although it is on an S100, the MICROWORLD DIGITALKER is port oriented and can be readily adapted to interface with virtually any microprocessor such as INSTRUCTOR 80, TRS80, Sorcerer or SYSTEM 80.

The DIGITALKER is supplied complete with technical application notes on the state of the art in speech synthesis and typical software to drive it under machine code or BASIC. The DT-S100 has a master word list of 143 individually addressable expressions and these can be combined to produce a vocabulary limited virtually by your imagination. National Semiconductor have given us advance information on the soon-to-be released expansion ROM set and the DT-S100 has provision to accept these optional ROMs as soon as they are released. These extra ROMs increase the basic library to 256 expressions on one board! Actually this is all stored in 32K bytes of ROM using the new maxiroms.

DIGITALKER type speech synthesis one of the fastest growing areas of microprocessor technology now is your chance to learn about this fascinating area. Applications include keyboards for the blind, control systems and computer games. The DT-S100 is an ideal project for school and is also sure to impress all who hear the high quality speech with natural inflection and emphasis.

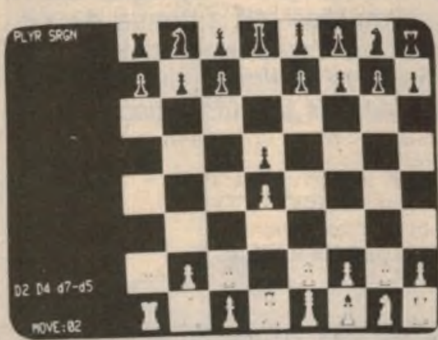
DT-S100 DIGITALKER kit complete with technical notes and full instructions. $149.50

POWERFUL SOFTWARE- WITH FULL SUPPORT

Unlike other companies who either "buy in" ready packaged software or give you little or no support, we at Applied Technology realise that a computer product is only as good as the software program behind it. Subsequently, we support our products with a continuing program of software expansion and improvement.

The INSTRUCTOR 80 is fully supported with a wide range of software available world wide. You can select from the wide range of games and utility programs in machine code, add the MICROWORLD EDITOR ASSEMBLER and write your own programs. Or you can add the MICROWORLD 12K LEVEL II BASIC (available in ROM or cassette) and enter the fascinating world of BASIC using prepared programs or writing your own.

NEW MicroWorld Level II 12K Basic. New, incredibly powerful Basic. Has advanced error reporting—you can correct errors as you proceed. MicroWorld Basic is fully interactive and gives you a powerful tool whether you're learning or writing programs. Cassette version $20 including tape and manual. S100 ROM Basic $160



As your needs may grow you can add disk drives such as the 315K MICROPOLIS 1043 and enter the world of word processors, business and other data base systems. INSTRUCTOR 80 will support CP/M 2.2 and consequently the world wide software base associated with it.

No wonder INSTRUCTOR 80 is the fastest selling S100/Z80 based kit computer on the AUSTRALIAN market today!

THE ADVANCED PRO COMPUTER SYSTEM

Expand your INSTRUCTOR 80 to suit your needs. Below is a suggested application as a word processor. The configuration uses 48K of RAM, MICROPOLIS 1053 615K dual disk, 1500 Daisy Wheel Printer with the INSTRUCTOR 80 and is running WORDSTAR under CP/M 2.2 This is more than a match for some of the so-called professional systems and will save you a fortune! As a guide, this system with all hard ware and software costs less than $5000.

YOU NEED TO YOUR SYSTEM

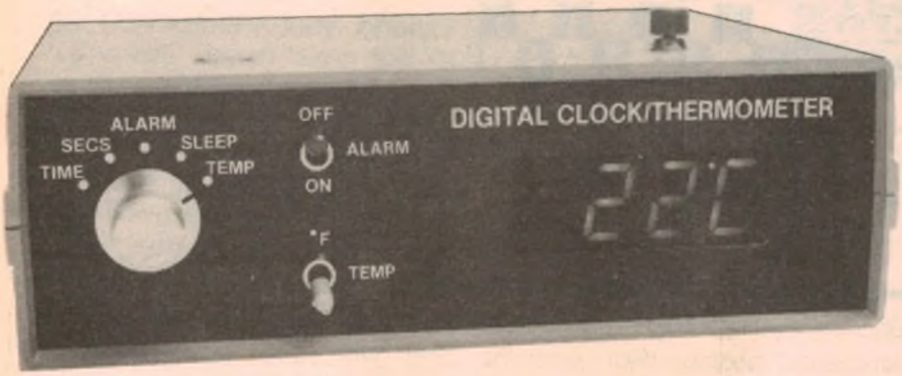
- Micropolis 1043 QUAD DENSITY DISK SYSTEM ... Plug in S100 card and you have 315K of disk memory. Includes diskettes and software/documentation package ($995 complete)
- PRINTERS ... We have a wide range of quality ITOH printers ranging from Model 8300 dot matrix at $875.00, to 8500 dot matrix with GRAPHICS for $895.00 right up to the word processor quality 1500 DAISY WHEEL unit at $1895.00

SUPER LOW PRICE ON ITOH M8500 GRAPHIC PRINTER.
$895

Tired of squinting at the mercury? Then rest your eyeballs on this!

Digital Clock and Thermometer

Many of our readers have requested this project — a digital thermometer with big bright display. But you also get a bonus 4-digit clock with alarm and more features than you can poke a stick at. It is based on a National Semiconductor module in which the IC chips are bonded directly to a PC board which carries the LED display and other components.



Let's face it, mercury or alcohol thermometers are not easy to read or use. A digital thermometer with a big bright readout has quite a few applications in the home, workshop and laboratory.

In the home, our digital thermometer can be used to keep a check on inside and outside temperatures, on your freezer and refrigerator and the temperature of tropical fish tanks. In the photographic darkroom, it can keep track of temperatures in developing tanks while in the laboratory and workshop the applications become wider still — measure heatsink or motor temperatures, etching baths and so on. In fact, the only limit is the number of temperature sensors you use and the overall permissible temperature range of −40°C to +89°C.

You can build this thermometer/clock (or clock/thermometer, which is easier to say) in a variety of forms. You can "go the whole hog" as we did and end up with a handsome but quite expensive unit which really looks the part and provides a lot of functions. Or you can forego some of the functions, put it in a less expensive case and save quite a lot of money.

THE CIRCUIT

Heart of the circuit is the MA1026 "Digital LED Alarm Clock/Thermometer Module" recently released by National Semiconductor. It requires only a handful of external components to produce a finished, working project; in particular, a power supply, function and time-setting switches and temperature sensors.

The MA1026 is a hybrid PC board-cum-integrated circuit. The board measures just 95 × 45mm. On one side it has two dual-digit LED displays while on the other it has components for the power supply, a number of transistors plus a few capacitors and resistors. It also has two IC chips which are bonded and terminated directly to the PC tracks. The main chip is roughtly 4mm square and covered with a blob of encapsulation under which a maze of leads can be seen terminating to the chip. There are 58 leads in all, which would make a large IC if housed in a conventional in-line package.

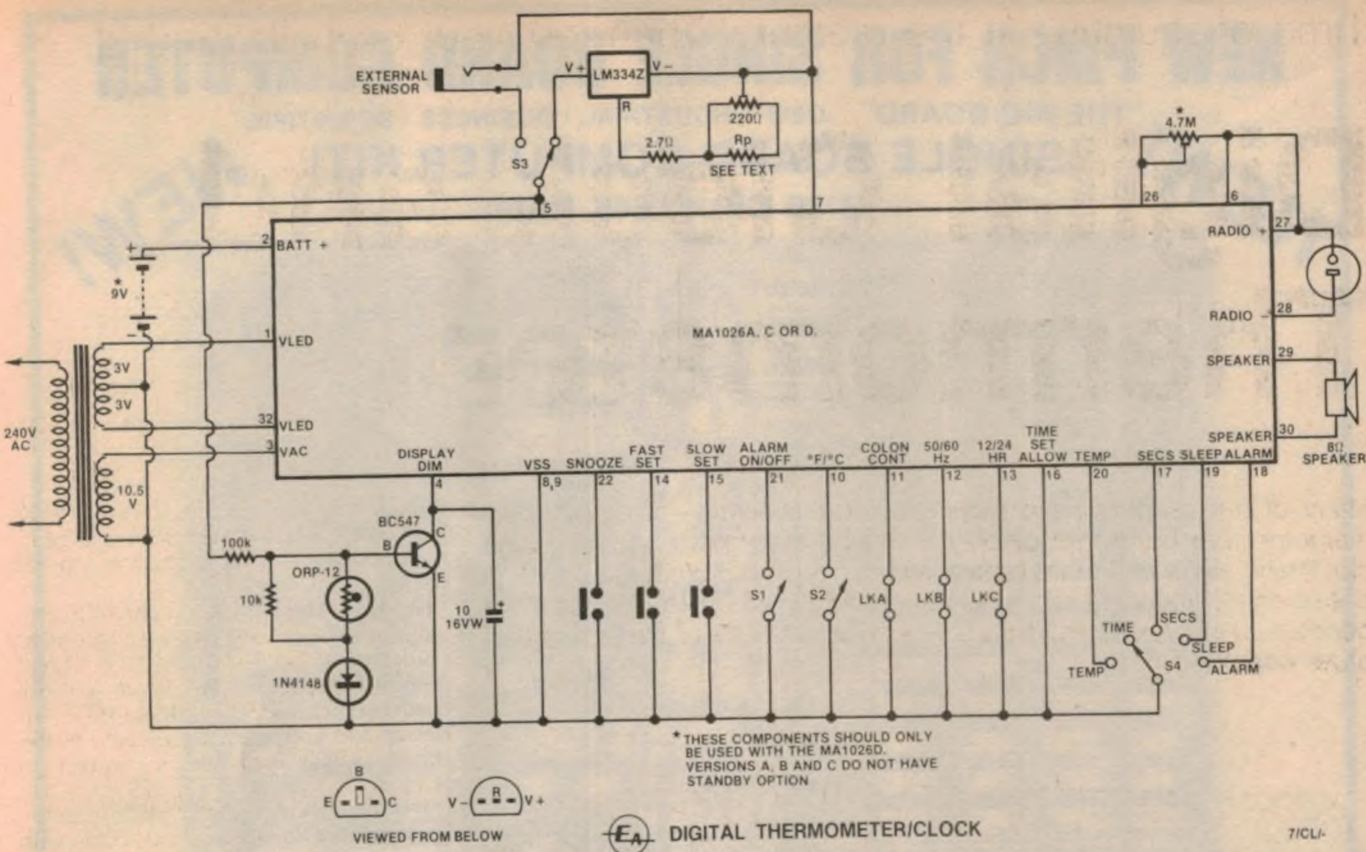
Like most clock chips, the MA1026 provides a list of optional features as long as your arm and which would take a great deal of space to describe in full. We will describe those which are featured in our design and briefly allude to some of the others which may be of interest to readers.

The main chip on the MA1026 module is virtually a conventional clock chip with some extra internal circuitry allowing it to display temperature values. Thirty-one of the chip pins drive the LED display from rectified but unfiltered DC while 12 control pins provide normal clock features with each pin pulled low to enable that particular feature. The controls are listed as follows: Colon control (low to stop 1Hz flashing), 50/60Hz select (low for 50Hz), 12/24 hour select (low for 24Hr which disables PM indication), Alarm off, Time Set Enable, Fast Set, Slow Set, Display Seconds, Display Alarm, Snooze and Brightness.

Two control pins provide the temperature display facility: Display Temp and Fahrenheit/Celsius select (low for Celsius), The remaining pins on the clock chip are for connection of supplies, temperature interface circuitry and the three control outputs: Alarm, Sleep and 24Hr.

Additional circuitry on the MA1026 module provides temperature input data from external sensors. The temperature sensor used is the LM334, made by National Semiconductor, who describe it as a three-terminal adjustable current source. National Semiconductor has made use of the temperature coefficient of current in this application. For the LM334, the output current increases by one microamp for every one Celsius degree rise in temperature.

When the current from the LM334 is applied to a 10kΩ resistor (on the module) the resulting voltage increases by 10 millivolts for every one Celsius degree rise in temperature. This is converted to a frequency signal which can be displayed by the clock chip counters in Fahrenheit or Celsius.



The circuit of our prototype may be modified to suit readers' individual needs. For example, S3 could be replaced by a multi-position switch to accommodate more temperature sensors. Note that each sensor requires its own resistor trimming network and each of these must be adjusted against a reference thermometer.

We should add, at this point, that the LM334 is guaranteed for accuracy only over the range from 0°C to 70°C. In order to guarantee accuracy and reliable operation over the full measurement range of the MA1026, we would have had to specify the more expensive LM134 which has an operating range of −55°C to +125°C or the LM234 which has an operating range of −25°C to 100°C (which would reduce the measurement range for very low temperatures). As it is, we feel that the LM334 will be satisfactory for most likely applications.

We have added several features to make the MA1026 even more attractive as a clock. First, we have added a back-up power supply which keeps the clock counters going in the event of a mains power failure — very handy in view of recent blackouts in NSW and Victoria. The back-up supply takes the form of a 9V battery which is normally isolated by a diode on the module. Some MA1026 modules may not have this diode and a capacitor necessary to run a standby back-up oscillator which drives the counters. We will talk about this aspect later.

The other feature we have added is a dimmer for the display. Many digital clocks with "fixed brilliance" displays are too bright at night (in darkness) or not sufficiently bright in rooms where there is a high level of ambient lighting. We have added an LDR circuit which automatically dims the display in darkness.

The LDR circuit consists of the LDR itself, two resistors, a capacitor and a transistor. A look at the circuit diagram will show how it is connected. The LDR is shunted by a 10kΩ resistor and then connected to ground via a diode. The other end of the LDR/resistor combination is connected to the base of an NPN transistor and one end of a 100kΩ resistor, the other end of which is connected to the positive DC supply from the module. The diode is used to keep the voltage at the base of the transistor in the region of the base-emitter conduction voltage, 0.6 volts.

> We estimate that the current cost of parts for this project is approximately
>
> **$80.00**
>
> This includes sales tax.

The collector of the transistor is connected directly to the dimmer input (pin 4) on the clock module. A 4.3kΩ pullup resistor on the main clock chip normally maintains the display at full brightness. If the dimmer input is now taken low the display will dim. This is exactly what happens when little or no light falls on the LDR. Under bright lighting conditions, the resistance of the LDR will be very low relative to the 100kΩ resistor at the base. This will result in the transistor being turned off and the dimmer input rising to full supply voltage (due to the on-board pull-up resistor) to give full display brightness.

If the light level happens to fall, the resistance of the LDR will start to increase, resulting in a positive bias being applied to the base of the transistor. This will result in a collector current flowing, pulling the dimmer input down to a lower voltage. When the LDR has no light falling on it, the transistor will be turned on and the display will dim down to 25% of full brightness. The 10kΩ resistor in parallel with the LDR is used to linearise the response of the LDR to changing light conditions. The 10μF capacitor connected between the collector and ground is used to smooth the half-wave DC present at the dimmer input.

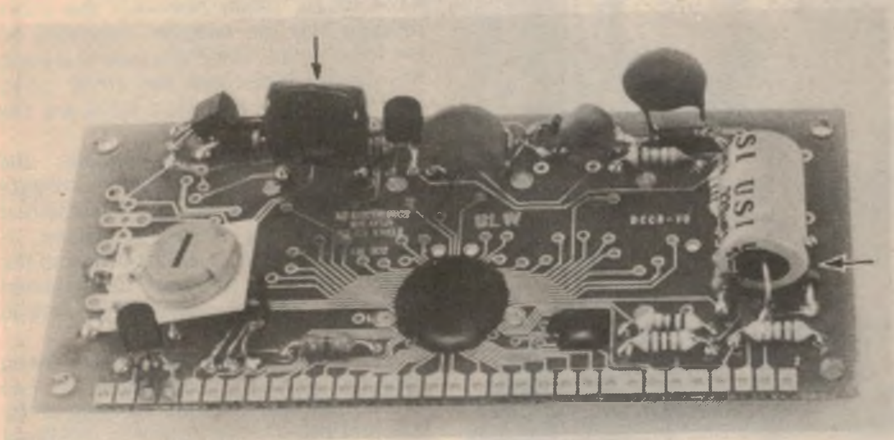
OUR PROTOTYPE

Our prototype unit was constructed in an attractive plastic case manufactured by Pac Tec of the US. This case is distributed in Australia by Associated Controls Pty Ltd and is available over the counter from Dick Smith Electronics.

The function select switch, the alarm on/off switch and the selection switch

are all mounted on the front panel together with the clock module itself. The time-setting push buttons, temperature sensor changeover switch and remote sensor socket and the sleep timer output socket are all mounted on the rear panel.

Five display modes are selected by the rotary selector switch: time (hours and minutes) seconds, alarm time, sleep timer and temperature. A toggle switch is used to select between the two temperature scales while a second is used for the alarm disable. A third toggle switch, located on the back panel, is used to select between the internal (rear-mounted) and an external temperature sensor.



The diode and capacitor arrowed must be added for the standby oscillator facility.

The sleep function allows an external transistor radio to be used with the clock unit. The radio can be switched on as the alarm device at the alarm set time and can also be enabled by the sleep timer. The sleep timer is a counter that starts counting down from 59 minutes. When the sleep timer reaches zero, the radio is switched off.

The output for this function is in the form of an open-collector output, the emitter of the switching transistor being connected to the positive side of the clock supply. The positive of the clock supply is used as the common between the clock unit and an external radio, instead of the zero volts line.

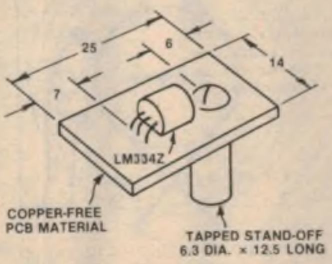
The MA1026 module has a time-set enable input but we decided not to make use of the feature and enabled it permanently instead. If desired a switch could be incorporated to disable the time setting mode. This is handy if you have inquisitive kids about the place who like to fiddle.

The LDR for the dimmer circuit and the snooze button have been mounted on the top of the case – the LDR so that it gets maximum exposure to ambient light, and the pushbutton so that it can be easily pressed to disable the alarm on a Monday morning.

The module is powered from a small transformer which has two secondary windings, one at 6V with a centre tap and the other at 10.5 volts. The 10.5 volt winding is used to power the clock chip and ancilliary circuitry while the six volt CT winding is used for powering the LED display and the alarm loudspeaker.

We have designed a printed circuit board on which all of the remaining components are mounted, including the power transformer. The board measures 172 × 120mm and is coded 81cl9. The board is larger in area than it really needs to be, but we have chosen this particular size to take advantage of the mounting locations in the base of the Pac Tec enclosure. This means that we have no screws showing through the bottom of the case – an advantage aesthetically and from a safety point of view.

We have also designed a front panel artwork for use with aluminium "Scotchcal" material for production of a suitable label. The artwork has been designed to be used with the Pac Tec enclosure, but could be modified by the constructor if he opted to used a different type of enclosure.



This diagram shows how to mount the sensor on the rear of the case.

As we remarked at the beginning of this article it is possible to build this project in a variety of forms. If you build it with all the features we have included and use the Pac Tec case the resulting unit will be relatively expensive but should give a lot of satisfaction as a "complete" project. On the other hand if you decide to make do without the Pac Tec case, front panel and dimmer facility you could also dispense with the PC board and save a substantial amount in total.

For example, you may wish to build a version which can display just the time and temperatures at five separate locations. This would require five LM334 sensors and their associated resistor network in each case plus a six-position, two-pole switch to perform the selection. The only other components required would be the MA1026 module itself, the transformer and two pushbutton switches for time-setting. Even the Fahrenheit/Celsius switch could be eliminated from such a basic version – just wire in a link for Celsius.

Alternatively, another possible version could provide just the time and alarm functions with, say, four temperature sensors. You would then require the parts mentioned previously plus a small speaker to sound the alarm (which is a pulsed 800Hz tone).

Let us now proceed to describe the construction of our prototype.

CONSTRUCTION

Construction of the unit will take time since there is a lot of preparatory work to be done on the enclosure and then quite a lot of wiring.

The first step is to mount the components onto the printed circuit board. Note that these include the mains terminal block.

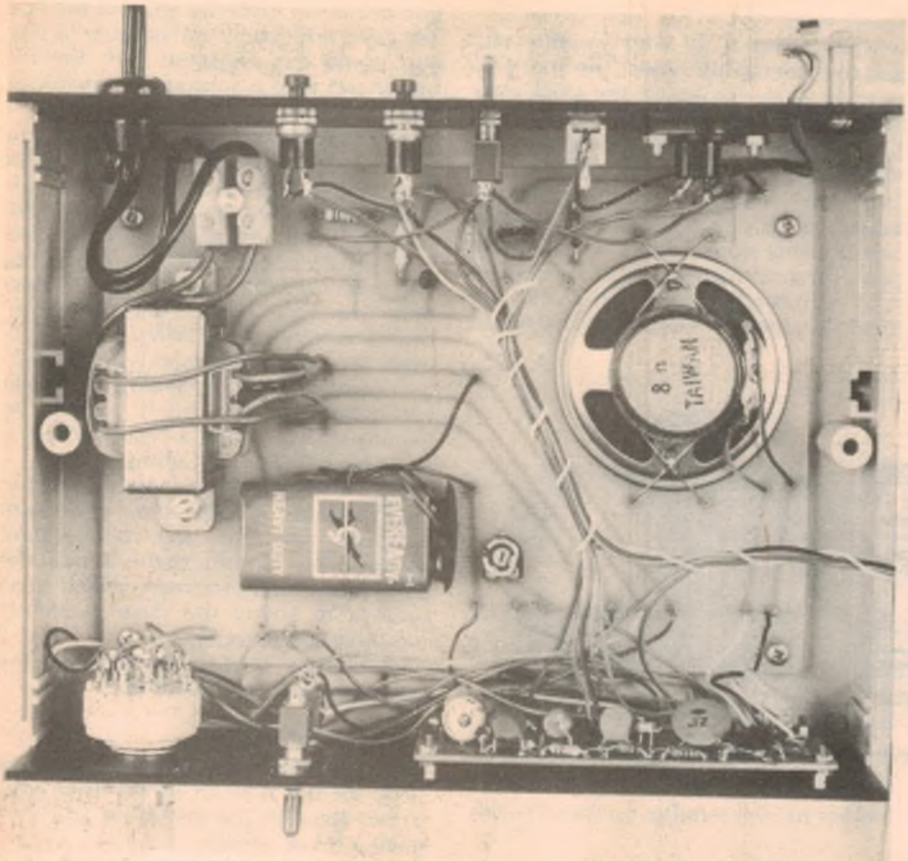
The use of PC stakes is recommended since they help in the final wiring operation.

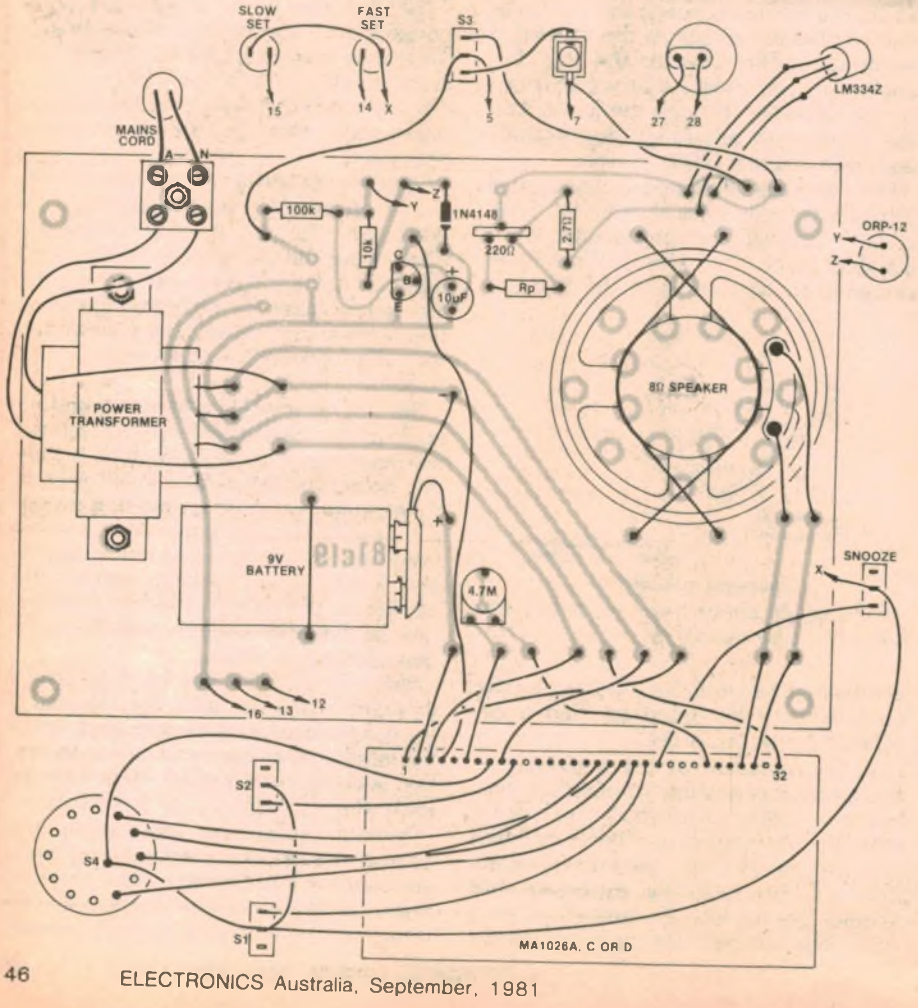
Once the board has been assembled, put it aside and start preparing the enclosure. This will involve cutting the opening for the LED displays of the clock module; drilling and countersinking the four screw holes for the module mounting screws; and drilling the other holes for the switches, pushbuttons and sockets.

The slot for the LED displays should be cut out next. Note that the module must be mounted onto the front panel before the Scotchcal label is affixed to the panel. In this way, the screws that secure the module to the panel are covered from view, resulting in a neat front panel. The small screws which secure the module to the panel should be countersunk so that they are flush with the panel when tightened down.

Once the module has been mounted you are ready to affix the Scotchcal aluminium label to the panel. First, spray the label with a clear lacquer for protection and then use a sharp razor knife to make the cut out area for the displays.

Carefully score the label along the cutout lines several times until the blade just starts to bite through. Now carefully apply pressure to the section to be removed. If the scoring is deep enough,





the aluminium will start to break away along the cut lines. If not score it a little more.

If the holes for the rotary switch and the two toggle switches were drilled prior to the label being stuck into place, then again, with the aid of a razor knife, carefully cut away the unwanted aluminium. Then strip away the label backing and affix to the case panel.

Now mount the rotary switch and the two toggle switches. The next step involves wiring up the connections that have to be made between the clock module and the switches mounted on the front panel. Once this part of the job has been done, put the front panel assembly aside and start work on the rear panel.

Mount the two pushbuttons, the double-pole, double-throw toggle switch and the two sockets onto the rear panel. The temperature sensor is mounted on the rear, but external to the case. A drawing showing a suggested mounting method appears elsewhere in the article.

Once the components have been mounted onto the rear panel we can turn our attention to the mounting of the LDR and the snooze button in the lid of the enclosure.

We mounted the LDR by drilling a hole in the lid and then carefully filing it until the body of the LDR was a tight fit in the hole. It was held in place using Aquadhere applied over the back of the body. (This glue takes a long time to dry in this application.)

The snooze button was mounted in the right hand top corner of the lid, an easily accessible place for the half awake.

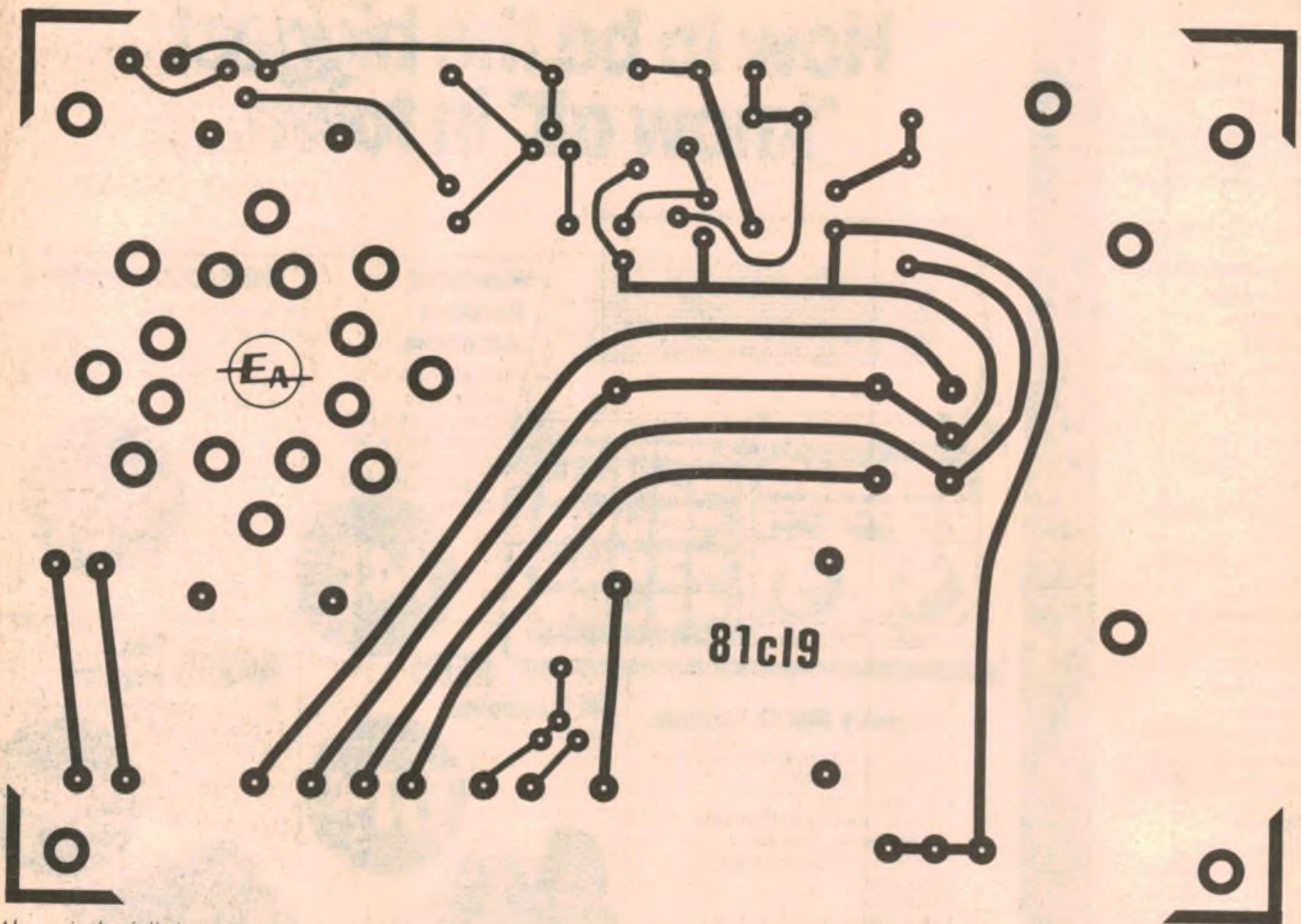
If you elect to use a metal case instead of the Pac Tec case, the mains terminal block should be mounted on the chassis rather than on the PC board and the earth wire in the three mains flex should be terminated to a solder lug secured by a screw and nut to the base of the case.

Once all of the mechanical work has been done (at least in terms of bolting things to panels) we can proceed with the remainder of the wiring.

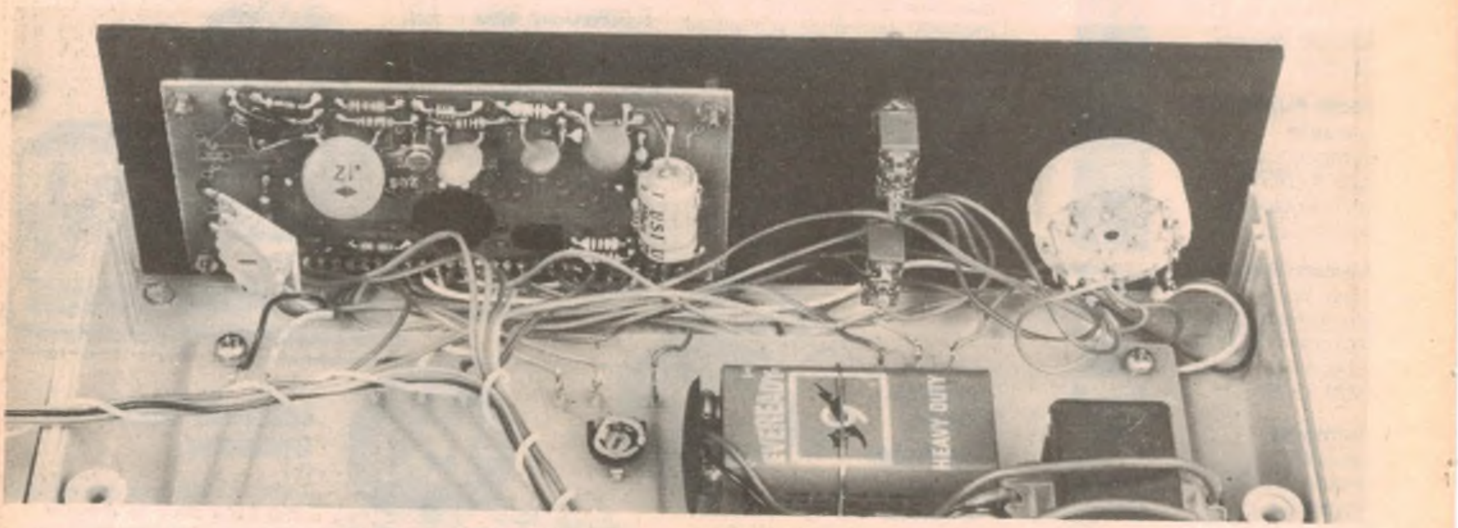
The mains cable used in the prototype was clamped in place by using a cord grip clamp. These are readily available from most component stockists.

With all of the internal wiring completed (the temperature sensors should not have been hooked up at this stage) and checked, apply power to the unit and note that regardless of the display mode selected, the display should be flashing on and off at one second intervals. This flashing is a mains failure indicator, and will occur after every power failure to the clock.

The flashing can be stopped by setting the function select switch into the time position and then pressing either of the two time-setting buttons on the rear panel.



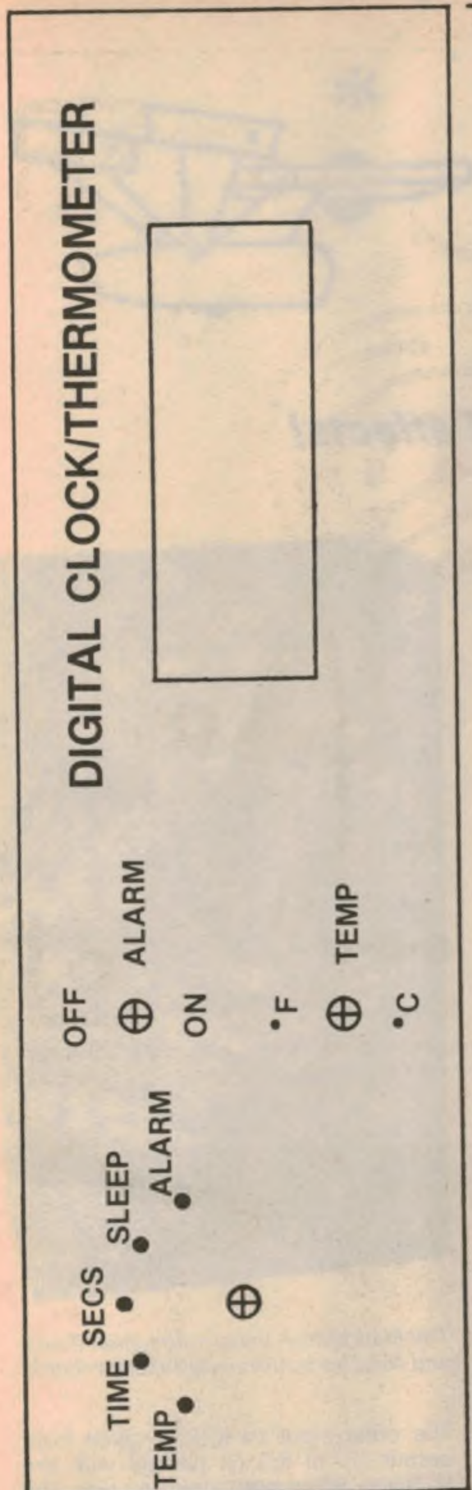
Above is the full-size artwork of the PC board while below is a photo showing the wiring behind the front panel. In our prototype only one pole of the selector switch was used but two poles will be required if you wish to use this switch to select more than one temperature sensor.



Go through each of the mode selections and make sure that the display comes up with the correct information corresponding to the selected mode. If not, then chances are that two of the mode selection wires have been transposed at the switch connections. The only setting that will give a nonsensical reading at this stage will be the temperature mode. It should read −40° in either F or C modes.

Connecting the battery will prevent the display from flashing when the power is interrupted. If your module is MA1026A, B or C you will have to add the diode and 0.1μF metallised polyester capacitor (in place of a link) shown arrowed in a photograph accompanying this article. It is necessary to set the 4.7MΩ trimpot for exactly 20Hz from the backup oscillator. This frequency can be measured at pin 26 of the module using a frequency meter or CRO, or it can be set by trial-and-error.

Now check that the dimmer circuit is functioning correctly. This can be done by exposing the LDR to bright light and noting that the display is bright. Now cover the LDR with your hand and note that the display dims.



This is the full size artwork for the front panel. Note that there is a discrepancy in the order of functions selected between this artwork and the photograph on p42. Unit is easier to operate with "temperature" adjacent to "time".

If all of these tests prove positive, remove the plug from the wall and mount and connect the temperature sensor.

To calibrate the temperature sensor you will require an accurate thermometer and a fan. Place the thermometer and temperature sensor so that they both receive the same draft from the fan and then adjust the 220Ω trimpot to obtain a reading on the display which agrees with the thermometer. This will involve a number of trial-and-error steps because of the slow update time of the temperature display.

If you find that the trimpot does not give enough range for adjustment (this is possile as no two current sources have absolutely identical characteristics) then place a 1.8kΩ resistor in the position on the board labelled Rp. This will reduce the overall value of the trimmer resistance. If on the other hand, the value of the resistance needs to be increased, then substitute a 10Ω resistor for the 2.7Ω. Any adjustment of values required should be quite small.

An external transistor radio can be controlled by the clock using the sleep timer output socket. Here the positive supply from the battery in the radio would be switched by the transistor on board the clock module. The positive of the radio supply and the positive of the clock supply are connected together to form the common connection.

Well, that's just about it. The rest is up to you.

PARTS LIST:

1 Pac Tec enclosure 205mm W × 57mm H × 159mm D
1 National Semiconductor clock module, type MA1026ALR
1 transformer Selectronics type X1132, DSE M-2824 or similar
1 printed circuit board, 172 × 120mm (81c19)
1 single-pole, 6-position rotary switch
3 single-pole double-throw miniature toggle switches
1 3.5mm earphone socket
1 polarised 2-pin DIN socket
1 50mm diameter loudspeaker
3 momentary contact pushbutton switches
1 type 216-9 volt battery and clip to suit (optional, see text)
1 4.7MΩ miniature trimpot
1 220Ω miniature trimpot
1 BC547 NPN transistor
1 1N4001 diode (see text)
1 1N4148 diode
1 10μF/16VW aluminium electrolytic capacitor
1 0.1μF metallised polyester capacitor (see text)
1 ORP-12 light dependent resistor
1 × 100kΩ, 1 × 10kΩ, 1 × 2.7Ω (all ¼W, 5%) resistors
1 LM334 programmable current source
1 mains cord and plug assembly
1 2-way mains-rated terminal block
1 cord-grip grommet
Hookup wire, solder, screws, nuts etc.

PHOTON TORPEDO

A low-cost alien exterminator with sound effects!

There you are warping among the deep space galaxies in the Starship "Enterprise" (or whatever other name takes your fancy) when you are attacked by hostile aliens. Are you worried? Not in the slightest — not when you've got a photon torpedo with fancy sound effects to defend yourself!

by JOHN CLARKE

For those who haven't already guessed, "Photon Torpedo" is our latest electronic game. It has all the ingredients necessary for a thriller – a space theme, a starship, hostile aliens, and a means of destroying the aliens. Add to that the realistic sound effects and you will almost be able to smell the smoke from the battle!

Of course, our new "Photon Torpedo" game will prove quite popular with those who cannot afford one of those fancy "computerised on-screen" games with its multi-coloured aliens. Or maybe you are sick of pouring money into the slot of a parlour-game machine, only to be quickly wiped out by a barrage of bombs and sundry missiles. Photon Torpedo overcomes these miseries – at around $24 it won't break the bank and, best of all, the aliens don't shoot back.

In fact, it's more like a turkey shoot. The aliens simply fly past and you try to zap them!

However, you don't have things all your own way. The alien craft are rather unpredictable and can move fast one moment and slowly the next. Consequently, it is quite difficult to hit the alien ships.

In addition, the alien craft are very quiet and sneaky so no sound effects have been provided for these. All the sound effects are generated when the photon torpedo is fired and when an alien craft is hit. The photon torpedo has a high-pitched whine when charging ("fire" button pressed) which dies away in frequency when fired ("fire" button released). When an alien craft is hit, a low frequency "groan" is produced to indicate death and destruction.

So the sound effects really add interest to the game.

To enhance the game even further, a Scotchcal artwork depicting a deep space background has been produced. A horizontal row of nine circular LEDs is used to depict the position of the alien craft, while the photon torpedo is represented by a vertical row of eight rectangular LEDs. The fact that the LEDs are physically butted together produces a good torpedo effect.

THE CIRCUIT

At the heart of the circuit are two 4017 decade counter/divider ICs (IC1, IC2) which drive the LED columns. These devices have 10 outputs, usually labelled "0" to "9". Only one of these outputs is high at a time and they turn on in sequence for a period of one clock pulse as the counter is clocked; from "0" to "9" then back to "0" and so on. They also have a reset input which can be used to reset the counter to zero at any point in this sequence.

IC1 drives the nine horizontal row LEDs via outputs "0" to "8" to represent the position of the alien craft. These LEDs are arranged on the PC board so that the eighth LED is intersected by the vertical column LEDs (the photon torpedo) driven by IC2. In both cases, there is a single extra LED immediately following the intersection.

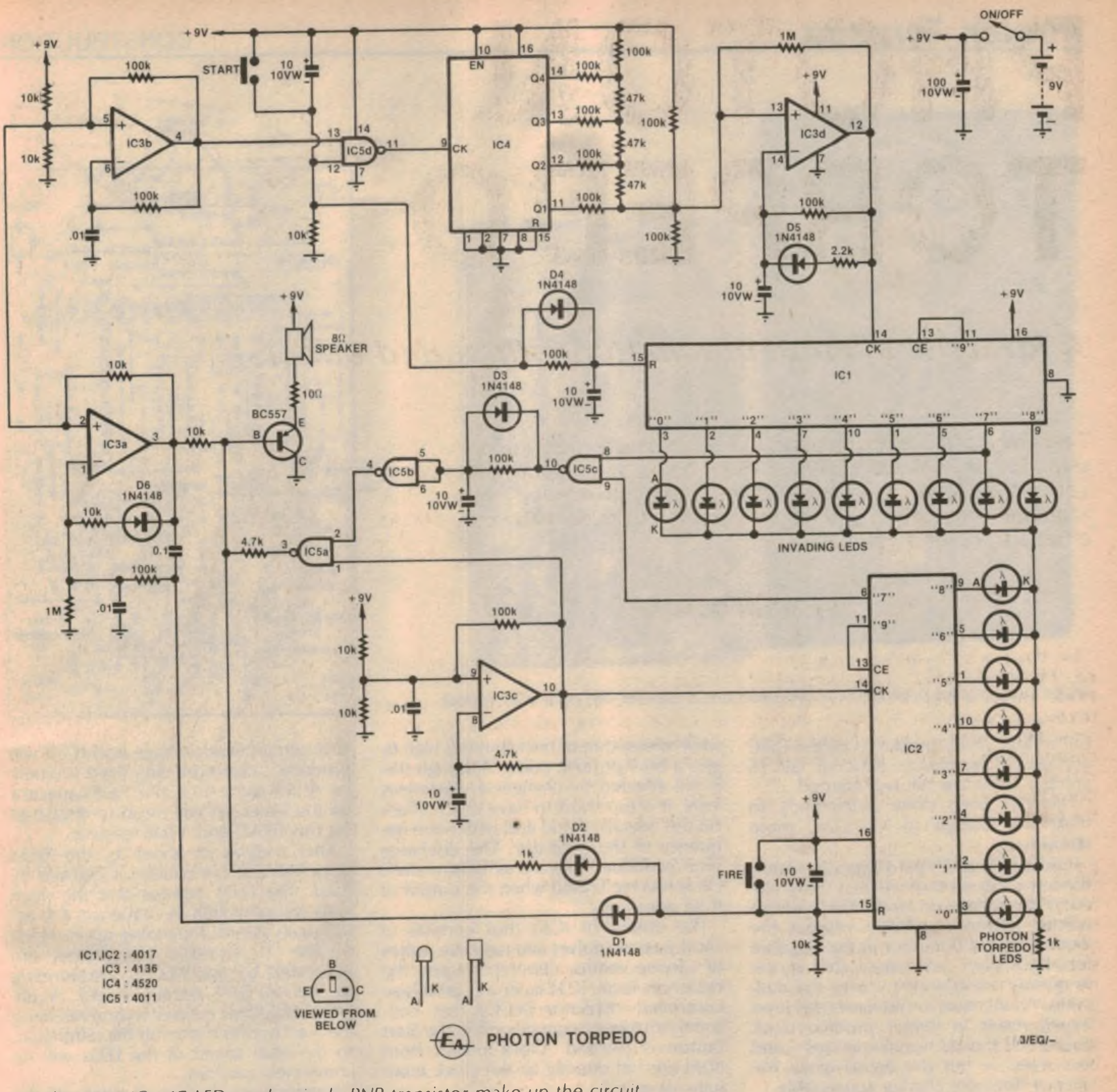
At the intersection, it is the row LED which is activated by output "7" (pin 6) of IC1. Since we cannot have two LEDs at the same point; the corresponding column LED for the photon torpedo is "ghosted". Instead of actually driving a LED, output "7" of IC2 (pin 6) is connected to one input of NAND gate IC5c.

The Start button initiates the alien attack and the Fire button exterminates them.

The other input to IC5c is taken from output "7" of IC1 (in parallel with the LED) and, when both inputs go high, the output of IC5c goes low.

Note that a single 1kΩ resistor limits the current through all the LEDs, the cathodes of which are tied together. When one LED is on, the remainder are reverse biased.

Clock pulses for IC2 are derived from IC3c, a 4136 op amp wired as a Schmitt trigger oscillator. A 10μF electrolytic capacitor connected to the inverting input is charged via a 4.7kΩ resistor towards the positive hysteresis point of the Schmitt trigger whenever the output (pin 10) is high. When this voltage is reached, the output of IC3c goes low and discharges the capacitor to the



Five low-cost ICs, 17 LEDs and a single PNP transistor make up the circuit.

lower hysteresis point. The output then switches high again and the cycle is repeated.

The hysteresis voltages are set by the 100kΩ feedback resistor between the non-inverting input and output, and by two 10kΩ resistors which hold the non-inverting input at half supply voltage.

When the fire button is pressed the Reset pin (pin 15) of IC2 is forced high, activating the "0" LED. Upon release of the fire button there follows a 100ms switch debounce period, after which the Reset goes low and the LEDs "fire" rapidly up to the final LED on output "8". When the "9" output subsequently goes high, the Clock Enable (CE) input (to which it is directly connected) also goes high, stopping the counter.

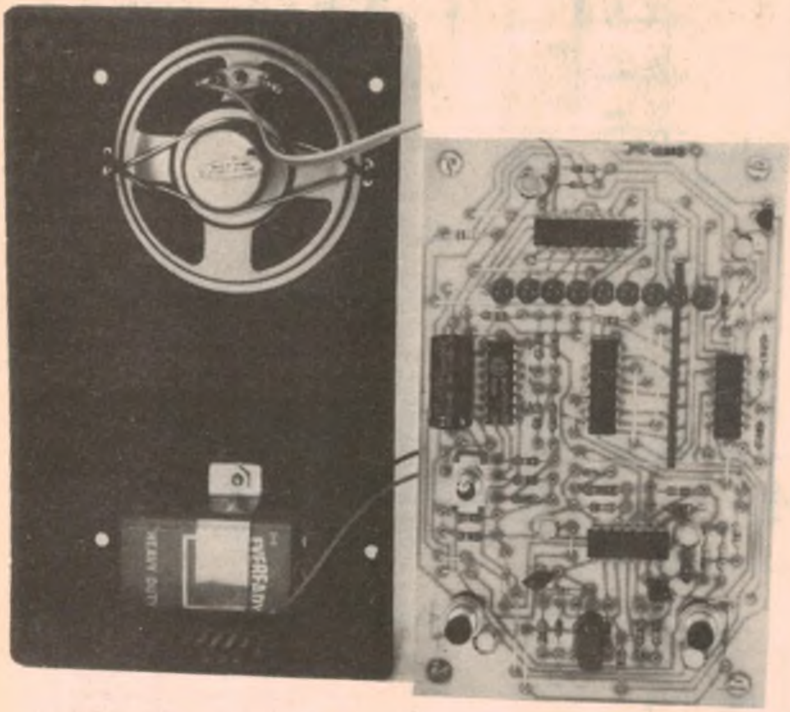
In other words, IC2 remains latched with output "9" high until the Reset pin is again forced high by pressing the fire button. None of the LEDs making up the photon torpedo are on during this standby condition.

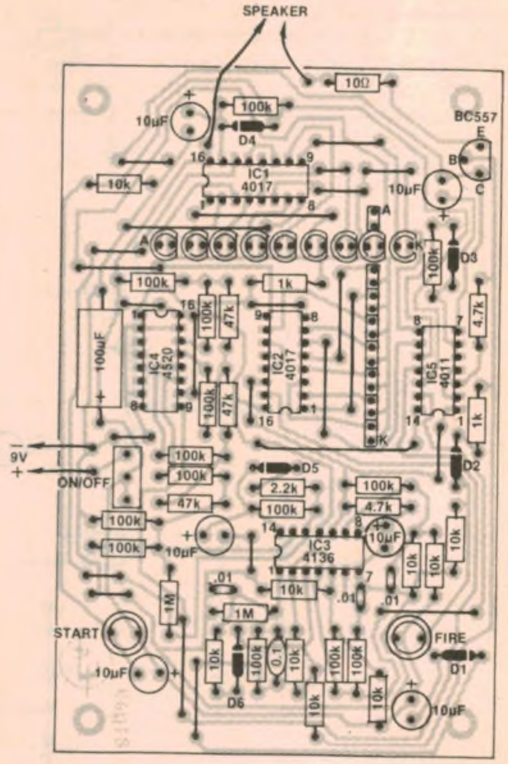
The clock circuit used to drive IC1 is rather more elaborate than that used for IC2. In particular, we have added extra circuitry to achieve a random sweep speed for the horizontal LEDs.

IC3b is a high-frequency Schmitt trigger oscillator, the output of which is gated by NAND gate IC5d. When the Start button is pressed, pin 12 of IC5d is forced high and clock signals from IC3b are gated through to the clock input of IC4. The Reset pin of IC1 is also forced high via a 1N4148 diode, thus preventing the row LEDs from traversing and keeping the "0" LED alight.

IC4 is a 4520 4-bit binary up-counter which continually counts while there is a clock input. The binary outputs Q1 to Q4 are connected to an R-2R ladder network to give a discrete voltage output representative of the the binary count number – in other words, a digital-to-analog converter (DAC). The output of the DAC is attenuated and biased to half the supply voltage by two 100kΩ resistors.

Normally, Q1 to Q4 are the reverse order to that used in our circuit, so that a linear ramp with 16 discrete voltage steps is produced. In our circuit, however, a linear ramp is not produced. By reversing Q1 to Q4, as we have done,





Make sure that all polarised components are mounted the right way round.

the voltage levels produced by the DAC are out of sequence, although all 16 voltage levels are still represented.

This has been done deliberately to make the output of the DAC more random.

IC3d is also a Schmitt trigger oscillator, the hysteresis level of which is determined by the voltage set by the DAC. With a normal Schmitt oscillator, without the diode and 2.2kΩ resistor in the negative feed-back path, an overall shift in the hysteresis points simply varies the duty cycle. An increase in the hysteresis level would result in longer positive clock pulses and shorter negative pulses – and vice versa – but the actual clock frequency does not change appreciably.

However, we want the clock frequency to change so that the row LEDs will scan at random speed. By adding diode D5 and the series 2.2kΩ resistor, the 10μF timing capacitor will charge rapidly when the output of the Schmitt is high to give a brief positive pulse. Although this is still affected by changes in hysteresis level, it is too short to have much affect on the overall period and hence the frequency of the oscillator. The discharge time continues to vary as before since D5 is reverse biased when the output of IC3d goes low.

The output of IC3d thus consists of short positive pulses and negative pulses of varying widths, depending upon the hysteresis level. IC3d is, in fact, a voltage controlled oscillator (VCO) that constantly changes frequency while the Start button is pressed. Clock pulses from IC3d are fed directly to the clock input (pin 14) of IC1.

When the Start button is released, pin 12 of IC5d is pulled low and no further clock pulses are passed from IC3b to IC4. Depending on just when IC4 is stopped, the output of the DAC will remain at a certain fixed voltage and IC3d will produce a corresponding fixed frequency. At the same time, the 10μF capacitor on the Reset pin will begin to discharge via the 100kΩ and 10kΩ resistors.

After a delay of about 1s, the Reset goes low and the counter is clocked by IC3d. The LEDs representing the alien craft will now light in sequence, the actual scan speed depending upon which of the 16 possible frequencies are generated by the VCO (corresponding to the 16 DAC output levels). A difference of a few milliseconds in releasing the Start button makes all the difference, so the scan speed of the LEDs will be completely random.

Note that the diode in parallel with the 100kΩ resistor is to allow an instantaneous reset when the Start button is pressed. When the Start button is released, this diode is reverse biased. As with IC2, IC1 is latched when the "9" output goes high (ie at the end of the scan) and remains that way until the counter is reset.

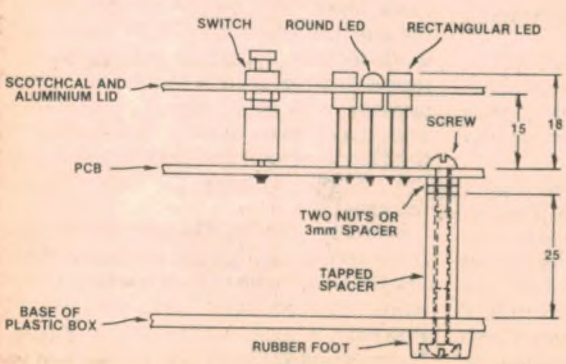


FIG. 1

Fig. 1: Diagram showing the general mechanical assembly of the game. The tops of the LEDs should be 18mm above the PCB.

SOUND EFFECTS

Let's now look at the sound effects circuitry. IC3a produces the Photon Torpedo sound, while oscillator IC3c is tapped off to provide the sound effect when the alien craft is hit.

Operation of IC3a is as follows: When the Fire button is pressed the 0.1μF capacitor is charged via diode D1, the inverting input is pulled high, and the output goes low. The .01μF capacitor on the inverting input then discharges through the 10kΩ resistor and diode D6 and the output switches high again.

This cycle is repeated, with the .01μF capacitor continually charging via D1 and the 100kΩ resistor and discharging via the 10kΩ resistor and D6. IC3a thus generates a constant output frequency whenever the Fire button is pressed and this provides the "charging" sound for the photon torpedo.

Upon release of the fire button, D1 is reverse biased and has no further affect on the circuit. The .01μF capacitor now charges through the 100kΩ resistor and 0.1μF capacitor and discharges through the 10kΩ resistor and diode. Because of the mismatch between the 100kΩ and 10kΩ resistors, the 0.1μF capacitor will eventually discharge and become positive at the output side of the op amp. As the 0.1μF capacitor discharges, the charging current supplied to the .01μF capacitor decreases and so the frequency of the oscillator decays.

This decaying frequency produces the sound when the photon torpedo is fired and is designed to stop when the last LED lights.

Refer back now to IC5c. Its output goes low when the row LED is "hit" by the photon torpedo (pin 6 of IC1 and IC2 both high) and this low is inverted by IC5b to give a logic high on pin 2 of

---

PARTS LIST

1 plastic utility box, 158 × 95 × 50mm
1 PC board, code 81ga9, 132 × 83mm
1 Scotchcal front panel, 91 × 154mm
1 57mm-diameter loudspeaker
1 9V No. 216 battery and clip
2 pushbutton momentary contact switches
1 SPDT miniature toggle switch
4 25mm tapped spacers
8 screws (15mm long) and nuts to suit spacers
4 rubber feet

SEMICONDUCTORS
9 5mm red LEDs
8 rectangular red LEDs
1 BC557 PNP transistor
6 1N4148 small signal diodes
2 4017 decade counter/divider ICs
1 4136 quad operational amplifier
1 4520 dual 4-stage binary up counter
1 4011 quad 2-input NAND gate

CAPACITORS
1 100μF/10 VW axial lead electrolytic
6 10μF/10VW PC electrolytics
1 0.1μF metallised polyester
3 .01μF metallised polyesters

RESISTORS (all ¼W, 5%)
2 × 1MΩ, 14 × 100kΩ, 3 × 47kΩ, 9 x 10kΩ, 2 × 4.7kΩ, 1 x 2.2kΩ, 2 × 1kΩ, 1 x 10Ω.

NAND gate IC5a. IC5a now gates through pulses from oscillator IC3c to give the "hit" sound.

This hit sound lasts for about one second and is held on by the 10μF/100kΩ delay circuit on the output of IC5c. (Note: the output of IC5c goes high again immediately after the "hit".) Diode D3 is included so that the 10μF capacitor discharges rapidly when the output of IC5c swings low.

A PNP transistor is used to drive the loudspeaker via a 10Ω resistor. The base of the transistor is driven from three sources: IC3a, IC5a and from the Fire button via diode D2 and a 1kΩ resistor.

IC3a drives the transistor when the Fire button is pressed. However, because D2 is forward biased, the signal drive is attenuated by the 1kΩ resistor between the base and D2. When the Fire button is released, D2 is reverse biased, the sound momentarily becomes louder, and the decaying photon torpedo sound is produced.

If a hit is made, IC5a drives the transistor via a 4.7kΩ resistor. Virtually no mixing of the IC3a and IC5a outputs occurs since IC3a stops soon after the hit.

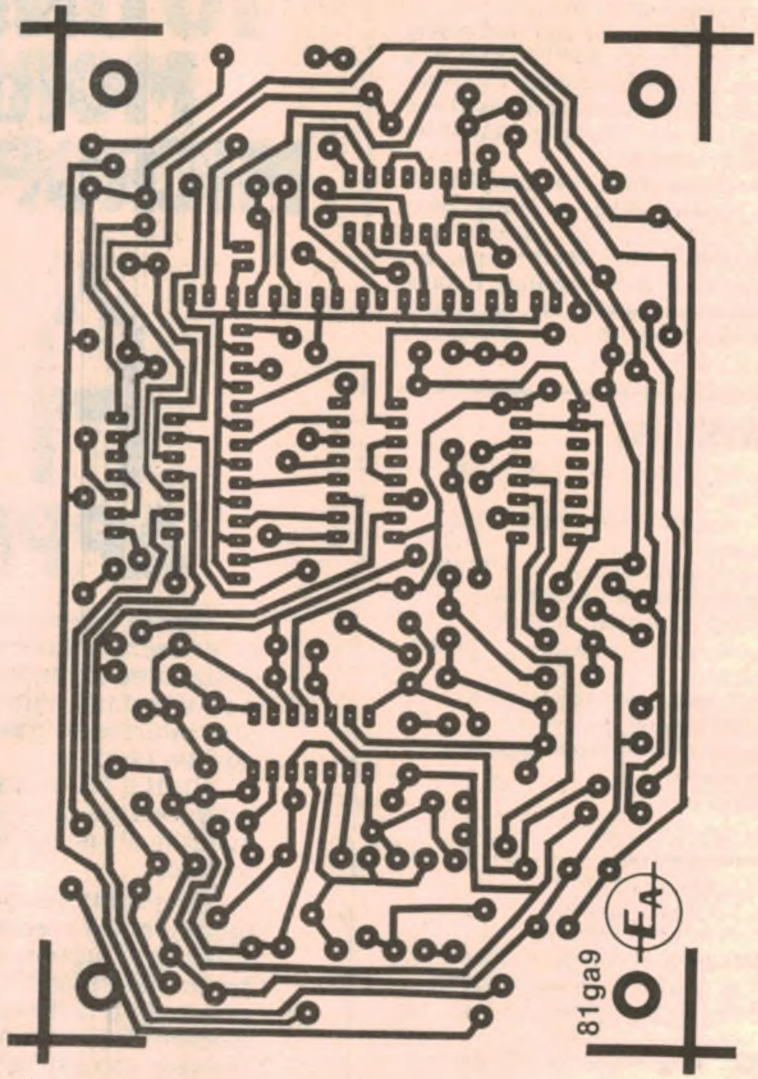
Power for the circuit is derived from a single 9V battery and is decoupled with a 100μF electrolytic capacitor. Battery life should be quite good. Four of the ICs are CMOS devices (and thus have low current drain), while the potentially "current-hungry" LEDs are only pulsed on for short periods of time.

CONSTRUCTION

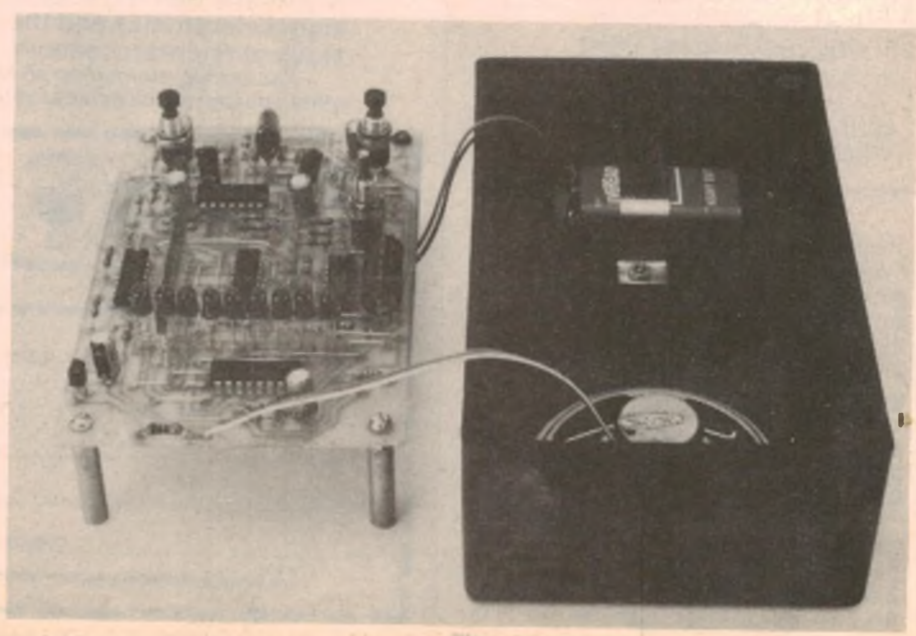
Despite the rather tricky operation of the circuit, the construction is simple. All components, with the exception of the battery and the loudspeaker are mounted on a printed circuit board (PCB) measuring 132 x 83mm and coded 81ga9.

Commence construction by mounting the various components on the PCB according to the component overlay diagram. Solder in the wire links, resistors and capacitors first, followed by the diodes and the transistor. Note that the link below the rectangular LED must be curved (or insulated) to prevent it shorting to the cathode of the adjacent LED.

The two pushbutton switches and the on/off switch are soldered directly to the



Above is the actual size artwork for the printed circuit board. View below shows the completed board, ready to be assembled into the case.

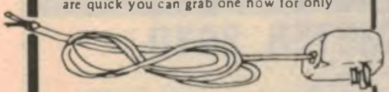


SPECIALS! SPECIALS! SPECIALS! SPECIALS!

JAYCAR'S PURCHASE OF THE ENTIRE STOCK OF MICRONICS (RANDWICK) HAS ENABLED US TO PASS ON GREAT SAVINGS

FERGUSON PLUG ADAPTOR SPECIAL

Fully Australian approved Plug Pack. Type PPA 1024. Can supply 30V RMS AC @ 250mA! These units normally sell for $8.50 but if you are quick you can grab one now for only

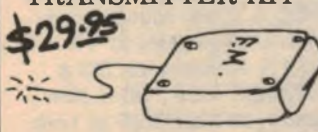


ONLY $3.00!!
SAVE OVER 60%

SORRY - due to weight personal shoppers only or $2.00 p&p.

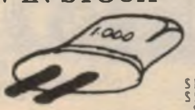
FM CRYSTAL CONTROLLED TRANSMITTER KIT

$29.95



Ideal for a high-quality wireless microphone system. We have taken the idea of the simple 1-transistor "toy" wireless microphone a step further. The problems with the simple unit is that they "drift" to an appreciable amount giving the AFC in the front end of the average FM tuner too hard a job to keep track of the signal.
By keeping the design simple and using quartz crystal control, we have produced what is still a simple transmitter but has the ability to send a quality drift free signal. This means that you can use this unit with a quality microphone and modest Hi Fi tuner to produce a good quality stage wireless microphone system!!
Housed in a small all-plastic box measuring 85 x 56 x 29mm it is a compact unit. A common type connector can be fitted to one end of the box for example enabling it to plug onto the end of a stage mic. Naturally the transmitter has many other applications as well. You can try one of these great little transmitters out for only $29.95 including the box.

HARD TO GET CRYSTALS NOW IN STOCK



1.000MHz	$16.50
1.8432MHz	$12.50
2.000MHz	$8.50
4.000MHz	$7.50
4.3361MHz	$7.50
8.867238MHz	$7.50

HIGH POWER IONIZER KIT

ONLY $24.50

Demand for this kit has been high indicating a strong need for a high-power ionizer. The Jaycar ionizer runs directly from the 240V mains and is capable of producing a high intensity electric field. Output voltage of the unit is around 7.5KV.
This remarkably low cost ionizer has been produced for the enthusiast who wishes to experiment with the effects of ionized atmosperes. We must emphasise that whilst this ionizer can be made to produce small quantities of ozone it will not do so unless you specifically configure it to do this.
The Jaycar ionizer runs directly from the mains and therefore it is a kit for experienced mature constructors only. It does have a number of built-in safety features however, along with a multi-page instruction brochure.
Grab a Jaycar Hi-power ionizer NOW for only $24.50

PCB SELLOUT

Listed below are many PCB's which are not commonly available. Check them out.

PROJECT	NORMALLY	THIS MONTH
ETI309 Car battery charger	$3.50	$2.00
ETI443 Compressor/Expander	$4.50	$2.50
ETI414C Power supply/Meter driver 414 mixer	$4.50	$2.55
ETI414D Preamp board for stage mixer	$4.50	$2.50
ETI419 100W Preamp PCB	$4.50	$4.00
ETI458 Peak Level Meter	$3.55	$3.25
ETI480/50 Famous 480 50 watt amp	$3.00	$2.50
ETI480/100 As above but 100 watts	$3.50	$3.25
ETI480 2-channel preamp for above	$3.50	$3.25
ETI482 480 stereo amp PCB	$4.50	$2.20
ETI581 +/-15V 150mA PCB	$3.50	$3.25
Jaycar 2010 +/-15V (any current) PCB	$3.50	$1.00
ETI603 Sequencer PCB	$4.50	$4.00
ETI604 (we think it was the metronome)	$4.50	$4.00
ETI729 UHF masthead amp	$2.50	$1.50
ETI 735 UHF convertor	$2.50	$1.50
ETI330 Car alarm	$2.50	$1.50

"ELECTRONICS AUSTRALIA" PROJECTS

75CD7 Cap Discharge Ignition	$3.50	$2.50
816A-3 Graphic Analyser	$12.50	$5.00
81CC5 "PC Birdies"	$2.55	$1.00
81AO6 Low distortion audio oscillator	$3.70	$3.70
81SP5 Sound level meter	$3.00	$2.00

81RC4A IR 2-channel switch PCB's
81RC4B
81RC4C
ALL $2.50 NOW $1.50 ea

TRANSISTOR SPECIALS!

TRANSISTOR SPECIALS
More stock from our purchase of Micronic's stock. You reap the benefit!!!

PART — THIS MONTH

BC209C
BC204
2N3638
2N3568
2N3566
2N3646
2N4355
2N3639
2N4392

ALL 10 CENTS EACH (minimum 20)

Remember, stock can only be sold once. So buy now!!

Call in to our showroom. We have literally dozens of specials from our Micronics buy. If you cannot afford to wait until next month that is!

CMOS SPECIALS!!

We have bought the entire stock of the mail order company 'Micronics' of Randwick NSW. They wanted to get out of the business so their loss is your gain!
Most of the CMOS below are the 'AE' type (NOT 'B') - but they are prime spec. brand new stock.

PART No	NORMALLY	THIS MONTH
4000AE	0.40	0.25
4002AE	0.48	0.25
4006AE	1.10	0.50
4007AE	0.38	0.20
4012AE	0.35	0.20
4018AE	1.50	0.50
4023AE	0.28	0.15
4024AE	1.18	0.50
4026AE	2.20	1.00
4027AE	0.90	0.50
4028AE	1.18	0.50
4029AE	125	0.55
4033AE	1.50	0.50
4047AE	1.20	0.50
4050AE	0.60	0.30
4051AE	0.95	0.40
4055AE	2.55	1.00

Remember! This CMOS will work in most 'B' suffix applications. We also carry the best range of 'B' suffix CMOS in town.

AUDIO AMPLIFIER IC's SLASHED!!

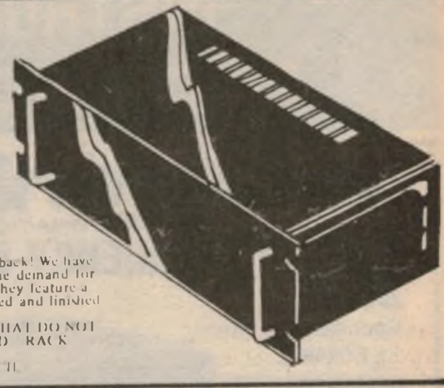
TYPE	POWER	NORMALLY	THIS MONTH
TAA611B	2W	$2.50	0.50c
TBA810	6.5W	$4.50	0.95c
TBA651	AM Tuner IF	$6.50	0.50c

FREE DATA SHEET WITH EACH UNIT!

SN 76477 NOISE GENERATOR SPECIAL
Normally $6.75 each NOW $4.75 each

RACK CABINET

ONLY $45



19" black anodised rack boxes back! We have had trouble keeping up with the demand for these 5¼ x 19" rack cabinets. They feature a magnificent 3mm black anodised and finished front panel.
BEWARE OF RACK BOXES THAT DO NOT CONFORM TO STANDARD RACK DIMENSIONS!!!
OURS ARE ONLY $45.00 EACH

NEW 8 CHANNEL MIXER KIT

We are completing work of our new 8-channel stereo mixer. A few specs
- 19" rack or console mount
- Balanced inputs and 2 outputs
- Equalisation on each input
- Uses latest NE5534 Op amps
- Very low noise
- Effects (eg "Echo" etc)
- Foldback send
- Switchable line and mic level inputs with separate attenuation control

Do not buy a mixer unit until you see this. Send SAE for more information.

ETI 489 ANALYSER KIT BACK!!!

This is the "real-time" analyser with built-in 10 band LED bar graph display of the audio spectrum. Completely portable and self contained instrument. Ideal for live P.A. work or home studios.
Now fitted with uniform brightness rectangular LEDs for a more pleasing dispay.
BACK BY POPULAR DEMAND
ONLY $155

ONLY $155.00

SPECIAL EA GRAPHIC ANALYSER

Now is your chance to grab this fantastic kit at a bargain basement price. We are stocked to the rafters and we need the space for more great kits.
Complete kit including quality front panel, fibreglass PCB etc.
NORMALLY $89.00
THIS MONTH $69.00
SAVE $20.00!!!
Colour option only $25.00. Horwood box to suit only $16.50
WE NEED THE SPACE - SO YOU REAP THE BENEFIT

2 CHANNEL EQUALISER KIT MODEL 2010

This truly magnificent equaliser kit the Jaycar 2010 is electrically identical to the ETI 485 & comes in a 19" rack cabinet with attractive front panel with push-button changeover switches.
NORMALLY $162 NOW ONLY $119
SAVE $43!!!!!!

SAVE $43.00

MUSICOLOR IV

2 kits in one! The lightchaser kit and the Musicolor kit in the one box and it's the original article box. 4 channels. Can be used with the Jaycar Light Bank shown below.

ONLY $94.50

LIGHT BANK

4 x ES lamp fittings on a special pre-punched mounting bracket. Make your project save where 240V AC is concerned and use this light bank. Does not include globes.

ONLY $29.50

KITS

"ELECTRONICS TODAY"

ETI-Car Burglar Alarm (July '81)	$24.50
ETI446-Audio Limiter	$9.00
ETI480-50 watt Amp Kit (module)	$23.00
ETI480-100 watt Amp Kit (mod.)	$27.00
ETI466-300 watt Amp Kit (mod.)	$70.00
3002SP-2 channel Speaker Protector	$13.00
3002PM-2 channel Power Meter 5-300 watts can be used as "VU"	$18.00
ETI473-Moving Coil Preamp absolutely comp. including power supply	$95.00
ETI729-VHF Masthead Amp Comp.	$35.00

"ELECTRONICS AUSTRALIA"

EA - "Le Gong"(3/81) Case extra	$14.95
EA - "PC Birdies" (5/81) Comp.	$14.95
EA - 2 channel Infra-Red Remote Control (5/81) complete	$65.00
EA - "Sound Level Meter" (5/81) comp. absolutely complete	$39.50

Jaycar

NOTE! NEW SHOP HOURS
Mon-Sat 9am-5.30pm
Sun- 10am to 2pm
Open Thursday night until 8pm.

380 Sussex St Sydney 2000

Ph. 2646688 Telex 72293 Mail Orders To: Box K-39 Haymarket 2000

P&P: $5 - $9.99 — $1.00; $10 - $24.99 — $2.00 $25 - $49.99 — $3.00

LOOK AT THESE PRECISION INSTRUMENTS AT A HOBBYISTS PRICE FROM CHRISTIE RAND PTY LTD

sabtronics
INTERNATIONAL INC

600MHz FREQUENCY COUNTER 8610

Specification: 10Hz to 600MHz guaranteed (5Hz to 750MHz typical). Sensitivity ≤ 10mVRMS– 100MHz, 50mVRMS for 100 to 450MHz, 70mVRMS 450 – 600MHz Temperature Stability 0.1ppm/C Gate time .1 sec 1 sec 10 secs. Ageing rate ≤ ±5ppm/year. Accuracy 1ppm + 1 digit. Protection: 90VRMS at 10KHz – 10VRMS at 600MHz

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

DIGITAL MULTIMETER 2010

A 0.1% Digital Led Multimeter for the price you would pay for a less accurate DMM. JUST LOOK AT THESE RANGES. DC & AC VOLTS from 100uV to 1000 Volts in 5 ranges each from 0.1% accuracy on DC & 0.5% accuracy on AC. DC & AC CURRENT from 100nA (0.1uA) to 10 Amps in 6 ranges each from 0.1% accuracy on DC & 0.5% accuracy on AC. RESISTANCE from 100 n ohm to 20 Mohm from 0.1% accuracy. DIODE TEST at 1mA, 10 micro Amp 0.1 micro amp. AC VOLT frequency range 40 Hz to 40 KHz. Overload protection 1200VDC of peak AC except on ACV: 2V & 2V ranges & AC/DC current 250V DC or AC peak, 2A & 10A at max (unfused)

PRICE: Kit $120.00 + tax = $138.00
Assembled: $140.00 + tax = $161.00

1GHz FREQUENCY COUNTER 8000

Specifications: 10Hz to 1GHz 15mV – 30mV sensitivity will resolve 10Hz at 1GHz. Ageing rate ± 5ppm/year. Temperature stability ± 1ppm /20-40°C

PRICE:
Assembled: $490.00 + tax = $563.50

FUNCTION GENERATOR 5020

Specification: 1Hz – 200KHz in 5 ranges sine, square & triangle wave. High 10Vpp 600. Low −40dB. TT1 out drive 10TT1 loads. DC Sweep input give 100:1 frequency range output & offset control.

PRICE:
Assembled: $220.00 + tax = $253.00

Batteries Not Supplied. Postage & Packing $3.00

WOULD YOU LIKE SOME OVERSEAS SOURCED EQUIPMENT LOCALLY MANUFACTURED IN ORDER TO CUT COSTS? DO YOU REQUIRE PROTOTYPES OR PRODUCTION QUANTITIES? WE MANUFACTURE FROM YOUR SPECIFICATION, DRAWINGS OR MODEL & OUR PRICES ARE AMONGST THE MOST COMPETITIVE IN AUSTRALIA.
WE ALSO UNDERTAKE DESIGN, DRAFTING, PCB LAYOUTS AND SERVICING CONTRACTS FOR YOUR EQUIPMENT, WITH A FAST TURNAROUND.

WE ARE ALSO AGENTS FOR THE RAYPROOF CORP WHO ARE THE LARGEST MANUFACTURER OF RADIO FREQUENCY SCREENED ROOMS IN THE WORLD AND CAN OFFER ROOMS WITH AN ATTENUATION OF 140 dB's. OUR ENVIRO-SYSTEMS DIVISION ALSO MAKES SCREENED ENCLOSURES TO SUIT CONFERENCE ROOMS, BOARD ROOMS & OTHER SECURE AREAS SO THAT THEY REMAIN FREE FROM "BUGGING".

CHRISTIE RAND PTY LTD

PO BOX 48 EPPING, NSW, 2121
PHONE (02) 477 5494

PLEASE SUPPLY
KIT ☐ ASSEMBLED ☐
AMOUNT $ .... INC $3.00 P&P
NAME ....
ADDRESS ....
....
BANKCARD No ....
EXPIRY DATE ....
SIGNATURE ....

PCB. As shown in Fig.1, they should be mounted so that the top thread of the switch stands off the board by about 18mm. Note that the solder lugs may have to be narrowed with a file so that they will fit neatly into the holes provided.

The LEDs are best soldered in place with the aid of a template. Cut a piece of stiff cardboard 18mm wide by about 70mm long. Now solder the LEDs in position, one at a time, making sure that the top of each LED is 18mm above the PCB (use the template) and that the LED is the right way round. When all are in place, they should be at an even height with no gaps between them.

This done, the ICs can be soldered into circuit and connections made for the battery and loudspeaker leads. Observe the usual precautions when soldering the CMOS devices to protect them against damage from static electricity. Connect the barrel of your soldering iron to the earth track on the PCB (use a clip lead) and solder the supply pins first to enable the internal protection circuitry.

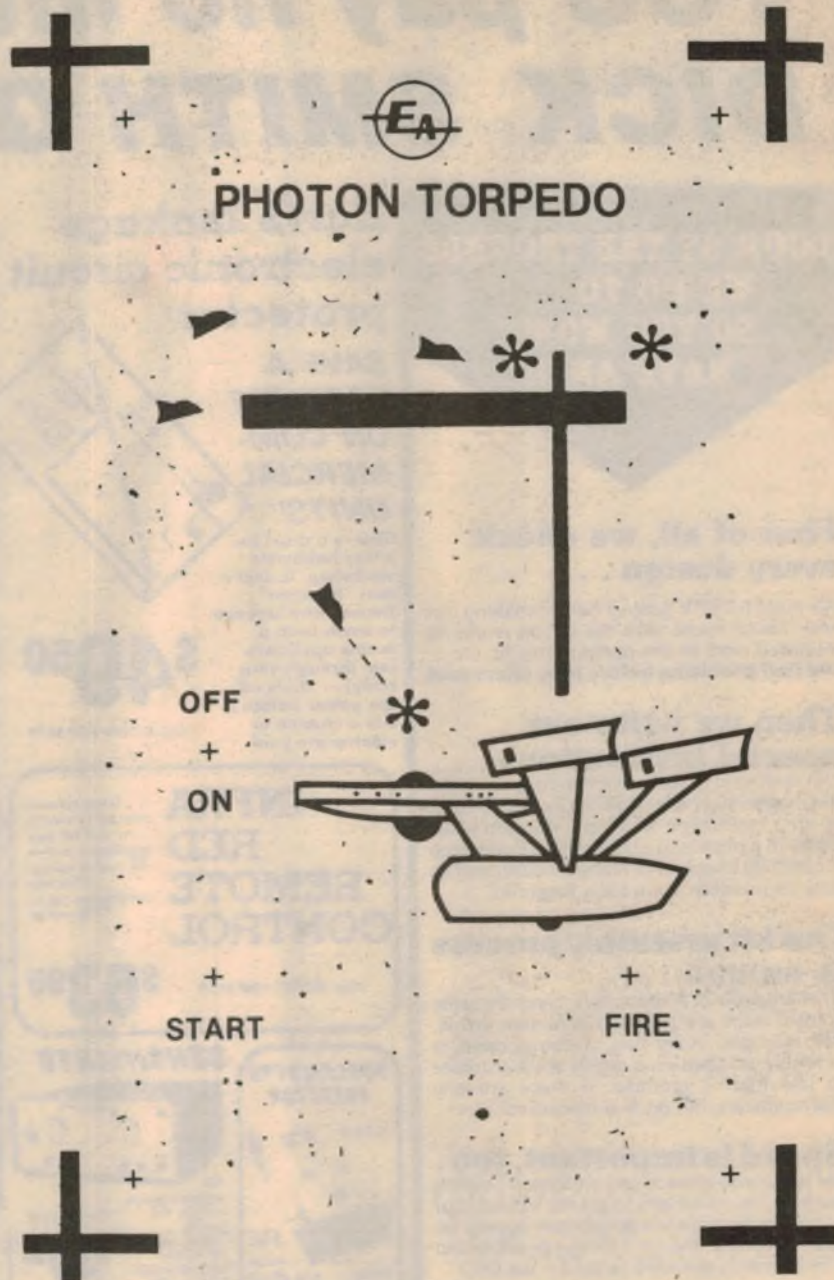
With the PCB completed, go back over your work, carefully checking for possible wiring errors. In particular, make sure that all polarised components have been correctly oriented. These components include the ICs, the transistor, LEDs, diodes and electrolytic capacitors.

We mounted the assembled PCB inside a plastic zippy box measuring 158 x 95 x 50mm. A Scotchcal adhesive label glued to the aluminium lid provides an attractive front panel for the game. This should be given a coat of hard-setting lacquer, such as "Estapol", to prevent scratching.

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

$24.00

This includes sales tax.



Here is an actual-size reproduction of the front panel artwork.

When the lacquer is dry, the switch holes can be drilled and the slots made for the LEDs. The slots are best made by first drilling along the marked lines with a small drill and then filing to shape so that the LEDs are a neat fit. This done, place the lid in position and screw on the nuts for the switches.

Provided you've done the job neatly, the PCB, will just fit within the box with the lid in place.

Although not strictly necessary, we provided additional support for the PCB by attaching it to the base of the box using four 25mm and 3mm spacers. Fig. 1 shows the general idea. Note that the 3mm spacers are made up using machine nuts (two per spacer).

As shown in the photograph, the loudspeaker is held in position with stiff wire strapped across it and looped through holes in the bottom of the box. You will also have to drill additional holes in the box to provide a sound grille for the loudspeaker (before mounting the loudspeaker of course!). The battery is held in place with a piece of scrap aluminium fashioned into a bracket.

With the wiring completed; mount the PCB assembly inside the box, screw down the lid, and attach the four rubber mounting feet (see Fig 1). You are now ready to shoot down the attacking alien craft.

Finally, there are a few adjustments which can be made to the circuit to suit your own personal requirements. To make the torpedo travel faster, reduce the 4.7kΩ resistor between pins 8 and 10 of IC3c; to reduce the time the torpedo sounds, decrease the 0.1μF capacitor connected to pin 3 of IC3a; and to increase the pitch of the sound, reduce the .01μF capacitor connected to pin 1 of IC3a.

The length of time the "hit" sound lasts can be adjusted by varying the 100kΩ resistor between IC5b and IC5c, while the maximum speed for the row LEDs is adjusted by varying the 100kΩ resistor in the negative feedback path of IC3d.

YOU pay no more for a DICK SMITH Quality Kit.

LOOK AT THE TROUBLE WE GO TO . . . SO YOU WON'T HAVE ANY!!

First of all, we check every design . . .

We build EVERY project before making our kits: just to make sure the circuit works as intended, and all the components fit, etc. **We find problems before they affect you!**

Then we write our special instructions . . .

Our technical department carefully re-writes the magazine articles into our exclusive step-by-step instruction manuals. We don't just throw in a photostat of the article! Every step is carefully checked to make construction as easy as possible: even for a beginner!

Our kit assembly process is unique . . .

At every stage of kit assembly, careful quality control steps are taken to eliminate errors. For example, every bag of components is carefully weighed on a digital scale accurate to less than 1 gramme: if there are any discrepancies, the pack is discarded!

Speed is important, too .

We know how anxious you are to start building the new kits: so we aim to get the kits into our stores by the time the magazines appear on sale. Of course, this isn't always possible: but if its humanly possible to do it – we do!

Our after-sales-service is very special too . . .

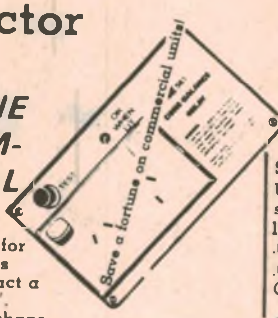
Who else offers a kit repair service? Our 'Sorry, Dick – it doesn't work' service means your kit is virtually guaranteed to work: even if you run into problems! For a lower-than-normal service charge, we find any errors you might have made: and fix them!

CAN ANY OTHER KIT SUPPLIER OFFER YOU THIS?

DON'T BE FOOLED BY INFERIOR KITS WITHOUT THESE VERY IMPORTANT FEATURES!

Earth leakage electronic circuit protector

SAVE A FORTUNE ON COMMERCIAL UNITS!



This is a must for every hobbyists workshop. In fact a real "lifesaver". Senses any leakage to earth from a mains appliance (eg. through your body) — shuts off the power before it has a chance to electrocute you!

$49.50

Cat. K-3315 P&P $3.00

LOOK AT THESE FANTASTIC SPECS!

DICK SMITHS' EXCLUSIVE SILK SCREENED FRONT PANEL

Cat. K-3467 P&P $4.00

AUDIO OSCILLATOR

Super low distortion audio oscillator. Uses the new VMOS for greater stability. Specs: Freq. range — 15Kz to 150KHz. Distortion .003% Mid band .011% @ 100KHz. .024% @ 20Hz. Amplitude stability ±1dB. Comes with deluxe silk screened front panel!

$65.00

Will negative ions improve your health?

find out with this ION GENERATOR

This easy to build kit breaks down dust and cigarette smoke particles. aids to a healthier and happier life. Comes complete with exclusive Dick Smith emitter head.

$37.50 Cat. K-3335 P&P $3.00

INFRA RED REMOTE CONTROL

Uses remote control to switch on and off any appliance within 10 metre range. Controls appliances up to 1200 watts.

Cat. K-3380 P&P $4.00

$63.95

SPECIAL!

AUDIO ANALYSER

K-3510 P&P $4.40

NOW **$75.00**

Like the horse without a cart... a graphic equaliser is fine - but for the best sound you need the analyser to complete your sound system. - Can also be used as level meter.

POOLS/LOTTO SELECTOR

K-3392

Picks numbers at random **$19.50** P&P $2.00

BENCHMATE

An indespensable tool for the bench. Combination 1W audio amplifier and 1.25 — 16V power supply @ up to 1A.

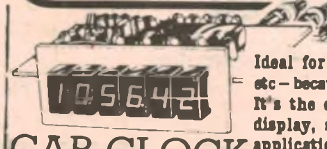
Cat. K-3478 **$39.50** P&P $3.00

SPEED SENTRY

Allows you to pre-set to a certain speed and gives a warning signal if you exceed the set speed.

$11.75

Cat. K-3245 P&P $2.00



Cat K-3498

Ideal for any car, boat, plane, etc – because it's 12 volt operated! It's the only one with seconds display, so its superb in home applications, too.

CAR CLOCK

$19.75

NOW AVAILABLE THE FANTASTIC SUPER 80 BUSINESS QUALITY KIT COMPUTER

See our double page ad elsewhere in this issue for full details

$15.75

K-3390 P&P $2.20

LEDS AND LADDERS

One of our most popular games; now completely updated, with brand new circuitry and controls.

HOT CANARY

An electronic bird whistle that sounds authentic. Keeps the kids amused for hours!

$14.95

Cat. K-3395 P&P $2.00

NEW KITS

ALL NEW-UNIVERSAL TIMER.

An incredibly versitile 7 function timer. Can be used as kitchen timer,stop watch, rally timer and industrial timer - with bright 4 digit 7 segment LED display.

$39.50

Case extra.

Cat K-3435

- Darkrooms
- Eggs!
- Industrial processes
- Business

EASY TO BUILD

DIGITAL CLOCK/ THERMOMETER.

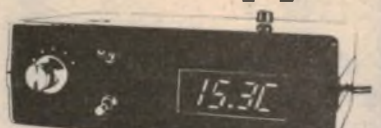
Short Form Kit

Cat K-3436

Huge bright red digital display, 6 display modes. Time and temperature display, alarm and control for clock, radio etc. 12/24 hour- C/F. Battery back up facility.

*Panel not supplied. Case shown optional (H-2505 @ $19.95)

$47.50



INCREDIBLE MUSICOLOR/CHASER

$89

Cat K-3143

complete with DICK SMITH design front panel & pre-drilled chassis.

Includes our famous 'Sorry Dick It Doesn't Work' Guarantee

What a beauty! A Musicolor and a Chaser all in one! This incredible new kit from Electronics Australia is virtually a whole lightshow in one case. (Build our strobe kit too and you'll have the best parties in the neighbourhood! Complete kit, including instructions.

UNIVERSAL SOUND SYNTHESIZER $17.50

Cat. K-3508 P&P $3.00

This kit consists of 5 projects based around a Texas Instrument IC. All dealing with sound effects!

ELECTROCHUNE *Synthesizer*

A versatile keyless monophonic organ that uses the circuitry of a synthesizer!

$68 Cat K-3506 P&P $4.00

CAR ALARM

New improved design. Without false triggering problems. Simple installation. Protect your valuable property from would-be thieves!

$27.50

Cat. K-3253 P&P $3.00

PARTS FOR NEW KITS

Semiconductors

Optically isolated triac 400v **Cat. Z-4516 $2.75**
MA-1026-ALR Clock/therm module
Cat. Y-1053 $29.50.
LM 3342 Temper/sensor **Cat. Z-6810 $1.95.**
4019B Quad and/or select gate **Z-5619 $1.00.**
40194 4 Bit bi-directional shift reg. **Z-5694 $3.50.**
SN76488N Uni synthesiser IC chip **Z-6823 $4.95**
LM394B Duel differential super mix pre - amp
Cat. Z-6083 $4.50
ICM7216B Frequency per counter **Cat. Z-5747 $29.95**
ICL7106 3.5 Digit driver **Cat. Z-6300 $9.50.**
ICD Display - 4 Digit **Cat. Z-4175 $8.95.**
MM5865N Uni timer IC Cat. Z-6816 $9.75
Z-6816 $9.75
4093B 2-Nand Schmitt trigger **Z-5693 $0.65.**
TLO 71 Bifet Op. Amp. **Z-6030 95c**
TLO 74 Quad Bifet Op. Amp.
Z-6034 $2.75.
CA 3080 Transconductance Amp. **Z-6024 $2.45**
CA 3140 FET Op Amp. **Z-5417 $1.84**
SH 76488 Complex sound generator
Z-6823 $4.95.

Printed Circuit Boards

Uni sound synthesiser **H-8640 $2.50.**
E.A. SEPT.
81SM7 Pavlovs Bagatelle **H-8411 $2.95.**
E.A. AUG.
Musicolour Mk IV **H-8410 $9.95.**
E.A. AUG.
Pavlovs Bagatelle **H-8411 $2.95.**
E.A. AUGUST
Super 80 computer **H-8402 $97.50.**
E.A. AUGUST.
Musicolour/ chaser **H-8410 $9.95.**
E.A. AUGUST.
Electrochune **H-8404 $11.50.**
E.A. JULY.
Pools/ Lotto Selector **H-8403 $2.50.**
E.A. JULY

UHF TV Downconverter

This single channel kit converts transmission from the UHF band down to the VHF band for normal TV reception

$32.50

Cat. K-3235 P&P $3.00

DICK SMITH Electronics

Mail Order Centre: P.O. Box 321 Nth Ryde NSW 2113 (02) 888 3200

145 Parramatta Rd **AUBURN** 648 0558; 613 Princes Hwy **BLAKEHURST** 546 7744; 818 George St **BROADWAY** 211 3777; 531 Pittwater Rd **BROOKVALE** 93 0441; 147 Hume Hwy **CHULLORA** 642 8922; 162 Pacific Hwy **GORE HILL** 439 5311; 30 Grose St **PARRAMATTA** 683 1133; 125 York St **SYDNEY** 290 3377; 173 Maitland Rd **NEWCASTLE** 61 1896; 263 Keira St **WOLLONGONG** 28 3800; 96 Gladstone St **FYSHWICK** 80 4944; 166 Logan Rd **BURANDA** 391 6233; 842 Gympie Rd **CHERMSIDE** 59 6255; 60 Wright St **ADELAIDE** 212 1962; 399 Lonsdale St **MELBOURNE** 67 9834; 656 Bridge Rd **RICHMOND** 428 1614; Cnr Dandenong & Springvale Rds **SPRINGVALE** 547 0522; Cnr Wharf St & Albany Hwy **CANNINGTON** 451 8666; 414 William St **PERTH** 328 6944 **COBURG** 383 4455

REMEMBER: They look so good your friends will never believe you built them!

4-digit universal timer & stopwatch

This project should prove really popular. It's a versatile "Universal Timer" that can be built as a stopwatch, an event timer or a countdown timer. Features include two independent counters that can time two different events at once, a bright 4-digit LED readout and switch-selectable timing rates from .01 to 1 second. We have no doubt that it will find many applications in sporting events such as athletics, yachting and rallying.

by GERALD COHN & GREG SWAIN

Here at last is a project that you can tailor to your own requirements. It's based on a single timer IC that's so versatile one could easily become confused just wading through all the various options.

Essentially, you have the choice of wiring the unit to operate in one of seven different modes, or functions. Sufficient information is presented here so that you can choose the function that's best suited to your particular application and, to this end, we have designed a "universal" printed circuit board to make the job as easy as possible.

We elected to wire our unit to produce a versatile stopwatch with optional event counter. As shown in the photograph, the circuit is built into a low-cost plastic zippy box fitted with three momentary-contact pushbutton switches on a 4-position rotary "Rate Select" switch. The latter sets the timer resolution to either .01s, 0.1s or 1s.

Alternatively, the Rate Select switch can be set to "EXT" so that timer counts external clock pulses (ie. operates as an event counter).

The maximum interval that can be timed and the display format both depend on the position of the Rate Select switch. In the low resolution 1s mode, for example, the unit displays elapsed time in minutes and seconds for a maximum count of 99hrs 59s. The other two modes display the results in seconds only (plus tenths and hundredths of seconds as appropriate), with maximum times of 999.9s and 99.99s for the 0.1s and .01s modes respectively.

In practice, if a maximum count is reached, the unit resets to zero and recommences timing. Leading zeros are automatically blanked during counting.

The three momentary-contact switches control the basic stopwatch functions and are labelled Start/Stop, Final Event and Reset. The Start/Stop button initiates timing by two independent counters and can subsequently stop and restart one of the counters while the other continues counting. The Final Event button stops both counters simultaneously, while the Reset button resets them to zero ready for the next event.

Once the Final Event button has been pressed, the contents of each counter are alternatively displayed by pressing the Start/Stop button. The function of the Reset button is self-explanatory – it simply resets both counters to zero.

We'll have more to say about the way the unit operates a little later on.

THE TIMER IC

At the heart of the circuit is an MM5865 "Universal Timer" IC from National Semiconductor. This 40-pin PMOS device contains all the logic necessary to control two 4-digit counters, to blank leading zeros and to cascade to another MM5865 device. Signals to various control pins start, stop and reset the counters, determine which of seven operating functions is performed, and set the resolution of the display (.01s, 0.1s, 1s or external clock).

Other features of the chip include up/down counting and selectable 6 or 10 modulo for digits 2, 3 and 4.

Block and Connection Diagrams

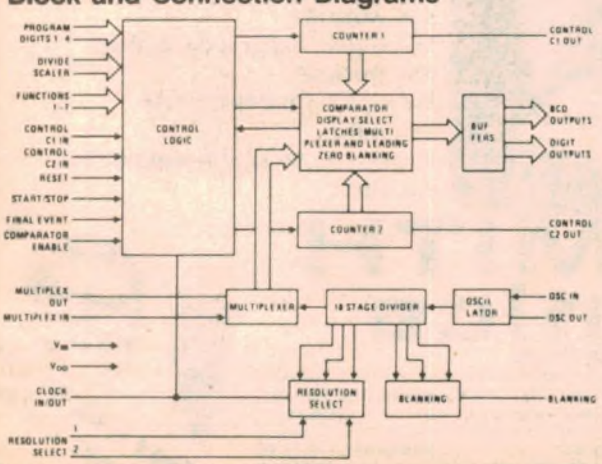


FIGURE 1.

Dual-In-Line Package

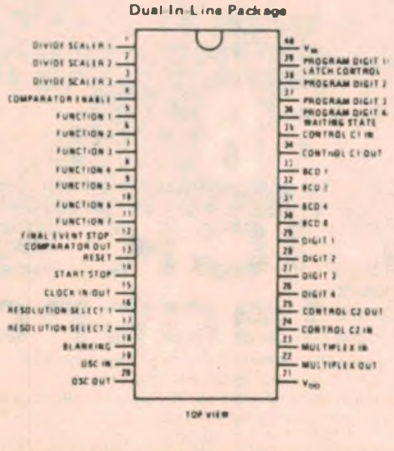
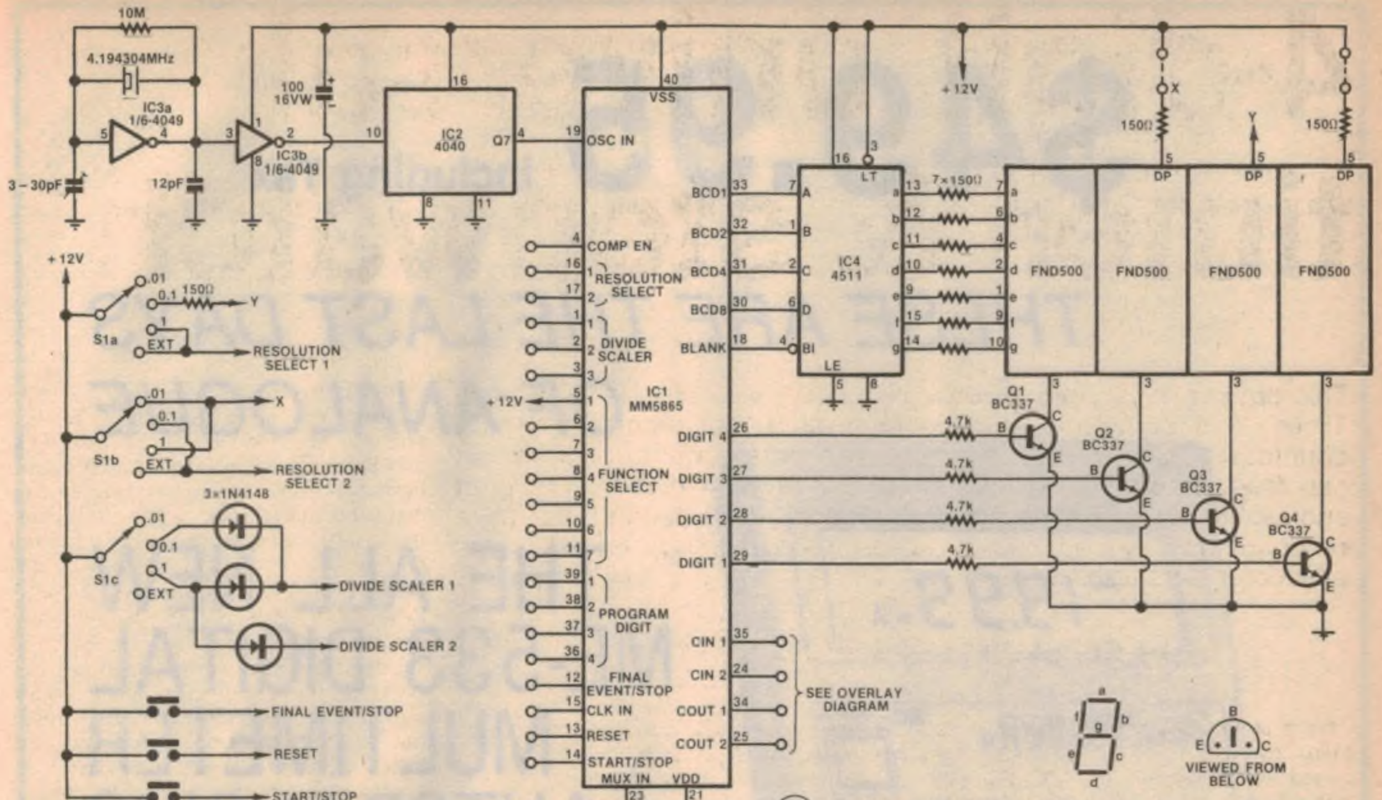


FIGURE 2.

Figs 1 & 2: these block and pin connection diagrams for the MM5865 will enable you to wire the circuit to your own requirements.



UNIVERSAL TIMER/COUNTER

7/CL/-

It's really very simple to use the MM5865 in a circuit that will perform a specific function. To change from one function to another, all you have to do is wire the appropriate function select pin (5-11) to the Vss (+12V) line and either add or delete logic switching to a few control pins.

The main thing to remember is that the Vss rail (+12V) represents logic high, while the Vdd rail represents logic low. A control pin is enabled simply by connecting it to logic high (usually via a switch), and disabled when left floating. Since the control pins are all tied to the Vdd rail by internal resistors, no external pulldown resistors are required.

Let's take a closer look at each of the seven chip functions and see what they have to offer. They are:

- Function 1: standard start/stop with total elapsed time memory;
- Function 2: standard start/stop with total accumulative event time;
- Function 3: sequential with total elapsed time memory;
- Function 4: standard split;
- Function 5: rally with total elapsed time memory;
- Function 6: programmable up count, repeatable upon command;
- Function 7: programmable down count.

The circuit (above) can be broadly divided into three sections: a CMOS clock (IC3a), the MM5865 timer IC, and the display circuitry.

The prototype was built into a low-cost plastic zippy box. Unit is powered either from a 12V car battery or from a 9-12V plugpack supply.

FUNCTION 1: this is the function we used for our timer. Counters 1 and 2 start counting up when the start/stop pin is momentarily taken high, but only counter 2's contents are displayed. A second pulse on the start/stop input stops the clock pulses to counter 2 and displays its contents, while counter 1 continues to count. A third pulse on the start/stop input resets counter 2, and starts a new count from zero. Subsequent pulses at the start/stop input repeat this sequence.

Counter 1 continues to count while counter 2 is being stopped and restarted. When a logic high is applied to the final event/stop input, both counters stop counting and the contents of counter 2 are displayed. The contents of counter 1 can now be examined by applying another pulse to the start/stop input. Further pulses at the start/stop input cause the display to alternately show the contents of the two counters.

How to use the various chip functions:

RESET: resets all logic and counters in functions 1 to 5 and function 7. In function 6, all logic and counter 2 are reset, the contents of counter 1 remaining intact. For a reset to occur, this line must be taken to a logic high.
START-STOP: used to control the counters as explained in the text describing each of the seven functions. For START-STOP to have any effect on the counters, it must be taken to a logic high.
FINAL EVENT/STOP/COMPARATOR OUTPUT: used to indicate to the circuit that no more events are to be counted or timed. Final event/stop affects the counters when it is taken to a logic high. This pin also serves as an output for the comparator. When a valid comparison has been made between the two counters (this requires the comparator to be enabled), the output will go to a logic high and can be used to control external devices if required.
DIVIDE SCALE INPUTS: used to determine whether the counters will count in modulo 6 or modulo 10. The table that follows shows the codes required to set the counter modulus. (Note: 1 denotes logic high; 0 denotes logic low).

DIVIDE SCALER 1	2	3	COUNTER 1 D4	D3	D2	D1	COUNTER 2 D4	D3	D2	D1
0	0	0	10	10	10	10	10	10	10	10
1	0	0	6	10	10	10	6	10	10	10
0	1	0	10	6	10	10	10	6	10	10
1	1	0	10	10	6	10	10	10	6	10
0	0	1	10	10	10	10	10	10	10	10
1	0	1	10	10	10	10	6	10	10	10
0	1	1	10	10	10	10	10	6	10	10
1	1	1	10	10	10	10	10	10	6	10

COMPARATOR ENABLE: To enable the comparator, pin 4 is taken high and held there. To disable, leave the pin floating or tie it to Vdd.
RESOLUTION SELECT INPUTS: used to select the frequency of the clock pulses to the counters. The table that follows shows the codes required for the different values of prescaling.

RESOLUTION SELECT 1	2	FREQUENCY OF CLOCK TO COUNTERS	DISPLAY RESOLUTION
0	0	100Hz	0.01 sec
0	1	10Hz	0.1 sec
1	0	1Hz	1 sec
1	1	External	

CLOCK IN/OUT: functions as either an input or an output depending on the code applied to the resolution select inputs. The first three codes in the table for the resolution select inputs use this pin as an output, while the last code in the table turns this pin into an input. When the last code is selected, this pin is used to supply the clock pulses to the counters.
BLANKING OUTPUT: used to blank the display at the beginning and end of each digit time to allow for internal delays between two cascaded chips (see Fig. 2). The display is blanked when the blanking output is at Vdd (logic low).
OSCILLATOR IN/OUT: These two pins are the input and output respectively of an inverting amplifier. Normally a 32.768kHz crystal is connected across these two pins together with a resistor and two capacitors to form a single inverter oscillator (not used here).
MULTIPLEX INPUT AND OUTPUT: not used in this design, allows an external multiplex rate to be used with the chip. The multiplex rate inside the chip is one fourth the multiplex input and multiplex output rate. For normal use, the multiplex input pin is tied to Vdd.
CONTROL C1, C2 IN and C1, C2 OUT: used to cascade two chips together. When the control C1 input is floating (or tied to Vdd), clock pulses to counter 1 are inhibited. When control C1 is at Vss, counter 1 is enabled. Control C1 out is at Vss when counter 1 is at maximum count and is floating at all other times. The control C1 input must be floating while digit programming is taking place in function 7. Control C2 pins operate on counter 2 in a similar way.
PROGRAM DIGITS 1-4: used to program or set any desired count into counter 1 (functions 6 and 7). When program digit 1 is at Vss, the least significant digit of counter 1 advances at a 2.5Hz rate. There is no carry-over from digit to digit. Program digit 1 has no effect if tied to Vdd or left floating. Only one program digit may be held at Vss at any one time.
PROGRAM DIGIT 1/LATCH CONTROL: besides setting a count in digit 1 of counter 1 in functions 6 and 7, this pin also allows the display to show counter 2 counting as described in functions 3 and 4.
PROGRAM DIGIT 4/WAITING STATE INDICATOR: besides setting a count in digit 4 of counter 1 (functions 6 and 7), this pin also indicates that the chip has been reset and is in the standby mode at power on. In functions 1-5, the waiting state indicator is at Vss until a start/stop transition has occurred. Once a start/stop transition has occurred, the output remains at Vdd.
NOTE: in functions 1 to 5, leading zeros are blanked for both counters 1 and 2. In functions 6 and 7, counter 2 has leading zero blanking. At switch on the display is blank for functions 1 to 5, and all zeros are displayed for functions 6 and 7.

FUNCTION 2: counters 1 and 2 start counting with a positive going pulse (logic high) at the start/stop input. A second pulse to the start/stop input stops the clock pulses to both counters, and stores and displays the contents of counter 2. A third pulse resets counter 2 and restarts both counters, with the contents of counter 2 being displayed. Subsequent pulses at the start/stop input repeat this sequence.

A pulse applied to the final event/stop input stops both counters and displays the contents of counter 2. Further pulses on the start/stop input causes the display to alternate between the contents of the two counters.

FUNCTION 3: as before, counters 1 and 2 start counting when a logic high pulse is applied to the start/stop input. A second pulse at the start/stop input resets counter 2, starts a new up count and displays the old count on the readout. If a pulse is now applied to the latch control input, the display will show counter 2 counting until another pulse is applied to the start/stop input.

A pulse on the final event/stop input stops both counters and displays the contents of counter 2. A pulse now applied to the start/stop input changes the display to show the contents of counter 1.

FUNCTION 4: counter 2 starts counting up beginning with a pulse applied to the start/stop input and is displayed counting. A second pulse on the start/stop pin stores and displays the contents of counter 2, while subsequent pulses update the display of the counter which continues counting. A pulse applied to the latch control pin will display counter 2 counting until the next pulse at the start/stop input. A pulse at the final event/stop input stops counter 2 and displays its final contents.

FUNCTION 5: counters 1 and 2 start counting up when a pulse is applied to the start/stop input. Counter 2 is displayed counting. A second pulse applied to the start/stop input stops counter 2 and the contents of counter 2 are displayed while counter 1 continues counting. A third pulse restarts counter 2 and displays counting.

Subsequent start/stop pulses repeat this sequence of events. A pulse applied to the final event/stop input stops both counters and their contents are displayed as before.

FUNCTION 6: counter 1 is displayed at switch-on or reset and is preset to a specific value by the 4-program digit inputs (pins 39, 38, 37 and 36). An on-chip comparator is enabled by pulling pin 4 high and hold it there. Counter 2 is displayed counting up beginning with a pulse applied to the start/stop input. When the contents or counter 2 equal the contents or counter 1, counter 2 stops, its contents are displayed and the comparator output is enabled (goes high). A pulse applied to the reset input restores the original programmed value in counter 1 and disables the comparator output. The contents of counter 1 can be reprogrammed as desired, but the comparator input must first be left floating or pulled low (Vdd).

Another pulse applied to the start/stop input repeats this sequence. If the comparator output pin is connected to the reset input, automatic reset will occur. However, this connection must be broken during digit programming.

FUNCTION 7: in function 7, counter 1 is displayed all the time. Counter 1 is preset to a specific value using the 4-program digit inputs, then the comparator and control C1 (pins 4 and 35) are enabled (pulled high). Pins 4 and 35 must be floating or connected to Vdd during digit programming, however.

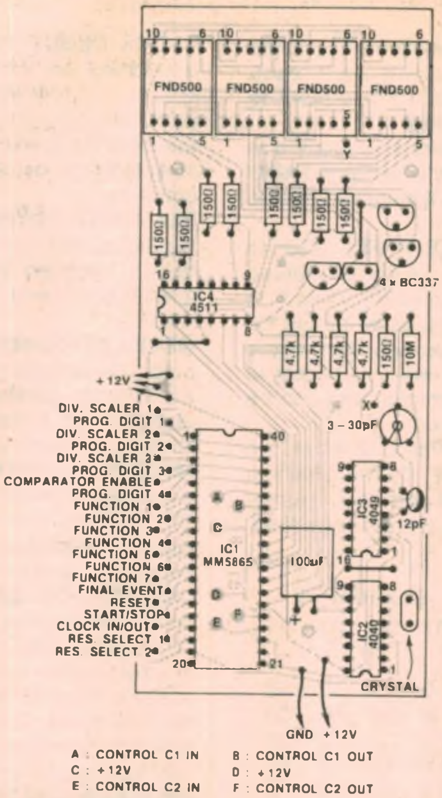
A pulse at the start/stop input starts a down count in counter 1 from the pre-programmed value. When counter 1 reaches zero, the clock pulses to counter 1 are inhibited and the comparator output is enabled. This is not resettable without programming a new count into counter 1.

The comparator and control C1 inputs must be inhibited (pulled low) and a reset pulse must occur before a new count may be entered into counter 1.

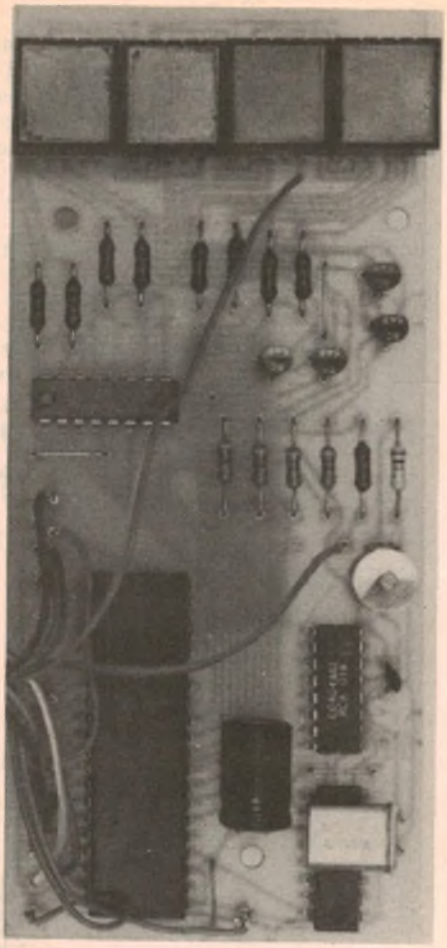
So those are the seven functions at your disposal. Now you can see why the MM5865 timer IC is such a versatile device!

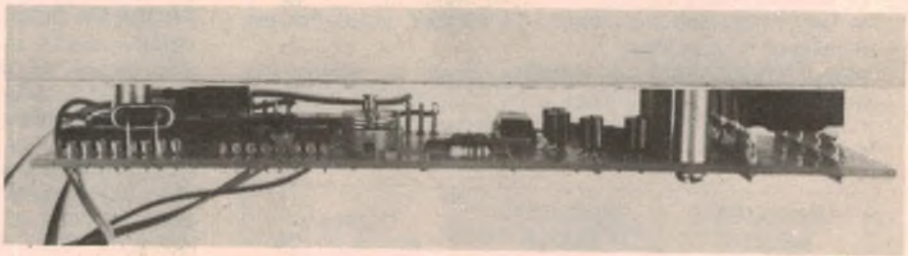
While it will be fairly obvious how most control pins are used, others may not be so obvious. The accompanying panel should clear up any remaining doubts that you may have. It lists each of the control pins in turn and details how they are used.

COMPONENT OVERLAY



The PCB assembly. Spare pads on board enable decimal points for digits 2 & 3 to be permanently enabled if desired. See circuit for switch wiring details.





View showing how the PCB is attached to the front panel using brass spacers.

PARTS LIST

- 1 printed circuit board, code 81uc8, 61 × 145mm
- 1 4-pole, 3-position rotary switch
- 3 momentary contact pushbutton switches
- 1 knob to suit switch
- 1 DC plug and socket set
- 1 zippy box, 159 × 96 × 51mm
- 1 "Scotchcal" front panel
- 40 Molex IC pins
- 1 4.194304MHz crystal
- 3 12mm tapped brass spacers

SEMICONDUCTORS

- 1 MM5865 Universal Timer IC
- 1 4511 BCD to 7-segment decoder/driver
- 1 4069 hex inverting buffer
- 1 4040 12-stage ripple counter
- 4 FND500 common cathode displays
- 4 BC337 NPN transistors
- 3 1N4148 diodes

CAPACITORS

- 1 100μ16VW electrolytic
- 1 12pF ceramic (NPO)
- 1 3-30pF trimmer

RESISTORS (¼ or ½W, 5%)

1 × 10MΩ, 4 × 4.7kΩ, 10 × 150Ω

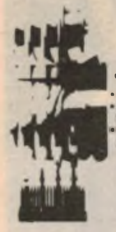
MISCELLANEOUS

Hookup wire, solder, screws, PC stakes etc.

THE CIRCUIT

As previously stated, we elected to wire our timer according to function 1. The circuit is quite straightforward and can be divided into three sections: an external clock oscillator, the MM5865 timer IC, and the display circuitry.

NEW PRODUCTS



ok

JUST WRAP™

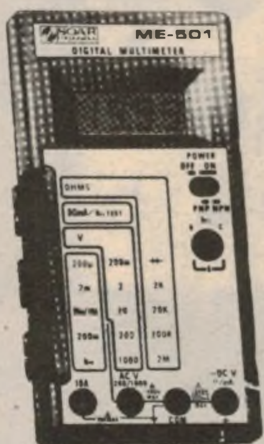
- 30 AWG wire
- .025" square posts
- Daisy chain or point-to-point
- Built-in cut off
- Includes 50 ft. wire
- No stripping or slitting required—just wrap

Part No.	Wire Color	Price
JW-1-B	Blue	$24.99
JW-1-W	White	24.99
JW-1-Y	Yellow	24.99
JW-1-R	Red	24.99

JUST WRAP™ Replacement Wire

Part No.	Color		Price
R-JW-B	Blue	50 ft roll	$4.99
R-JW-W	White	50 ft roll	4.99
R-JW-Y	Yellow	50 ft roll	4.99
R-JW-R	Red	50 ft roll	4.99

SOAR MODEL 501A



4 digit large LED display.
Add $3 P&P and certified mail for specs **$79**

10 TURN POTENTIOMETERS

Stock resistance values
50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 100k.

Spectrol model 534 ¼" shaft.
Price 1—9 $8.50
10 + values may be mixed $7.90

EPROM PROGRAMMER KIT

Kit of parts as featured in Electronics Australia July, 1980. Programs 2708, 2716 and 2532. Use with TRS80, Sorcerer, and Compucolor. Kit does not include connector from the programmer to computer.

Complete Kit	$72.49
Kit without case	$59.99
Pack and post	$2.50

DIG CAPACITANCE METER

Kit of parts featured in Electronics Australia March, 1980. Four digits.

Complete Kit	$52.49
Kit without case	$39.99
Pack and post	$2.50

COMPONENTS

4116 RAMS	$3.00
2114 RAMS	2.90
2708 EPROM	6.90
741's 10 up	2.50
555's 10 up	2.90
BD139 10 up	5.50
BD140 10 up	5.50
SC141D 10 up	11.00
SC151D 10 up	21.10
RED LEDS 10 up	1.40
RED LEDS 100 up	11.00
YELLOW LEDS 10 up	2.30
8 PIN I/C SKTS 10 up	2.00
BC548	0.15 ea
BC549	0.19 ea
MJ802	3.60
6,800/50V CAPS (LUG)	4.50
5,600/40V CAPS (PCB)	1.90

CLAMP METER

MODEL YF-700

Top of the range model AC Voltage 150V 300V 600V AC Current 6A 15A 60A 150A 300A. Resistance 5kΩ (Midscole 200Ω)

was $49.99
NOW ONLY
$43.55

SCHUGART SA 400
5in Minifloppy Drive
$399.00 Tax Inc
$347.00 ex

RITRON COMPUTER GRADE P/S

+5V reg 10a 16V unreg @ 1A.
KIT $79.95 inc
Built and tested $99.50

ETI636 MOTHERBOARD

7 Slot Motherboard $90.00
Built and Tested $120.00
ACTIVELY TERMINATED

INTERSIL LCD $34.50
3½ DIGIT PANEL METER KITS

Build a working DPM in ½-hour with these complete evaluation kits.
Test these new parts for yourself with intersil's low cost prototyping kits complete with A/D converter and LCD display (for the 7106) or LED display (for the 7107). Kits provide all matrials including PC board, for a functioning panel meter ICL7106EV (LCD)

COMPUTER COMPONENTS

Attention Sorcerer & TRS 80 owners. Memory expansion kits available. We also offer full service on the popular computer projects and systems.

SPECIAL 4116 RAM OFFER
8 OFF PRIME SPEC 4116 I/Cs $23.00
16 4116s for $32.00

STATIC RAM KIT 16K S-100
2114 $2.50; 2716 $6.90; 2708 $6.90

DIP PLUGS

Ideal for use with flat ribbon cable or to mount components on

14 pin $1.20 | 24 pin $1.20
16 pin $1.40 | 40 pin $5

POWER TRANSFORMERS

SPECIALLY DESIGNED FOR MICROCOMPUTERS

- Good regulation electrostatic shield
- RI 810 8V @ 10A 2 x 15V @ 1A $24.50
- RI 820 8V @ 20A 15V @ 1A 15V @ 3A $35.50

20 TURN CERMET TRIM POT

SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1M, 2M.

1—9	$1.40
10—99	$1.30
100	$1.20

Values may be mixed.

Hexadecimal Keypad
$24.50/each

19-key pad includes 1-10 keys ABCDEF and 2 optional keys and a shift key.

Ideal for dream project

MULTIDIALS

Dials to suit 10 T Pots

Model 21 1.8" dia	$16.50
Model 16 .9" dia	$12.50
Model 18 1" x 1.75" dia	$20.60

COMPUTER COOLING FANS

Muffin fan 4⅛" square
110V $39.50
240V $26.50

Range of larger fans available. Send for details.

cermet single TURN TRIM POT

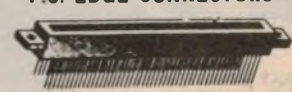
Spectrol model 63P
ACTUAL SIZE

STOCK VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 200K, 500K, 1M, 2M.

1—9	$1.00
10—99	0.90
100	0.80

Values may be mixed.

P.C. EDGE CONNECTORS



S100 gold plated wire wrap	$8.50
S100 solder tail	$6.90
D2 Motorola bus	
43/86 solder tail	$8.50
43/86 gold plated wire wrap	$10.50

HAVE YOU BUILT A DREAM YET!

ELECTRONIC AUSTRALIA MICROCOMPUTER PROJECT

Kit for main board (including programme 2708)	$109.00
Also available re-designed 6802 PCB	$11.90
PCB (Fibre glass) only	$10.90
2708 programmed	$15.50
Key Pad 19 Keys	$24.50
Kit (less key pad)	$94.00
PCB for power supply	$3.50

Bankcard Mail Orders Welcome

Please debit my Bankcard. EA 9/81
Bankcard No. ....
Expiry Date ....
Name ....
Signature ....

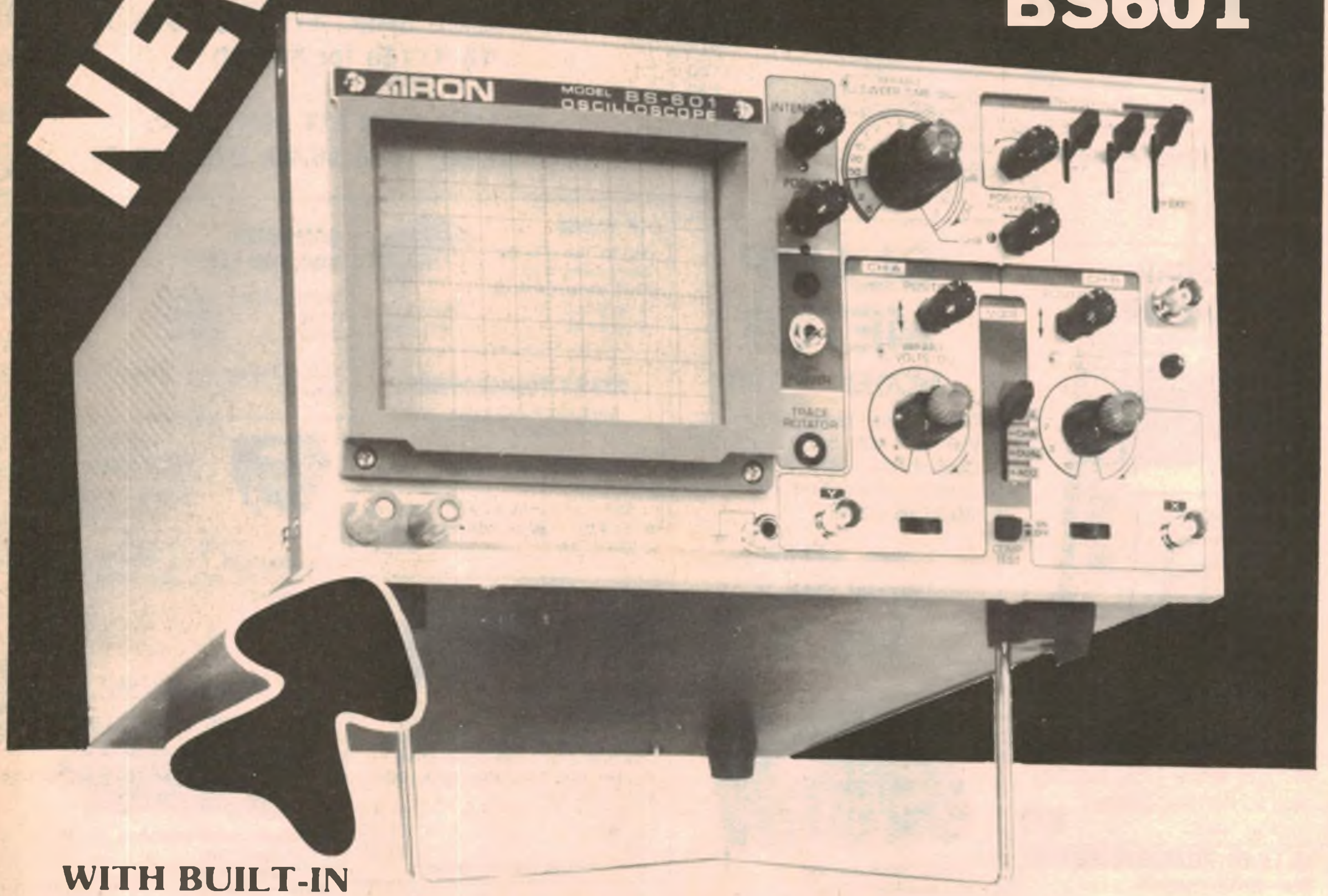
Prices subject to change without notice. Send 60c and SAE for free catalogues.
MAIL ORDERS: PO Box 135, Northcote, Vic 3070. Minimum pack and post $1.00.
Phone (03) 489 8131.

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131

NEW!

20MHz/5mV BS601



WITH BUILT-IN COMPONENT TESTER AT NO EXTRA COST!!

Find faults faster... check component values... see characteristics on the screen.

- *5mV/div to 10V/div in 11 ranges*
- *20MHz bandwidth, 17nS risetime*
- *Timebase 0.5uS to 0.5S/div in 19 ranges*
- *Dual Trace - CHA, CHB, Dual, Add, Subtract modes*
- *5x Magnifier on sweep*
- *150mm bright rectangular CRT with internal parallax-free graticule*
- *X-Y operation and Z modulation*
- *T.V. sync*
- *Front panel trace rotate*

Aaron Corporation (formerly Application Inc) have a wide range of scopes. Send for a copy of our 8 page scope guide describing other models up to 40MHz and a full range of accessories.

$550.00 ex tax

$632.50 inc. Sales Tax

The BS601 is sold and serviced by ELMEASCO and leading electronics suppliers.

ELMEASCO

Instruments Pty. Ltd.

P.O. Box 30, Concord, NSW. 2137
13-15 McDonald St., Mortlake, NSW. 2137
Phone: (02) 736-2888, Telex: 25887

P.O. Box 107, Mt. Waverley, Vic. 3149
21-23 Anthony Drive, Mt. Waverley, Vic. 3149
Phone: (03) 233-4044. Telex: 36206

Adelaide: (08) 271-1839 Perth: (09) 398-3362
Brisbane: (07) 229-3161

For stability, we used a crystal-controlled clock to drive the timer IC. This consists of a simple "pi" type oscillator using one 4069 CMOS inverter (IC3a) and a 4.194304MHz crystal. The output is squared up by a second 4069 inverter (IC3b) and then divided by 128 by a 4040 14-stage binary counter (IC2) to give the required 32.768kHz.

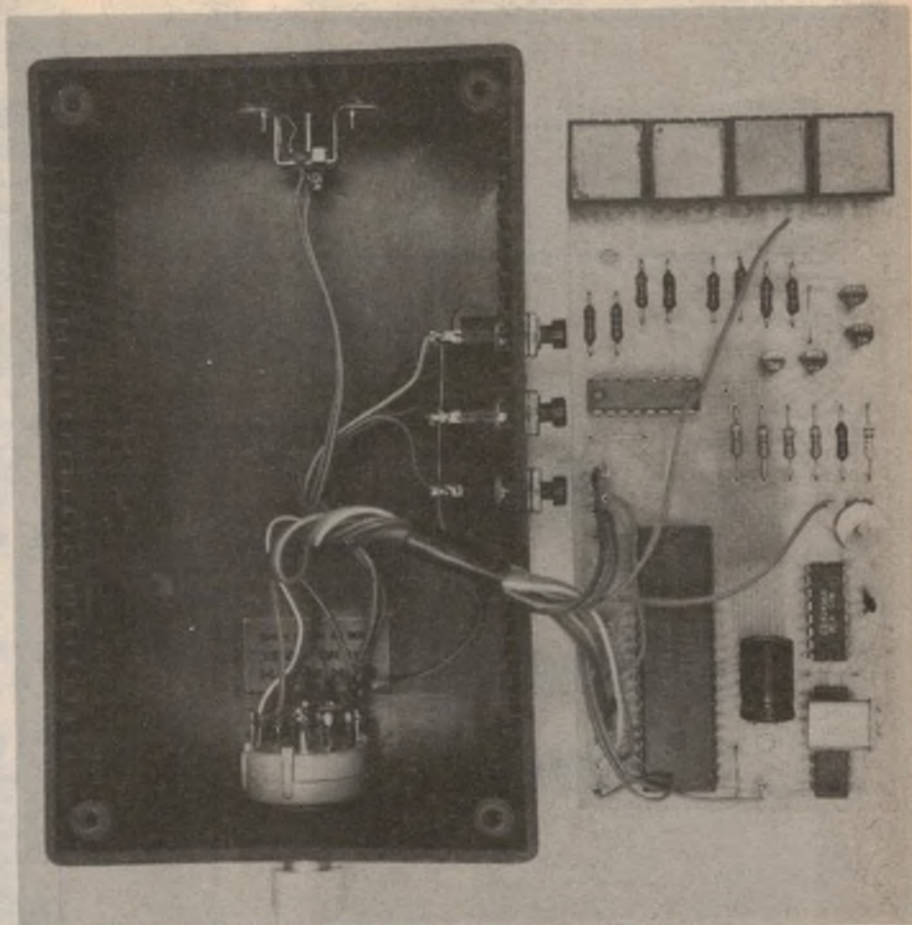
Some readers may be wondering why we have not made use of the MM5865's on-board oscillator. The reason is that this oscillator requires an external 32.768kHz crystal and these, unfortunately, are not easy to obtain and are quite expensive – despite the fact that they are used by the million in electronic watches.

It's actually far cheaper (and easier) to use the arrangement shown here – that is, to use an external 4.194304MHz crystal oscillator and divide down to the required frequency! This frequency (32.768kHz) is taken from pin 4 of IC2 and drives the timer IC direct via pin 19.

The four 7-segment LED displays interface to the 5865 via a 4511 BCD to 7-segment decoder/driver (IC4). Since the display is multiplexed, only a single decoder/driver is required. The common cathodes of the displays (type FND-500) are controlled by the digit drive outputs of the 5865 and are driven by four BC337 driver transistors (Q1-Q4).

Control pin switching makes up the remainder of the circuitry, as described above in function 1. The Start/Stop, Final Event/Stop and Reset inputs are all controlled by momentary-contact pushbutton switches, while a single 3-pole, 4-position rotary switch controls the timer resolution and divide scale inputs, and takes care of the decimal point switching. The three 1N4148 silicon diodes wired to switch S1c perform the Divide Scale decoding.

Power for the unit is supplied either from a 9-12V DC plugpack adapter or from a 12V car battery (typically via a cigarette lighter adapter). The unit is not suitable for operation from dry cells because of the current consumed by the 7-segment displays.



Internal view of the prototype with wiring completed. Note that the three 1N4148 diodes and a 150Ω resistor are wired direct to switch S1 (see circuit).

CONSTRUCTION

Construction of the Universal Timer is simple and should only take you a couple of hours. All components with the exception of the switches, diodes and DC input socket are mounted on a small printed circuit board (PCB) measuring 61 × 145mm and coded 81uc8.

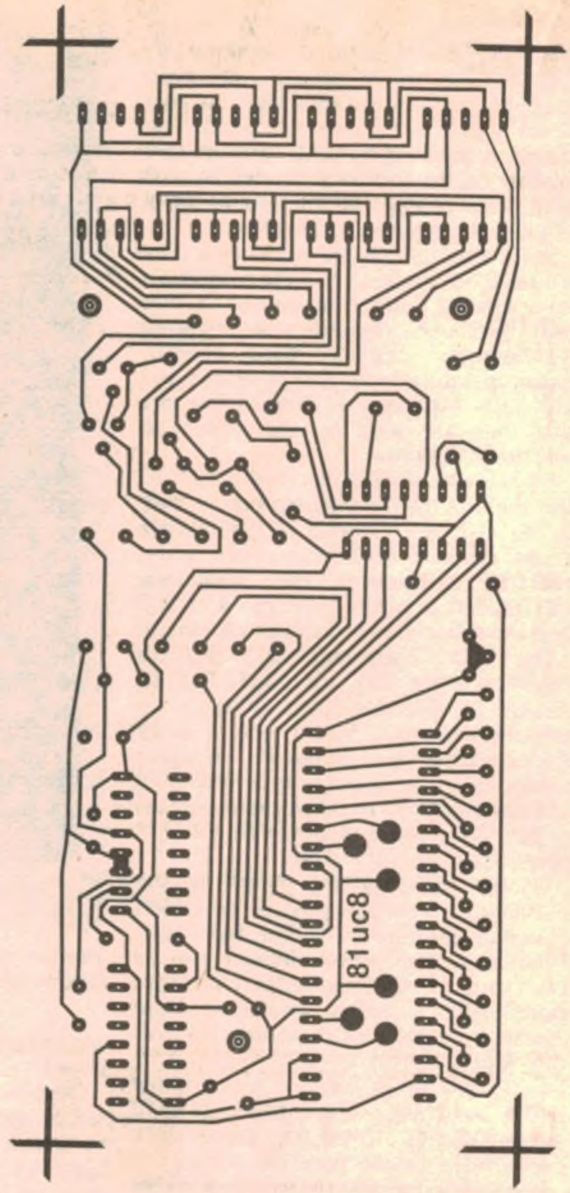
Commence construction by mounting the various components on the PCB according to the overlay diagram. Fit the wire links and resistors first, and then the capacitors, transistors and ICs. Make sure that all polarised components are correctly oriented and do not apply too much heat when soldering as the tracks are rather narrow and may lift from the board.

Observe the usual precautions when soldering the CMOS ICs into circuit – try to avoid handling the pins; earth the barrel of the soldering iron to the earth track on the PCB; and solder the power supply pins first. Although not used in the prototype, we recommend that you use a 40-pin low-profile socket for MM5865 IC. PC stakes are recommended for all external connections to the board.

The four 7-segment displays are mounted on the board using Molex IC socket pins. The reason for this is to raise the displays to a level where they can protrude through an aluminium panel when the board is mounted (see photographs).

The last component to go onto the board is the 4.194304MHz crystal. Before mounting, bend the leads of the crystal at right angles. The crystal is then

ACTUAL SIZE ARTWORK



Actual-size artworks for the front panel and printed circuit board.

soldered into position such that it lies flat on top of the 4040 IC as shown in the photograph. Note that the 100μF electrolytic capacitor is mounted in similar fashion.

We mounted the assembled PCB inside a small plastic zippy box measuring 159 × 96 × 51mm. Using the front panel artwork as a guide, drill holes in the case for the three pushbutton switches, the rotary switch and the DC input plug. The PCB itself is mounted on the lid of the box using three 12mm-long brass spacers.

Before mounting the board, however, it will be necessary to cut a slot in the lid (front panel) to accept the displays, using the front-panel artwork as a template. This done, the mounting holes for the three brass spacers can be marked and drilled. Use countersunk screws when attaching the spacers, and make sure that the screws are flush with the surface of the lid so that the "Scotchcal" front panel can be fitted.

Once the wiring has been completed, the unit should be carefully checked for possible errors. In particular, check the PCB carefully for such things as incorrect component placement, reversed component polarity and improperly etched or broken board tracks. Testing involves simply switching the unit on and trying it out.

Remember that all leading zeros are blanked, and therefore no digits will be showing at switch on. Only the appropriate decimal point will be alight.

If you have a frequency counter handy you can check that the master oscillator is running at the correct frequency. If not, you will have to check the unit against a stopwatch. The trimmer capacitor allows the oscillator to be set precisely to the correct frequency.

As you can see from the wiring diagram, the unused control pins are all brought out to separate pads on the PCB. This has been done to make it easy for you to change from one function to another. Once you've got the timer working in function 1, why not experiment with other modes?

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

$42.00

This includes sales tax.

etone Loudspeakers

LOUDSPEAKER SENSATIONS!!!

Since introducing ETONE speakers to our city showroom we have been staggered by the interest. Why? Because they are about the most underated product made in Australia today.
Call in today and find out why so many people are switching over to ETONE for both P.A. and Hi Fi applications.

P.A. SPEAKERS

SIZE	MODEL	DESCRIPTION	POWER HANDLING (RMS)	FREE AIR RESONANCE Hz	PRICE
25 CM (10")	**131**	GUITAR BASS GUITAR GENERAL AMPLIFIED INSTRUMENTS AND GENERAL PURPOSE P A	60	50	$51.50
30 CM (12")	**246**	EXTENDED RANGE SPEAKER FOR GENERAL P A SPEECH REPRODUCTION STAGE MONITORS AMPLIFIED MUSICAL INSTRUMENTS, DISCO SOUND	80	65	$78.00
	267	WHEN COMBINED WITH SUITABLE HIGH-FREQUENCY DRIVER THIS SPEAKER HANDLES THE BASS AND MIDS RANGE OF SYSTEMS FOR LIVE BAND P A SPEECH REPRODUCTION THEATRE SOUND STAGE MONITORS DISCO SOUND BY ITSELF THIS SPEAKER CAN BE USED FOR AMPLIFIED INSTRUMENTS SUITABLE FOR USE IN HORN TYPE ENCLOSURES AS MIDRANGE SECTION OF BAND P A	150	50	$131.00
38 CM (15")	**801**	WHEN USED IN HORN TYPE ENCLOSURE THIS SPEAKER HANDLES THE LOWER MID FREQUENCY RANGE (250-1,200 Hz) OF LARGE LIVE BAND P A SYSTEMS WHEN USED IN COMPACT BASS-REFLEX ENCLOSURES TOGETHER WITH SUITABLE HIGH FREQUENCY DRIVER. THIS SPEAKER HANDLES THE BASS AND MIDS RANGE OF SYSTEMS FOR LIVE BAND P A STAGE MONITORS THEATRE AND DISCO SOUND	200	30	$214.00

*We believe that this is the best speaker that ETONE makes. Its a worldbeater

ETONE HI FI SPEAKERS

Call in for free advice regarding your custom Hi Fi speaker system.

SIZE	MODEL	DESCRIPTION	POWER HANDLING (RMS)	FREE AIR RESONANCE Hz	PRICE
15 CM (6")	**600**	PASSIVE RADIATOR DESIGNED SPECIFICALLY FOR USE WITH 608 WOOFER IN THE PLAYMASTER 3-13L SPEAKER SYSTEM SYSTEM DETAILS AVAILABLE ON REQUEST			$18.50
	605	HI-FI MIDRANGE FOR USE IN HIGH QUALITY SYSTEMS CAN BE CROSSED OVER AS LOW AS 200Hz. BUT GENERALLY USED TO COVER THE RANGE 500-5,000Hz	120 when crossed over at 500 and 5,000Hz	80	$32.00
	608	HI-FI WOOFER DESIGNED SPECIFICALLY FOR USE WITH 600 PASSIVE RADIATOR IN THE PLAYMASTER 3-13L SPEAKER SYSTEM. THIS SYSTEM OFFERS EXTENDED LOW BASS RESPONSE IN A SUPER COMPACT ENCLOSURE (13 LITRES)	80 when used in Playmaster 3-13L System	50	$34.55

Celestion

Massive 18" Quality English "CELESTION" brand P A. speaker slashed in price. This unit can handle 200 watts RMS (even BASS) or 300 watts program
This unit normally sells for $369 but you can get one now for only $299 SAVE $70.00!!!
FREE 18" Bass/P.A. Bin cabinet design with each unit

18" SPEAKER SELLOUT

save $70

FREE SPEAKER CABINET DESIGNS

We will supply at no charge professionally designed cabinet drawings for your ETONE speaker systems. Fold back monitors, P.A. Bins and Hi Fi systems are available.
Interstate customers: send S.A.E. with your enquiry

ETI 3600 and 4600 Synthesiser PCB's

Get in fast. These are scarce.

ETI 601 PSD Power supply distribution PCB	$3.50
ETI 601 PS Power supply PCB	$4.50
ETI 601 P Auxiliary Module	$4.50
ETI 601 L External input module	$4.50
ETI 601 C Transient No. 1 Generator	$8.50
ETI 601 E Keyboard controller	$10.00
ETI 601 F Noise generator	$4.50
ETI 601 G Transient No. 2 Generator	$6.50
ETI 601 H Voltage controlled filter	$4.50
ETI 601 J Output module	$8.50
NG 576 Digital keyboard control note generator	$6.50
A 104 Keyboard contact board	$10.00

MOTOROLA

PIEZO HORN TWEETERS

Sensational Frequency Response

Model	Description	Freq. Resp.	Price
KSN1005A	3.5" super horn	3kHz-40kHz	$15
KSN1025A	2" x 6" super horn	2kHz-22kHz	$24

Jaycar

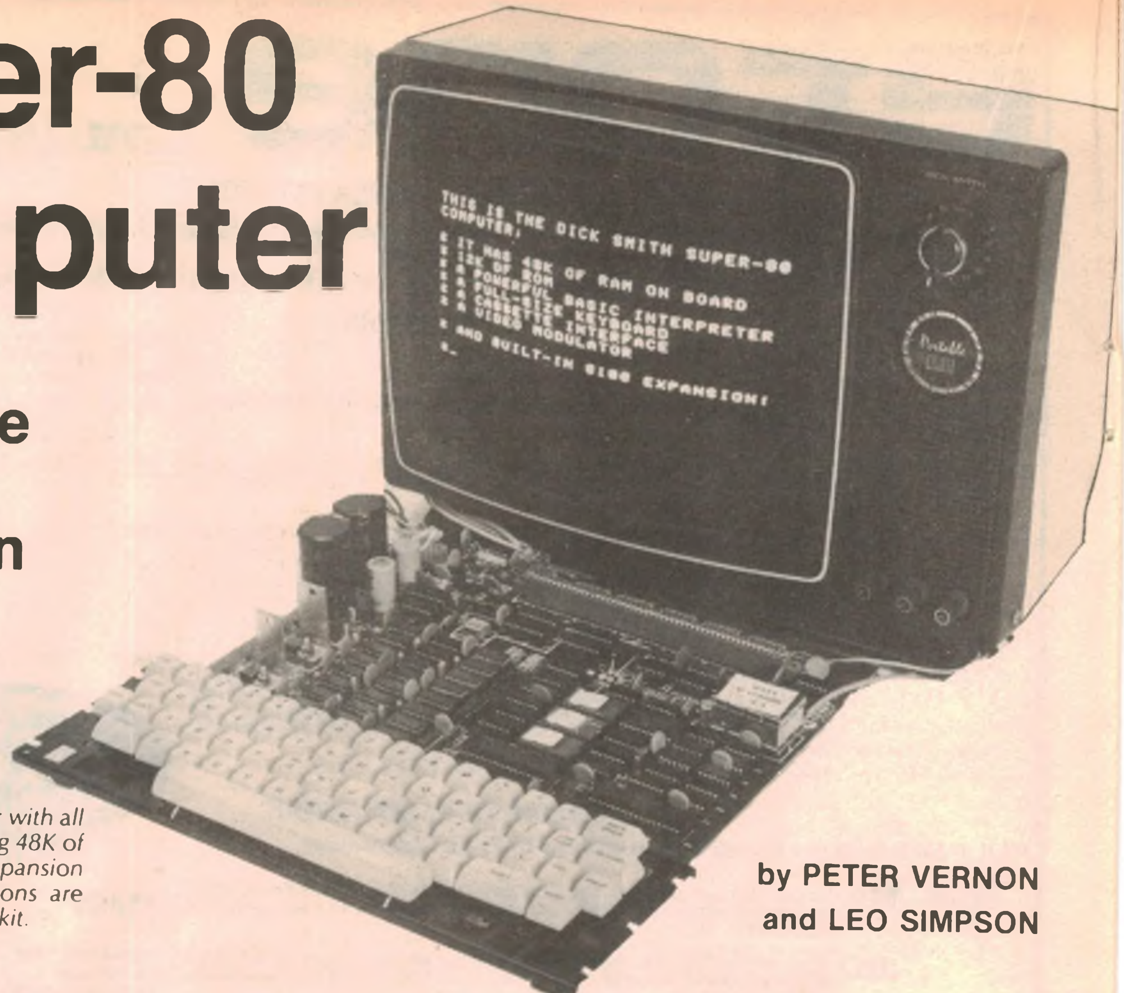
NOTE! NEW SHOP HOURS
Mon-Sat 9am-5.30pm
Sun- 10am to 2pm
Open Thursday night until 8pm

380 Sussex St Sydney 2000

Ph. 2646688 Telex 72293 Mail Orders To Box K-39 Haymarket 2000

Jaycar Dealer:
D.E.S. ELECTRONICS 157 Brisbane St. Dubbo Ph. 829355

Super-80 Computer



Here are the details of construction

This is the Super-80 Computer with all options on the board including 48K of RAM, 12K ROM and S100 expansion socket. Note that these options are not included in the standard kit.

by PETER VERNON and LEO SIMPSON

In this second article on the Super-80 single board computer we discuss the full block diagram of the system in detail and then proceed to a step-by-step discussion of the construction. To make this process easy, the construction is broken down into easy steps with each section of the circuit being tested when it is complete. But first, let us discuss the block diagram.

Fig. 1 is a block diagram of the Super-80 computer. The main component of the system is the CPU, or Central Processor Unit. It fetches instructions from memory and performs them, stores and retrieves data from memory or input/output devices in response to the program instructions and provides signals which control all the operations of the system.

The CPU of the Super-80 is the Z80 microprocessor, one of the most widely used eight bit processors. "Eight bit" means that the CPU handles data organised as eight bits in parallel (known as a "byte"). These eight bits can be thought of as code numbers which may represent letters of the alphabet, numbers, or a particular operation to be performed by the microprocessor.

Every action within the microprocessor is synchronised by a 2MHz "clock" signal generated from the 12MHz master oscillator by a series of frequency dividers. A complementary 2MHz clock (shown as $\phi 1$ and $\phi 2$ in Fig. 1) is provided for those S-100 boards which require a two-phase clock.

Memory

Since the CPU fetches and executes one instruction at a time there must be somewhere to store the sequence of instructions that make up a program. This is the primary use of the memory, although it is also used to hold data which will be used by the program. Data which does not change, such as the codes for ASCII characters, can be held in Read Only Memory (ROM) while data that is changed by the program (such as employee numbers or the score in a game) must be stored in RAM.

RAM in the Super-80 consists of readily available 4116 dynamic memory chips. These chips are organised as 16K x 1-bit, where "K" stands for a binary thousand (2^{10} or 1024 decimal). Each chip thus has 16 x 1024, or 16,384 separately addressable locations, each of which stores one bit of information. A single bit is not very useful as it can only represent one of two states (either "1" or "0"), so the memory is organised by connecting the address lines of eight 4116 chips in parallel. When addressed the memory chips respond as a group, storing or outputting eight bits of data.

The minimum configuration of the Super-80 is 16K. Filling all three rows on the board with 16K chips expands this memory to 48K bytes, suitable for very large Basic programs. Expanding the memory is simply a matter of plugging in more chips and adding a single link to the board. If sockets are inserted for all three banks of memory at the time of construction and a DIP switch used in place of the wire links, memory expansion is a very simple process.

The links, or "memory configuration switches" are used to tell the microprocessor how big the memory on the board is. With this information the Monitor program can automatically position the video display memory and its own scratch pad area at the top of available memory. The area reserved for use by the Monitor is the top 1K of installed memory, and includes space for a system stack of 120 bytes. This "scratch pad" area is used for temporary storage by the Monitor program.

With no links in place, the processor will read the memory size as 16K. Link C in place indicates 32K (two banks of RAM), and Link D indicates a 48K memory. Note that only one of these two links should be in place at the same time. Link A is really only relevant if the EPROM version of Basic is installed. It determines whether the processor will jump to the Monitor program or Basic when the computer is turned on or reset. Link B causes the computer to enter a test mode,and its use will be described in the section on construction.

Read Only Memory, as the name implies, is memory which cannot be written into but which can be read from. RAM loses its contents when the power is turned off but ROM retains data indefinitely, and is used to store data and programs which must be ready for use as soon as the computer is turned on. EPROM stands for "Eraseable Programmable Read Only Memory". The contents of the memory can be erased by exposure to ultra-violet light and new information programmed in by use of special equipment. The Monitor program of the Super-80 is held in a 2516 EPROM, so experienced programmers can write their own software, program it into a 2516 and substitute it for the Monitor provided in the kit.

Socket positions are provided on the Super-80 PCB for three EPROMs. Two of these, U33 and U42, are 2532 types which can store 4K bytes each, and the third, U26 may be either a 2516 2K type or a 2532. As supplied the Super-80 kit includes one 2516 with the 2K Monitor program stored in it. A Basic interpreter will be available in a set of three 2532s, one of which will also contain the Monitor program. Changing U26 from a 2516 to a 2532 EPROM requires cutting one track and linking another on the bottom of the board.

A total of 12K bytes of memory space is taken up by the full complement of EPROMs. RAM can occupy a maximum of 48K, for a total memory of 60K bytes. At the top of the "memory map" is 4K bytes of unused address space. Addresses for this area can be decoded and used by the experimenter for adding additional components in the computer's address space.

Video display

Timing signals for the video display circuitry are generated from the 12MHz master clock by a divider chain. These signals provide the addressing to scan each line of the video picture and build up the characters on the screen. They also define the "picture window" (the space taken up on the video screen by the video display).

The "picture window" comes on a quarter of the frame time after the vertical sync pulse and stays on for half the time of a single picture frame. This timing is determined by the $\overline{BUSREQ}$ signal generated by the divider chain which causes the Z80 to give up control of the system bus and output a signal called

The block diagram at right summarises the functions performed in the Super-80 computer ▶

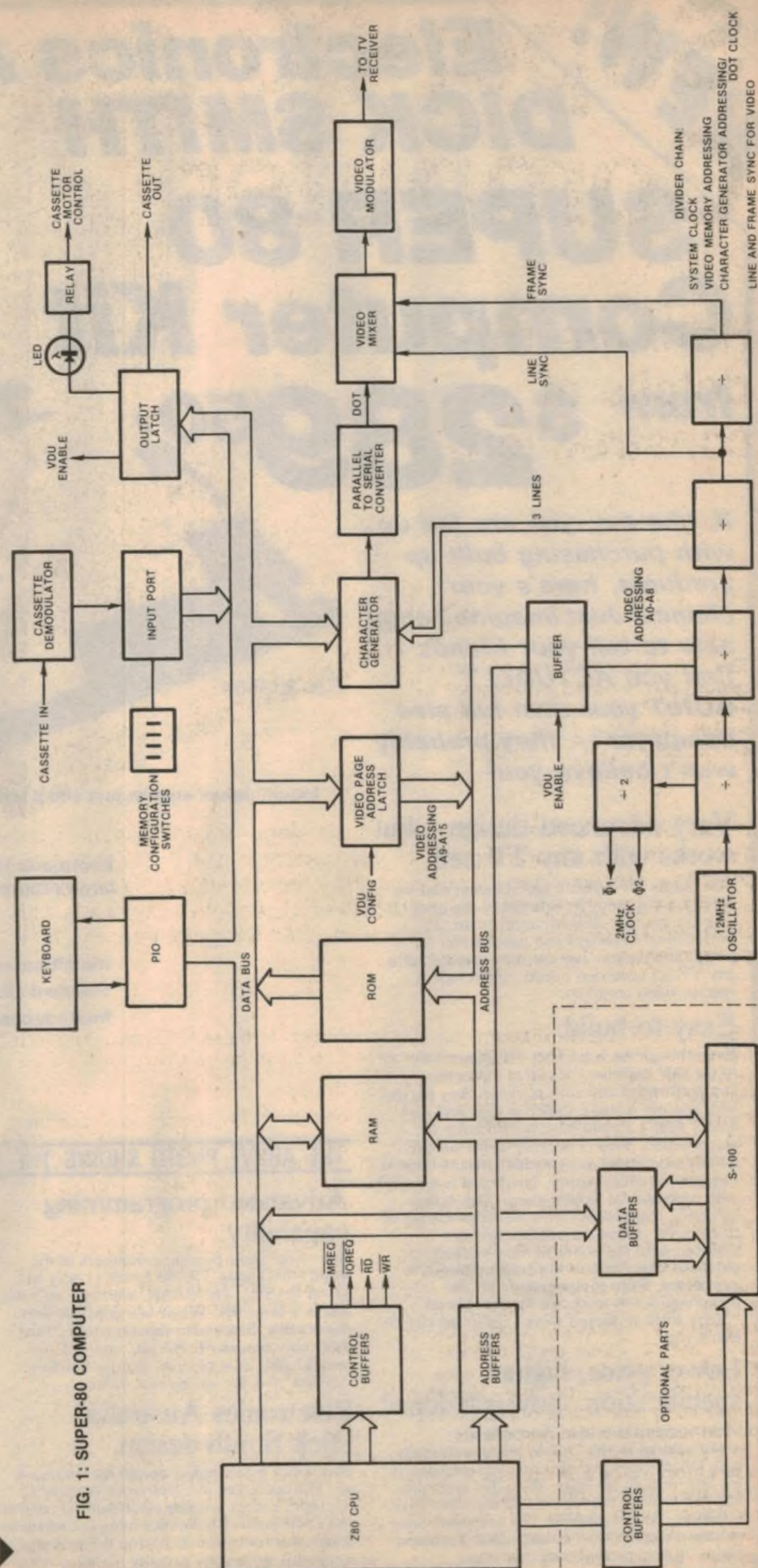


FIG. 1: SUPER-80 COMPUTER

NEW! Electronics Australia/ DICK SMITH

SUPER 80 Computer Kit

from $289.50

If, like me, you are fed up with purchasing built-up products, here's your chance! Just imagine being able to tell your friends that you ACTUALLY BUILT your own full size computer — they probably won't believe you!

Very advanced design - but works with any TV set!

The 'Super 80' offers a specification that we believe just cannot be bettered at the price. It uses the popular Z80 Microprocessor IC, a professional keyboard and has a direct RF output so that you can use the computer with any TV set (you don't need to purchase a special video monitor).

Easy to build.

Even though we would not recommend this kit to the raw beginner, this kit is extremely straightforward and easy to build. Any person who can use a small soldering iron and can solder neatly should have no difficulty in construction. This is because of the unique double side board design which means there is virtually no other wiring. The board is covered with professional 'solder mask'; this makes soldering much easier without the problems of bridges, etc. Once the components are soldered onto the board in their marked positions over 98% of the construction is completed. Even if you cannot get the completed kit to work, we have a special "Sorry Dick it doesn't work" repair service to assist you.

Lower price, higher specification - how is it done?

Most computers sold in Australia are manufactured in the U.S.A. where extremely high labour rates prevail - and you pay dearly for this on built up units. With this computer kit, you provide the labour and therefore save a fortune. And remember, this computer does not have a small toy-like calculator keyboard but a full size professional typewriter keyboard.

THE ABOVE PHOTO SHOWS THE BASIC BOARD WITH THE FOLLOWING

Advanced programming capability.

One of the most popular computers in the world (the Tandy TRS80 Level 1) only has 4K of BASIC. The BASIC we have with this unit is a large 9K. When you consider that our popular Sorcerer computer (over 2,000 sold) only has an 8K BASIC and sells for over $1,000, it is obvious that by building yourself, you are saving real money.

Electronics Australia/ Dick Smith design.

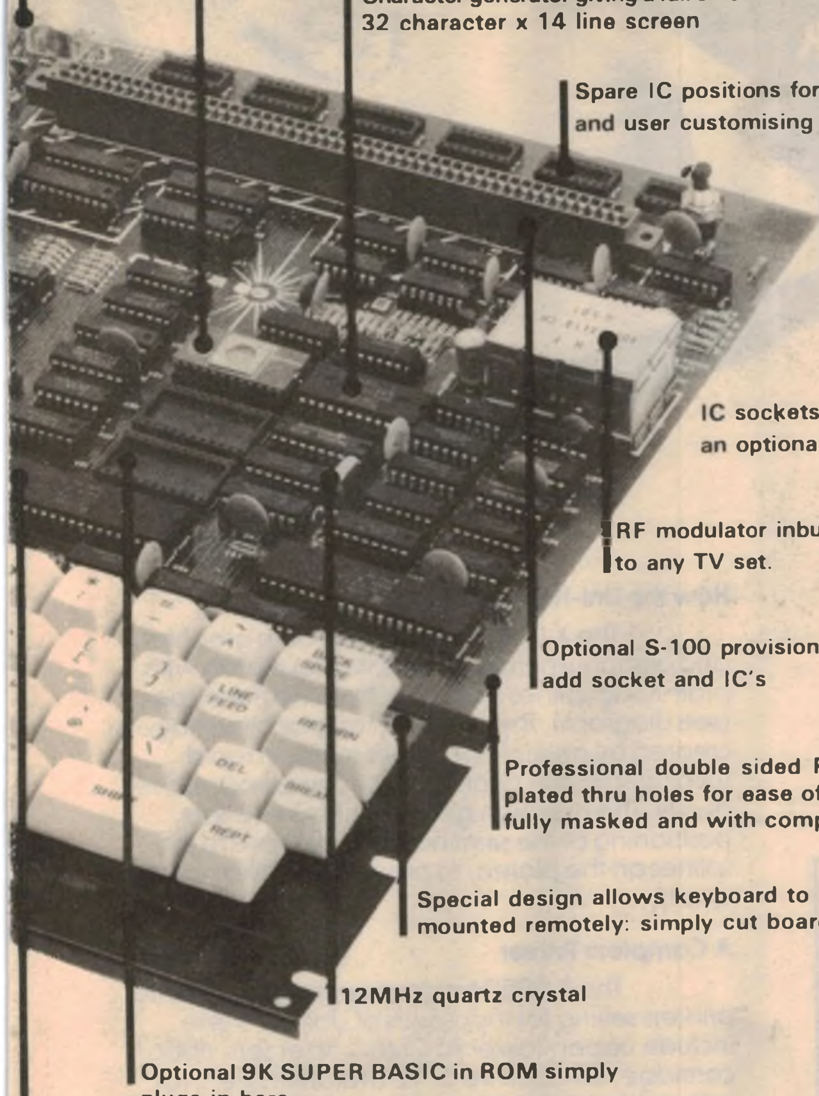
This is not a half baked design with no back up. The resources of Electronics Australia, Australia's most popular electronics magazine, and Dick Smith Electronics have combined to design and bring you this kit in the interests of computer enthusiasts actually building and not just buying. The design is fully Australian.

Imagine how much you will learn!

Most computer enthusiasts can program a computer but would have absolutely no idea of how to build one. By building this kit you will learn both the technical side of construction, how it works and then how to program. What a fantastic background for a future . . .

Sectional construction.

We have designed this kit not only for the serious computer user but also for first time users like the student or hobbyist. This is why we have a short form kit which may be added to as you build (and as you have the money!). For example, you may build the computer originally and operate it with 'BASIC on tape' and then add 'BASIC in ROM', add the S-100 and provide other parts at a later stage.



Relay to operate cassette unit automatically

2K Monitor program supplied

Character generator giving a full 64 characters
32 character x 14 line screen

Spare IC positions for prototyping
and user customising

IC sockets available as
an optional extra

RF modulator inbuilt: connects
to any TV set.

Optional S-100 provision: simply
add socket and IC's

Professional double sided PC board with
plated thru holes for ease of construction,
fully masked and with component overlay

Special design allows keyboard to be
mounted remotely: simply cut board here

12MHz quartz crystal

Optional 9K SUPER BASIC in ROM simply
plugs in here

Famous Z-80 microprocessor as used in
Tandy & System 80 computers

*Copy of articles will be included
when available from EA.

Comprehensive manuals available:

The construction details will be given in Electronics Australia magazine and full copy* of the EA article will be supplied with each kit. We also have available two very comprehensive manuals to assist in construction and programming:

Combined construction, assembly and technical manual.

Cat B-3600 **$12.50**

Cat B-3602 **$14.50**

Super 80 Basic does this:

Over 50 separate versatile commands.
Features: arithmetic and integer functions user-defined functions, machine language routines, text editing, string operations.
Also contains 25 error codes to assist you in programming.
'Super 80 Basic' reference manual

Short Form Kit

Designed for computer applications where 'Basic' programming is not required. Kit supplied with Eprom Monitor and 16K RAM. Cat. K-3600 **$289.50**

Add these items to make a fully operating computer system to your own requirements:

Transformer to suit	M-2325	**$22.50**
BASIC program (interpreter) on cassette	K-3602	**$24.50**
IC Socket set (recom.)	K-3603	**$12.50**
BASIC program in EPROM (set of 3 IC's)	K-3604	**$99.50**
S-100 Expansion	K-3606	**$19.50**

OPTIONAL EXTRAS ADDED: S-100 EXPANSION, IC SOCKETS, FULL 48K RAM

'Sorry Dick, It Doesn't Work'

All parts with this kit are guaranteed tested and new, but we cannot guarantee the labour content provided by you. If, after completion, your Super 80 fails to operate, you may take advantage of our 'Sorry Dick, It Doesn't Work' service.
Our Service Centre will check and repair your Super 80 for the cost of **$100.** This fee includes any necessary replacement of components, etc.
If you send your Super 80 to us under the 'Sorry Dick, It Doesn't Work' service, **it must have been constructed using IC sockets.** If we receive a kit which does not use IC sockets, or if the kit is so badly constructed as to make effective repair impossible, we reserve the right to return your kit in the condition received, together with the service fee.
Under our 7 day satisfaction guarantee, you may return any kit in its original condition for a full refund of the purchase price. We cannot give a refund once construction has commenced, if any internal packs of components are opened or if the carton or kit is damaged

7 DAY SATISFACTION GUARANTEE

Purchase this kit and inspect it for up to 7 days. If you do not wish to go ahead and construct this kit, simply return to us in condition as supplied and your money will be refunded in full

Yes, this makes the full 16K computer with 9K basic on tape, transformer and IC Sockets — only — $349!

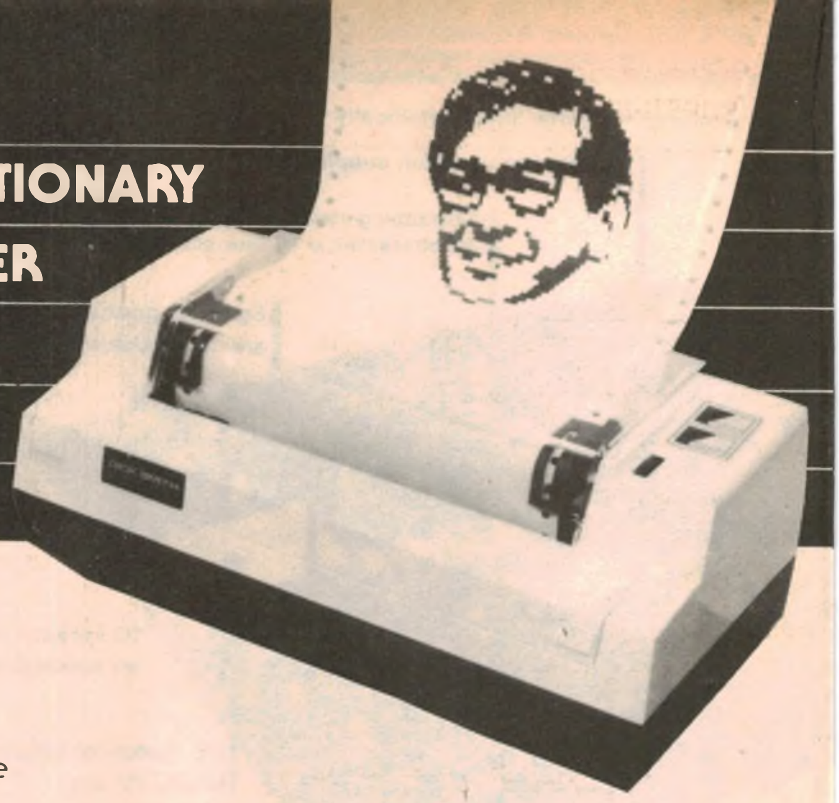
DICK SMITH Electronics

DSE/A019/LM

NSW AUBURN 648 0558 • BLAKEHURST 546 7744 • BROADWAY 211 3777 • BROOKVALE 93 0441 • CHULLORA 642 8922 • GORE HILL 439 5311 • NORTH RYDE 888 3200 • PARRAMATTA 683 1133 • SYDNEY 290 3377 • TIGHES HILL 61 1896 • WOLLONGONG 28 3800 **ACT** FYSHWICK 80 4944 **QLD** BURANDA 391 6233 • CHERMSIDE 59 6255 **SA** ADELAIDE 212 1962 **VIC** COBURG 383 4455 • MELBOURNE 67 9834 • RICHMOND 428 1614 • SPRINGVALE 547 0522 **WA** CANNINGTON 451 8666 • PERTH 328 6944
Mail Order Centre: PO Box 321, North Ryde 2113. Phone: (02) 888 3200

SUPER 80 EXCLUSIVE TO DICK SMITH'S

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



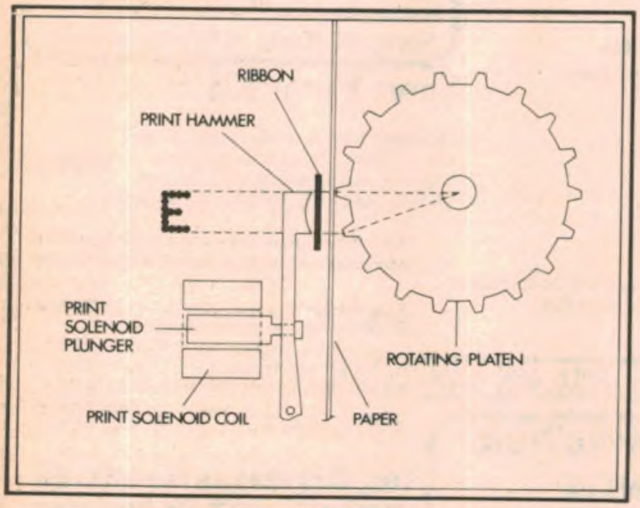
Cat. No. X-3252 P&P $5.50

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

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

At an incredible unit price of $495!

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



A Product of the Seiko Group

It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

Fan Form Paper
2,000 sheets continuous fan form paper to suit printer
Cat. X-3254 .... **$27.50**

Replacement Ribbons
Cat. X-3253 **$6.95**

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

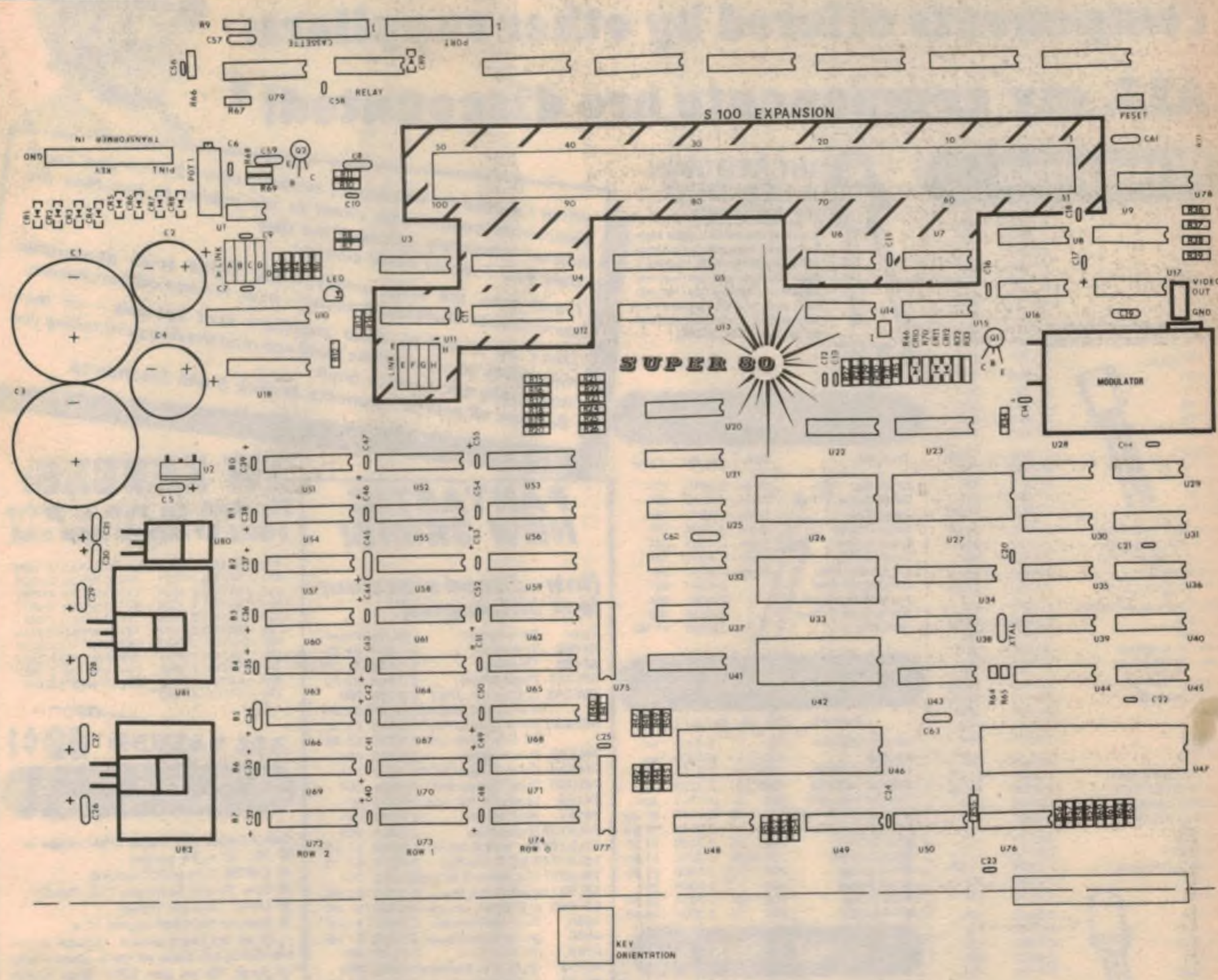
The X-3252 DOT MATRIX PRINTER has a Centronics-type parallel data interface and is compatible with System 80, TRS-80, Sorcerer and Apple computers etc.

EXCLUSIVE TO DICK SMITH STORES

SEE OUR OTHER ADVERTS FOR STORE ADDRESSES
Available by mail order (P. & P. $5.50 from P.O. Box 321, North Ryde)

VISA

®



This is the component overlay of the Super-80 PC board reproduced smaller than actual size and shown without the keyboard section. (Reproduced by permission of Dick Smith Electronics).

BUSAK, allowing the video circuit to take over the bus and read information from the memory for display on the screen. The display consists of 512 consecutive bytes (16 lines of 32 characters each).

Part of the address for the video display memory is made up of the contents of the "video page address latch" shown on the data bus in Fig. 1. By writing a byte of data to this latch (selected by the signal VDU CONFIG) the start address of the 512 byte block of display memory can be changed. With 16K bytes of memory, 31 different display "pages" are available to the programmer.

As shown in Fig. 1, three circuit elements convert the contents of the display memory into a composite video signal. The character generator is a ROM which reads the ASCII codes from memory, combines them with the line scan information and "looks up" an internal table to produce the correct pattern of dots for each line of the character. This dot pattern is loaded into the parallel to serial converter which in turn passes them one at a time to the video signal mixer where they are combined with the line and frame sync signals. The resulting composite video signal can be fed directly to a video monitor or used to modulate a VHF signal for connection to the antenna input of an unmodified television set.

While the video circuitry is reading the memory the Z80 is disconnected from the rest of the system by the BUSREQ signal and is not performing any processing. In effect the speed of the processor is reduced by 50%. When the timing of an operation is critical, such as cassette reading and writing the VDU circuit is disabled by writing a VDU ENABLE bit to the output latch, preventing the generation of the BUSREQ signal. The video will be enabled again by changing the state of the VDU ENABLE bit. User programs which require the full speed of the processor can also use this method to disable the video display temporarily.

Cassette interface

The first point to be made is that contrary to our statement in the first article, the cassette interface of this version of the Super-80 operates at only one speed, 300 baud (a limit set by the Monitor program) and loads the 9K Basic interpreter in about five minutes. Tones of 1200Hz and 2400Hz are used by the interface to represent the zeros and ones of binary code, in accordance with the "Kansas City" cassette standard.

Data to be saved is split into blocks of 256 bytes each and a "checksum" is calculated and recorded on the tape for each block. As the processor reads each block it also calculates a checksum and compares it with the result previously written on the tape. If the two sums match the data block has been read correctly and all is well. If there is a

‘Don’t be misled by a few ‘bargain’ components offered by other suppliers: ALL my components are discounted!’

TRANSISTORS

AC126	Z-1054	95c
AC127	Z-1062	95c
AC128	Z-1064	95c
AC187	Z-1080	80c
AC188	Z-1082	95c
AD161	Z-1110	$1.75
AD162	Z-1112	$1.75
BC109C (BC549C, BC209C)	Z-1329	34c
BC159 (BC179, BC214, BC559)	Z-1359	17c
BC639	Z-1388	45c
BC640	Z-1389	45c
BCY71	Z-1241	95c
BD139	Z-1443	55c
BD140	Z-1444	55c
BD682	Z-1460	$1.45
BD681	Z-1462	$1.26
BF115	Z-1560	75c
BF173	Z-1590	89c
BF180	Z-1602	73c
BF184	Z-1604	$1.00
CL33 NPN disp driver	Z-1750	$1.00
CL34 PNP disp driver	Z-1752	90c
D13T1 (2N6027) PUT	Z-1780	59c
DS2646 UJT	Z-1786	95c
FPT100 (photo trans)	Z-1950	$1.38
MEL12 (photo darlington)	Z-1952	95c
MJ2955	Z-1800	$1.50
MPF102	Z-1832	59c
MPF105 (2N5459)	Z-1838	58c
MPF106 (2N5484)	Z-1840	58c
MPF131 (MPF121)	Z-1848	$1.20
OC26 (AD149)	Z-1930	$2.75
OC44	Z-1932	95c
OC71	Z-1941	75c
TIP31B	Z-2020	79c
TIP32B	Z-2024	79c
TIP2955 (MJE2955)	Z-2005	$1.25
TIP3055 (MJE3055)	Z-2008	$1.25
TT800 (2N4030)	Z-2064	89c
TT801 (2N3019)	Z-2068	19c
2N2053	Z-2130	[illegible]
2N3055	Z-2145	[illegible]
2N3055 (Motorola)	Z-1804	$1.50
PN3563	Z-2180	30c
BC337	Z-2190	23c
BC328	Z-2242	17c
2N4360	Z-2246	22c
PN3642	Z-2250	45c
BC338	Z-2252	30c
PN3645	Z-2256	25c
PN4250	Z-2320	48c
PN4258	Z-2326	38c
2N4342	Z-1833	$1.18
2N5484	Z-2340	58c
2N5590	Z-2390	$8.60
2N5591	Z-2391	$12.95
2N6048	Z-2394	$16.20
BUX80	Z-2150	$7.50
MJ15003	Z-1808	$5.00
MJ15004	Z-1810	$5.00

INCREDIBLE! A LED THAT FLASHES!

Amazing advances in solid state technology have now put a micro-circuit INSIDE a LED, making it flash! Ideal for projects, warning indicators, alarms, etc. All you do is apply power – no more circuitry needed. (Data sheet available on request). Cat Z-4000

$1.50

LEDS

Type No	Size	Cat No	Price
Small Red	3mm	Z-4010	20c
Small Green	3mm	Z-4020	28c
Large Red	5mm	Z-4030	16c
Large Orange	5mm	Z-4036	55c
Large Yellow	5mm	Z-4034	34c
Large Green	5mm	Z-4032	28c
Large clear Red	5mm	Z-4038	55c
Rectangular Red		Z-4040	40c
Rectangular Green		Z-4042	40c
Rectangular Yellow		Z-4044	40c
Infra Red		Z-3235	$1.50

RECTIFIERS

Type No	PIV	A	Cat No	Price
1N4002 (EM401)	100	1	Z-3202	6c
1N4004	400	1	Z-3204	8c
1N4007 (EM410)	1000	1	Z-3207	14c
1N5408 (MR510)	1000	3	Z-3228	43c
1N5404 (1N5624)	400	3	Z-3222	43c
MR110 (SO-10 stud)	100	10	Z-3240	$1.45
MR410 (SO-10 stud)	400	10	Z-3244	$1.98
BYX21L/200	200	25	Z-3260	$1.95
BYX21L/200R	200 (r)	25	Z-3262	$1.90
WO-2 bridge	200	1.5	Z-3300	$1.90
WO-4 bridge	400	1.5	Z-3304	70c
PA60 bridge	600	8	Z-3326	$5.60
PB40 bridge	400	25	Z-3334	$5.50

SIGNAL DIODES

Type No	Type	Cat No	Price
DSOA91	Germ G/P	Z-3042	12c
OA47	Gold Bonded	Z-3232	38c
OA90	Germ G/P	Z-3030	18c
OA91	Germ G/P	Z-3040	18c
OA95	Germ G/P	Z-3050	18c
BB119	Silicon G/P	Z-3060	34c
BA102	Sil Vancap	Z-3070	43c
OA202	Sil small signal	Z-3100	34c
1N4148	Hi Sp switch	Z-3120	5c
5082-2800	Hot carrier	Z-3230	$2.88

Yes! On these most popular transistors we offer a unique FIVE YEAR GUARANTEE (as long as they are used within specs) – and the specs are equal or better than the 'usual' 'BC' . . . series transistors!

BC547 (Z-1300) BC548 (Z-1308) BC549 (Z-1319): ALL 14¢ each!

BC557 (Z-1340) BC558 (Z-1348) ALL 17 cents each!!!

When I started my electronics business over 12 years ago, I sold discounted components direct to the public: at less than the normal 'wholesale' prices of the day! They said I would never survive!

I still have the same policy today: prime spec, guaranteed components at discount prices – even for one-off purchasers.

Don't be fooled by other supplier's spot specials – or their apparently cheaper prices (until you read the fine print telling you how many you have to buy!)

Save on all your components at Dick Smith Electronics.

FANTASTIC NEW SEMIS!

(Introduced since our last catalogue).

Type:	Description:	Cat No:	Price:
BF469	Transistor	Z-1635	$1.20
BF460	Transistor	Z-1636	$1.20
BPW50	PhotoDiode	Z-1956	$3.50
2N5245	N Channel JFET	Z-2335	90c
	4 digit L/C display	Z-4175	$8.95
MC3021	Opto Triac Driver	Z-4516	$2.75
	60 deg. solar cell	Z-4835	$2.95
74LS05	Hex Inverter	Z-4905	40c
74LS32	Quad 2 input NOR	Z-4932	35c
74LS86	Quad 2input OR	Z-4986	45c
74109	Dual J/K flip flop	Z-5252	50c
74157	Multiplexer	Z-5267	85c
74LS139	Multiplexer	Z-5285	90c
74LS165	Par load 8 bit s/r	Z-5288	$1.65
74LS174	6 bit D flip-flop	Z-5290	$1.00
74LS367	Hex driver/3 st o/p	Z-5292	75c
74LS373	Dual D flip flop	Z-5295	$1.95
81LS95	(97) tri-st. oct div.	Z-5300	$1.80
4040	Bcd/dec decoder	Z-5640	$1.70
4046	phase-locked-loop	Z-5646	$1.95
4069	Inverter Circ.	Z-5669	45c
40938	Quad 2 in Schmitt	Z-5693	65c
40194	4 bit bi direct s/r	Z-5694	$3.50
72168	freq/period counter	Z-5747	$29.95
MM5369	(EYRN) 60 Hz div	Z-5782	$3.50
CA3080	Op amp	Z-6024	$2.45
TL071cp	Fet inp op amp	Z-6030	95c
TL074cp	quad fet op amp	Z-6034	$2.75
LM334N	Quad comparator9	Z-6039	70c
LM311	Voltage compar.	Z-6048	70c
LM394C	Dual matched pre	Z-6083	$4.50
NE5534	Low noise preamp	Z-6090	$4.25
ICL7106	3.5 digit driver	Z-6300	$9.50
LM317T/KC	Adj pos v/reg	Z-6541	$1.95
LM334	Temp Sensor	Z-6810	$1.96
MM5865	Timer	Z-6816	$9.75
XR2206	Synthesiser IC	Z-6820	$5.95
79101	Melody IC	Z-6822	$6.25
SN76488N	Synthesiser	Z-6823	$4.95
Z-80PIO	PIO chip for Z-80	Z-9101	$14.95
2516	Prog monit. eprom.	Z-9207	$11.95

1W ZENERS:

For about the same as you're paying for 400mW types now!

4V7	(1N432)	Z-3523	5V1	(1N4733)	Z-3525
5V6	(1N4734)	Z-3527	6V2	(1N4735)	Z-3529
6V8	(1N4736)	Z-3531	7V5	(1N4737)	Z-3533
8V2	(1N4738)	Z-3535	9V1	(1N4739)	Z-3537
10V	(1N4740)	Z-3539	11V	(1N4741)	Z-3541
12V	(1N4742)	Z-3543	13V	(1N4743)	Z-3545
15V	(1N4744)	Z-3547	16V	(1N4745)	Z-3549
18V	(1N4746)	Z-3551	20V	(1N4747)	Z-3553
22V	(1N4748)	Z-3555	24V	(1N4749)	Z-3557
27V	(1N4750)	Z-3559	30V	(1N4751)	Z-3561
33V	(1N4752)	Z-3563			

ALL VALUES: 29¢!

IC'S

Don't forget, we stock a full range of

- TTL IC's (74 series)
- CMOS IC's (4000 series)
- Low Power Schottky TTL (74LS)
- Linear IC's (all types)
- Special function digital IC's

– all at discount prices. Space is too limited to list them all here: please refer to page 75 or our 1981 Dick Smith Catalogue for a full listing (also see the new listing at left).

BIG SAVINGS – USE OUR BULK PACKS!

Big savings on individual prices are made using our bulk packs. We have various types of resistors and capacitors in hobbyist packs at big discounts. Try these for example:

Resistor Pack: 300 computer selected 1/4 watt values (worth $12.00). Cat R-7010 *$5.90*

Metal film pack: 300 1% 1/4 watt metal film types (value $18.00) Cat R-7015 $12.90!

Greencap pack: 60 greencaps, various values, at least $13 value (Cat R-7040) $6.50!!

Electrolytic pack: 55 electros, worth at least $16.00 (RB Type) Cat R-7030 $6.50

Ceramic Pack: over 60 ceramics, worth around $8–$9 Cat R-7050 $4.50!!

THIS IS ONLY A SMALL PORTION OF OUR RANGE: IF WHAT YOU WANT ISN'T LISTED, ASK FOR IT: WE PROBABLY STOCK IT!

MANUFACTURERS . . .

Dick Smith components are prime spec, top quality and guaranteed! We import direct to save you money! Phone our wholesale division, Dick Smith Distributors on Sydney (02) 888 3200 for quantity prices on all our components.

DICK SMITH Electronics

STOCK UP NOW!

- AUBURN 648 0558
- BLAKEHURST 546 7744
- BROADWAY 211 3777
- BROOKVALE 93 0441
- CHULLORA 642 8922
- GORE HILL 439 5311
- PARRAMATTA 683 1133
- SYDNEY 290 3377
- NEWCASTLE 61 1896
- WOLLONGONG 28 3800
- CANBERRA 80 4944
- BURANDA 391 6233
- CHERMSIDE 59 6255
- ADELAIDE 212 1962
- MELBOURNE 67 9834
- RICHMOND 428 1614
- SPRINGVALE 547 0522
- PERTH 328 6944
- CANNINGTON 451 8666

MAIL ORDER CENTRE: P.O. Box 321 North Ryde. NSW. 2113. Ph. (02) 888 3200 mismatch, a tape read error has occurred.

Tones to be written on the cassette tape are produced entirely by software, and are sent out through the output latch shown in Fig. 1. On playback the signals coming from the tape are decoded by a CMOS phase-locked loop. The PLL tracks the signal from the tape and detects when it changes from one frequency to the other. A comparator converts the analog input of the PLL into a square wave which is fed to the input port. The level at which the comparator will trigger is set by a multi-turn potentiometer which is used to align the decoder circuitry.

Because the display must be turned off during cassette operations, a "correct loading" indication is provided by a LED on the board. The LED changes state (from off to on or vice-versa) every time a correct block of data has been read from the tape.

The motor of the cassette recorder is controlled by a relay. Special motor control commands are supplied in the Super-80 Monitor program so that tape rewinding, etc, can be performed easily.

Keyboard

To understand how the computer reads the keyboard, consider the 60 keys as an 8 x 8 matrix with four "dummy" elements. One group of eight rows is strobed by one port of the PIO (Parallel Input Output chip) and the other group, of eight columns is scanned by the second port. By sequentially setting each row of keys low and then checking which of the column inputs has gone low the processor can identify a particular key in the matrix. The key pressed will be the one at the intersection of the row currently being scanned and the column which has gone low in response to the scan.

By looking up a table stored as part of the Monitor program the Z80 can convert information about the row and column of the key pressed into the correct ASCII code and store it in memory for display on the video screen.

The PIO also provides a "software reset" feature, which allows programs to be interrupted while running. It continually monitors the inputs corresponding to the "Control", "C", and "4" keys. When these three keys go low together the PIO generates a signal which causes the processor to stop whatever it is currently doing and "jump" back to the Monitor program, ready to receive new instructions.

Initialisation

After a reset pulse has occurred, either as a result of turning the computer on or pushing the reset button, the internal counter of the Z80 which contains the next memory address to be read from (the Program Counter) will be set to zero. This gives rise to a problem, because there won't be an executable program in RAM when the power is first turned on. It is necessary to branch to the programs in ROM which initialise the system.

This branch is caused by the Start of Day (SOD) circuit. After a reset pulse the SOD circuit forces the processor to jump to address C000 (hex), which is the start of the Monitor program. It does this by disabling the RAM and forcing the address of the Monitor onto the address bus. The circuit is in turn disabled when an instruction is read from an address above C000, allowing the processor to continue reading from the ROM and carry out the routines necessary to set the system up for use.

S-100 expansion

The S-100 expansion interface of the Super-80 has been designed to conform to a subset of the IEEE 696 specification of the S100 bus. It does not allow Direct Memory Access from S-100 boards to the memory on the main board, as the circuitry required to support this facility would add considerably to the cost and complexity of the system. This is not a serious disadvantage, but does mean that S-100 boards to be used with the Super-80 must be selected with compatibility in mind.

We will not discuss the S-100 interface in any detail at this stage. That can be left to a later article. Suffice to say that the S-100 interface makes available the data and address bus connections, plus some of the control signals from the Z80 CPU.

Video monitor

Before you can get down to construction you must arrange for a suitable video monitor. This is because the stage-by-stage testing of the assembly process requires connection of the video monitor in order that you can "see" that the circuit is operational. You have two choices, but both require that you have an ordinary TV set available.

The first choice is certainly the easiest. Just use the Super-80's on board video modulator to connect to the VHF antenna terminals on any TV set, colour or black and white. But since you may not care (or be allowed) to monopolise the family colour set, it would probably be wise to obtain a small black and white set for this purpose.

Later, as you become more adventurous, you may decide to use the direct video output from the Super-80 to bypass the video modulator. This will most probably give better picture definition but will require modifications to the TV receiver itself. Again, you probably should not contemplate modifying the family colour set (after all, you would not want to risk family wrath by accidentally "modifying" the set to the extent that it had to be repaired). For those who are interested, we gave details of simple modifications to TV sets to enable them to have a direct video connection in the DREAM 6800 article in the July 1979 issue of "Electronics Australia".

Cassette recorder

You will also need a cassette recorder which has a 2.5mm motor control socket. These are normally provided on cheap mono portable cassette recorders which are ideal for this application. Preferably, the deck should not have auto level control for best results. This means that you can forget about using the family stereo cassette deck. Just as well too, otherwise your brother might revolt when he wants to play his latest tape from "Adam and the Ants".

Construction

Assembly of the Super-80 computer is quite straightforward. There are a few points to watch, but the key to success is to work in an organised way, going step by step through the assembly process and double-checking your work at each stage. Read the "Guide to Kit Construction" booklet included in the kit, and if you are unsure of your soldering skills practise for a while with a piece of scrap board.

A small soldering iron of about 15-20W is essential for soldering the fine tracks on the board, although a slightly larger iron may be necessary for making mechanical connections for the transformer and video modulator. Fine gauge resin-cored solder should be used. Wire cutters and a small pair of pliers will also be necessary for trimming and dressing component leads.

The solder masks on both sides of the board should prevent any solder carrying over to places where it shouldn't, but to be on the safe side have some means of removing solder such as a solder sucker or de-soldering braid handy. A small brush and some methylated spirits can also be used for removing excess resin to make the visual inspection of the board easier.

At this point check the parts list against the parts supplied in the kit. Note that a full set of sockets, parts for the S-100 interface, memory expansion beyond 16K and Basic in EPROM are not supplied in the standard kit but are available as options, as explained last month.

You will need also a transformer, a length of 3-core mains cable and a 3-pin power plug. A mains switch, a fuse and fuseholder will be required, as well as a box to enclose the completed transformer assembly. If you have already decided to house the computer in its own case, you will no doubt also use this to house the power transformer and thereby dispense with the need for a separate box for the transformer itself.

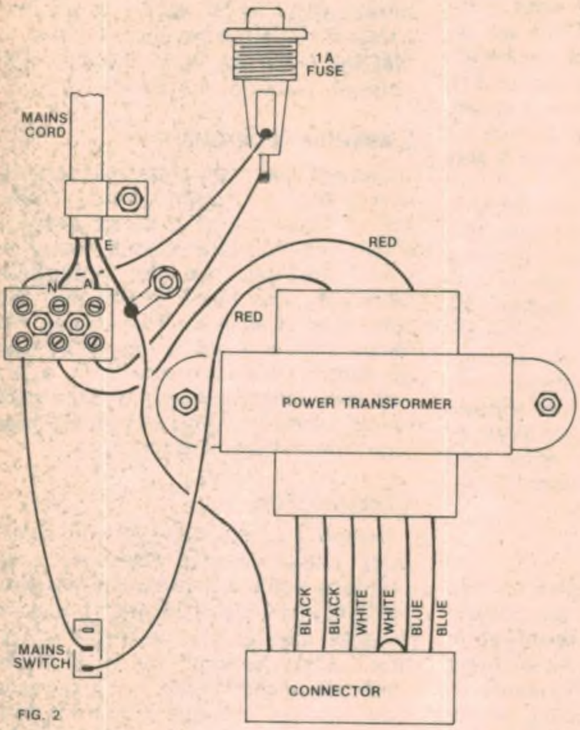


FIG. 2

At left is a suggested wiring layout for the power supply which may be housed in a separate box or in the same enclosure as the computer board. Either way, for safety's sake, all mains wiring should be completely isolated from the user.

You have a number of options in the way you build this computer. You can build it all on the single board as we did, for simplicity. Or you can cut off the keyboard section (along the dotted line on the underside of the PC board) so that you can have the keyboard angled for convenient use in a sloping front case. Alternatively, you could elect to have the keyboard separately housed and connected to the main computer case by a flat cable.

There are two ways to approach the construction. You can go at it like a bull at a gate: put all the components on the board and turn it on when you are finished. You never know – it might just work first time without problems. It would be better to take the more prudent approach and take it in easy stages, testing each section as it is complete. In this way, if you do come across malfunctions, you will at least know where to look for the problem.

We recommend that you start by building the power supply and then continue to follow the procedure outlined below.

First install the transformer in a suitable metal box which can be earthed and provide safe isolation of mains wiring. A suitable case may already be in your junk box or you could use one of the range of economy cases from Dick Smith Electronics, such as type H-2743 from the DSE catalogue.

We have provided a wiring diagram which suggests how the transformer can be connected. Drill holes in the front and rear panels of the case to suit the mains switch, fuseholder and cord entry holes for the three-core mains flex and the output leads. These latter holes should be fitted with grommets. Similarly, drill the base of the case to provide mounting holes for the transformer, mains cord clamp, three-way insulated terminal block and output lead connector.

Wire the fuseholder, mains switch and transformer primary connections in series, as shown in the diagram. Connect the mains earth wire to a solder lug bolted securely to the case.

Bring the secondary leads of the transformer plus an earth wire out to a seven-way tagstrip or an insulated terminal block (shown as "connector" in our diagram). Two of the secondary windings must be connected together in order to feed one of the bridge rectifiers on the PC board. To determine how the connections are made, you will need a multimeter with a 30VAC (or more) range. Temporarily join one of the blue wires to one of the white wires. Then connect the power and measure the voltage between the remaining blue and white wires. The result should be about 25VAC.

If this is the case, you have struck the right connection first go and the two joined wires may be permanently joined on the connector strip to become a centre-tap. If you measured zero voltage, try a different combination of blue and white wires until you get 25VAC between the two "free" blue and white wires.

Now make up a cable of six wires to connect the power transformer connector to the PC board. One of these wires joins to the common centre-tap connection mentioned above and thus eliminates one length of wire. These wires should ideally match the colour of the leads from the transformer except for the "centre-tap" which can be some other colour such as orange while the earth connection can be green.

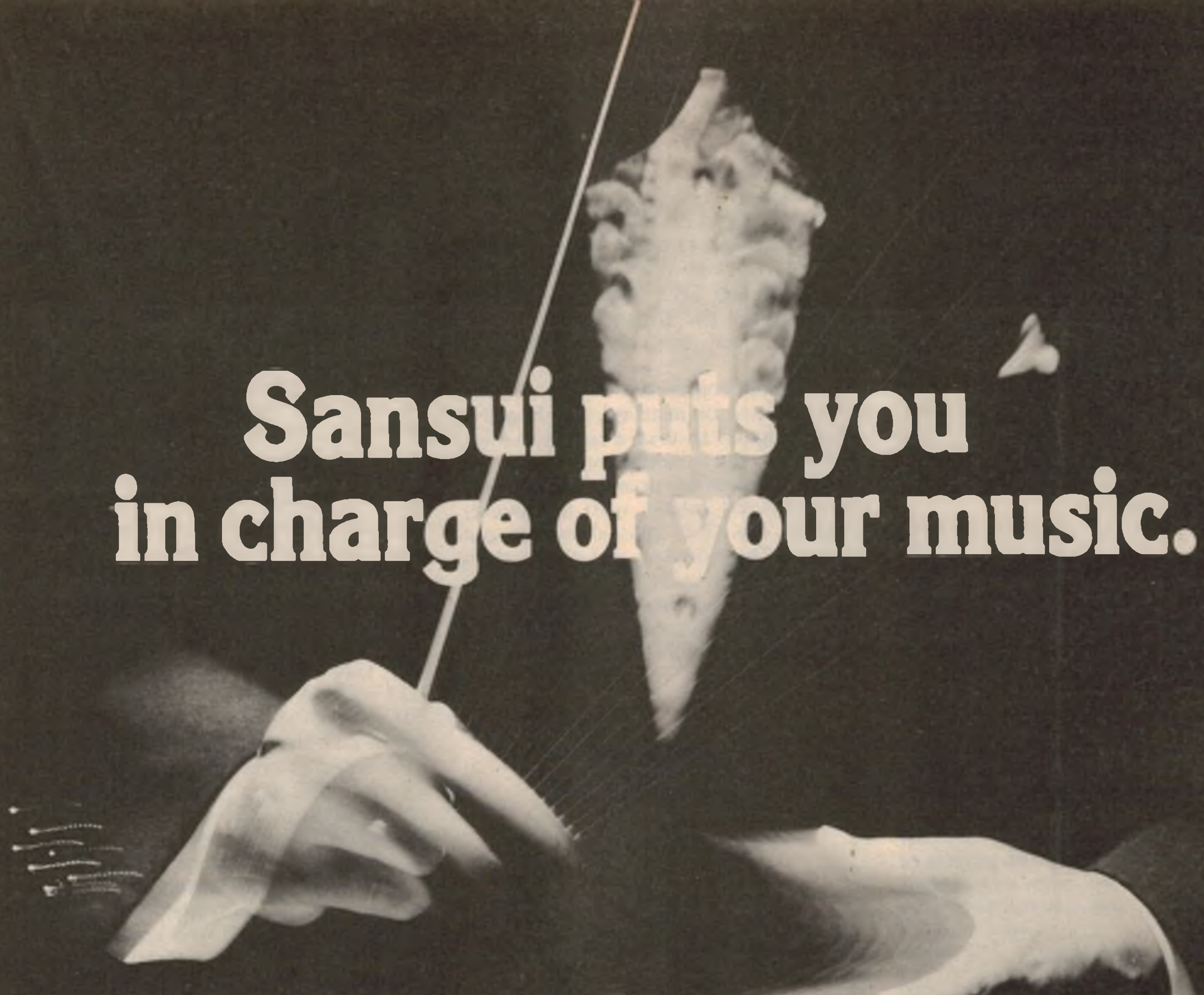
Run the wires in a suitable length of plastic tubing and pass the resulting cable through a grommetted hole in the case. At the other end of the cables, the individual leads should be stripped and tinned, ready for connection to the PC board. The cable should be anchored to the PC board (when the connections are made) with a cord clamp to avoid undue flexing of the solder connections.

With the transformer assembly completed, you can start work on the board, locating the components as shown on the component overlay. We have reproduced it here in this article, minus the keyboard section, to allow you to easily follow the text. First insert and solder the eight rectifier diodes, CR1 to CR8 and three filter capacitors, C1, C2 and C4. C3 is omitted unless you are building a version of the Super-80 which includes the S-100 interface. Note that all of the eight diodes point the same way, with cathodes (striped end of the package) towards the filter capacitors. With this done, connect the power transformer cable.

The PC board is actually designed to take a Molex connector for the supply connections but we understand that this connector will not be available from Dick Smith Electronics. Therefore the connections must be soldered directly to the PC board. Starting from pin 1 (as marked on the PC component overlay) connect the "free" blue wire. Then solder the orange centre-tap wire right next to it. Then miss the next pin and solder the remaining white wire to pin 4. Then solder the black wires to pins 5 and 6 and the green wire to pin 7 (which is marked GND).

Now apply power to the transformer and measure the DC output voltages from the rectifiers: the cathodes of CR2 and CR3 joined together should have about +12V DC present; cathodes of CR6 and CR7, about +20VDC and at the anodes of CR5 and CR8, about −20VDC. These are unloaded voltages which will be reduced somewhat when the regulators and other circuitry is connected. Before going on with the assembly, discharge C1, C2 and C4 with a resistor.

Install the regulators U80 (7812), U81 (7805), U82 (also a 7805) and U2 (a 7905). First use a pair of pliers to bend the leads about 10mm from the body of the regulators so that they lie flat on the board with the leads in the holes provided. The two 7805 regulators have heatsinks which should be installed with the shorter part beneath the regulator and



Sansui puts you in charge of your music.

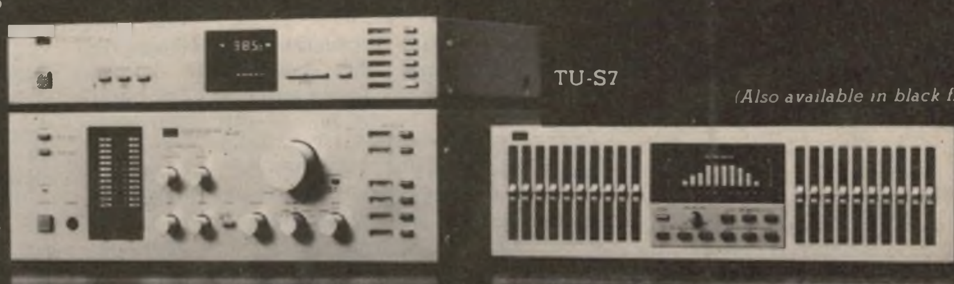
Does listening to your stereo system make you feel like you're at a live performance? Of course it doesn't. And if you don't agree, either you've got a tin ear or you've never been to a live performance. The best a stereo system can hope for is to approach the rich dynamism of the real thing. And at Sansui, that's our goal.

One way we do this is to put you in charge of the way your system sounds. Nobody we know of has a listening room with the fine acoustics of a music hall. And none of the standard reproduction methods—discs, tapes, FM—can accommodate the full dynamic range of a symphony. That's why you need versatile take-charge stereo equipment like the SE-8, a full 10-band stereo graphic equalizer with a built-in real-time spectrum analyzer. In a nutshell, it lets you recreate an approximation of the original performance.

Even if you don't opt for the remarkable versatility of the SE-8, you get *four* tone controls—Super-bass, Bass, Presence and Treble—with the AU-D7 "Linear-A" DD/DC integrated amplifier. Plus, you get MC-cartridge capability and the pure-sounding Linear-A design that has eliminated switching and cross-over distortion completely.

And when you're ready for the vast treasure-trove of musical enjoyment available over the airwaves, we've got the matching TU-S7 Quartz Synthesizer Tuner. It offers 3 tuning modes including preset pushbutton tuning of 6 FM and 6 AM stations.

If you want your music to sound like a live performance, let Sansui put you in charge.



(Also available in black finish.)

Sansui

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

the longer side vertical. Bolt the regulators into place then solder the leads to the pads beneath the board.

Now install the tantalum capacitors C5, C17, C26, C28, C29, C30 and C31. Be careful about the polarity of these devices. Turn on the power and check the output of the regulators.

You should be able to measure close to +5VDC across C26 and C28, +12VDC across C30 and −5VDC across C5. Make sure that the polarity of the output voltages agrees with the polarity marking of these capacitors.

Once again it is a good idea to discharge the reservoir capacitors C1, C2 and C4 before proceeding with further assembly. Now install the memory supply bypass capacitors, C32 through to C55. Twelve of these are tantalum capacitors, so pay attention to the polarity markings when inserting them.

Sockets

In our opinion the use of sockets for all ICs on the board is mandatory. Desoldering an IC from a double-sided board is well nigh impossible, at least without risking damage to the plating of the board. In addition, even though you may only plan a minimum 16K system at the moment, microcomputers have a way of growing! Construction and future expansion is greatly simplified by having a full set of sockets in place, and it also allows you to take advantage of the Dick Smith "Return for Service" coupon if worst comes to worst.

Orientation of the IC sockets is quite important. The sockets we were supplied with have a rectangular notch in one end and one rounded corner to indicate pin 1. Match this mark with the orientation markings on the PCB. After soldering each group of five or six sockets connect the transformer and repeat the voltage tests, remembering to discharge the reservoir capacitors after each test.

Install and solder the remaining capacitors, potentiometer and the resistors on the PCB. Check off each part on the parts list as it is soldered and be careful to match each component with the overlay diagram. Note that R64, and R65 are mounted vertically on the board and that the potentiometer is mounted so that the set screw faces the rear.

Next to C2 on the PCB is a space for four wire links. Each of these links has a specific effect on the operation of the computer as described earlier. No links should be fitted as yet, but a 4-way DIP switch (if you have one) can be installed at this stage instead of the links.

The 12MHz crystal should be mounted so that it is raised a little off the PCB to prevent the metal case shorting tracks beneath it. The reset pushbutton can be mounted directly on the board or linked by a short piece of wire so that if the computer is installed in a case the switch can be mounted on the outside.

Next install the two transistors, Q1 and Q2, the LED and the four diodes D9, D10, D11 and D12. Again watch the orientation of these parts, and remember that they are sensitive to heat.

The connecting cords for the cassette deck can now be installed. The board is again designed to take a six-way Molex connector but connections may be made directly to the board. This involves three shielded cables, with the shields going to the GND pins shown in our diagram. The Speaker and MIC cables should be fitted with 3.5mm jack plugs to match the sockets on the cassette recorder while the motor control cable should be fitted with a 2.5mm jack plug.

This diagram shows the connections to the cassette interface port on the PC board.

The motor control relay and the video modulator should now be installed. Mount the modulator with a slight clearance underneath so that the metal body is not in contact with any of the tracks on the board.

Keyboard

A separate sheet describing the assembly of the keyboard is supplied with the kit, but a few hints are in order. Assemble the mechanism and rubber stoppers for the space bar first, making sure that the keyswitch for the space bar is the right way around. Assemble the Escape and Backspace keys next and mount them in place in the metal framework. The whole assembly can now be mounted on the keyboard setion of the PCB. It is much easier to position three keyswitches than to mount the whole assembly with 60 switches in place!

Note the instructions regarding the right hand shift key. There is no keyswitch under the end of the left hand shift key or the end of the return and backspace keys. The three holes on either side of the space bar will also be left empty. Snap the keyswitches into position starting with the bottom row, and be careful to install them correctly. They go into position in the metal frame easily, but are very difficult to remove.

At this point your kit should be looking something like the photographs published in the last issue. The next step is the simplest and perhaps the most exciting – plugging in the chips to make the beast go!

Installing the ICs

The kit assembly manual available from Dick Smith Electronics provides a detailed list of the chips to be inserted and test points to verify the correct operation of each stage of the circuit. An oscilloscope, frequency counter or logic probe is required to take advantage of this information, but the kit can be assembled without these aids.

First insert U39, U45, U40, U36, U31 and U29, the divider chain which produces the video timing signals from the 12MHz master clock. Next install U15, U30, U28, U50, U76, U16, U35, U22 and U23 and we are ready for our first test. But before applying power take particular care to see that each IC is correctly oriented – look to see that the notch (or dot indicating pin 1) matches the notch on the IC socket and the pictorial socket on the PC board.

Connect a television set (tuned to Channel 1) to the output of the video modulator, or if you are using a direct video monitor make the connection to the video output. Temporarily link pins 25 and 23 of the socket U46, the Z80 microprocessor. Switch on the video monitor and the power to the board. If all is well you should see rows of white rectangles on the display screen. It may be necessary to adjust the tuning of the television set or the video modulator to obtain a steady display.

If no rectangles appear test instruments really become necessary. A logic probe which can detect fast pulse trains as well as fixed logic levels is the minimum requirement. Use the probe to trace back along the frequency divider chain and the VDU timing circuitry. All the outputs of the ICs in this section should be pulse trains, not fixed levels. If the pulse train disappears, try replacing the IC at this point and repeat the test with the video monitor. More precise tests are possible with an oscilloscope or frequency counter. Each IC can be checked for the presence of an output signal of the correct frequency, as described in the kit assembly manual.

Switch off the power but leave the video monitor connected and the link in place in the socket of U46. Remove the character generator, U27, from its protective packaging and insert it in its socket. When you switch on the power to the board and the video monitor you should see a display of characters on the VDU. Temporarily link pins 7 and 8 of the socket of U18 and check that the video screen goes blank. At the completion of these tests switch off the power and remove both wire links.

Insert U44, the divider for the processor clock. If possible, check for a 2MHz oscillation at pin 7 of this chip. This is the master clock frequency for the Z80. U9 is next, the buffer for the Reset circuitry. If you have a logic probe check that pin 12 of U16 now goes from low to high with each press of the reset button. Turn off the power and insert U8, U14, U17, U38, U43, and U34.

Central processor unit

Before inserting the Z80 chip there are some tests to be made. If you have a logic probe check pins 1 to 5 of the microprocessor socket. They should show a changing signal, rather than a continuous low or high level. Pin 11 of the socket is the +5V input, which can be checked with a multimeter. Pin 26, the reset input, should go low each time the reset switch is pushed and released.

Turn off the power and wait a while. Remove the Z80 CPU from its conductive foam packaging, handling the ends of the body only. Align it above the socket and gently ease it into place. Patience is the major requirement for this operation. Be careful that no pins are bent under the body of the chip.

U77 is installed with pin 1 towards the front of the board. Next install U37, U3, U32 and U48. The EPROM containing the Monitor program, U26, is installed at this point. Insert U41 then connect the video monitor and apply power to the board. You should see a jumble of characters on the screen, with the words "SUPER-80" in the second line. If all is well shake hands with yourself and go and have a cup of coffee or something.

Make sure the power is off before inserting U5 and U13, the address buffers, and U20 and U21, the RAM address multiplexers. Install U10, U25, U18 and U75.

Finally

The next test uses a software routine in the Monitor ROM to test out the operation of the circuitry installed so far. If your board passes this test you will have a fully functioning computer very shortly.

Place a temporary link into "Link B" on the board, or close the switch if you are using one. When you turn on the power the LED on the board and the VDU screen should go on and off slowly, about every eight seconds. As the LED goes on the relay of the cassette interface should close with an audible click.

The next step is the installation of the eight RAM chips in the first bank of memory furthest from the power supply. The chips to be inserted are U53, U56, U59, U62, U65, U68, U71 and U74. With the chips in place switch on the power and look for a pattern of characters on the screen. The RAM will contain random patterns of bits which will probably be displayed as rows of @@@@@@@ or ????? characters. If link B is in place the test mode will flash the screen on and off.

Remove link B, or open the switch at the B position. The pattern on the screen should stabilise. Insert a wire link in the link A position, or close the appropriate switch. The screen should clear and the words "SUPER-80" will appear at the top centre. At the left of the next line will be the monitor prompt character, a ".".

All that's left now is the keyboard interface and the cassette circuity.

Turn off the power and insert U78, U49 and U47, the PIO chip. Turn on the power and push the reset button. A flashing cursor "–" will appear next to the period on the second line. Type on the keyboard and check the letters that appear on the VDU. Read the manual on the Super-80 Monitor commands and try each one. Note that none of the commands relating to the cassette interface will work, as these components have not yet been installed.

Cassette interface

Install U1 and U79. U79 is a CMOS chip so take appropriate precautions.

If you have a copy of the Basic interpreter cassette you can adjust the cassette interface to load it correctly. Connect the EAR (speaker) and MIC cables to the recorder, but do not connect the motor control cable as yet. Rewind the cassette and play it with the volume control at maximum. Use a multimeter to measure the voltage between pins 2 and 3 off U1. After the cassette has been playing for about 30 seconds adjust the set screw of the potentiometer to give a reading which fluctuates around 0V. The cassette interface will then be correctly aligned.

At this point your Super-80 computer should be fully operational. Rewind the cassette recorder and connect the motor control cable. Follow the procedure given in the Monitor manual for loading Basic, then refer to the Basic manual. If you don't want to use Basic at this stage refer to the Monitor manual or a reference book such as "Programming the Z80" by Rodnay Zaks (Sybex Inc USA, 1980). Remember that even the fanciest "high level language" is made up of combinations of fundamental machine code instructions. There's plenty of room to experiment!

Construction of the S-100 expansion interface, memory expansion and the installation of the Basic EPROMs will be covered next month. We will also provide circuit diagrams and trouble-shooting procedures and some simple machine code programs to get you started.

The Serviceman

Antennas, transformers: we live and learn.

I have two stories this month — one of my own and one from a colleague — and, while they are technically about as far apart as they can be, they do have a common factor. In both cases the end result seemed to contradict what one would expect from basic principles.

My first story is another from my colleague on the NSW south coast and again involves the problems of TV antenna systems in fringe areas. It serves to emphasise that we in the metropolitan areas should be thankful that most antenna installations are routine, yielding fairly predictable results.

As regular readers may recall, my south coast colleague works in the channels 4 and 5A region, south from Wollongong, where signals from the Sydney stations are, to say the least, patchy and unreliable. As well as the parent channels of 4 (commercial) and 5A (ABC), there are translators in the Bateman's Bay area on channels 9 (from 5A) and 11 (from 4).

Collectively, they give good coverage of the area, but there are some people who want to receive the Sydney commercial stations as well, and who are prepared to spend a lot of money to achieve this. This, then, is the background and the rest of the story is best told more or less in my colleague's own words.

EXPERIENCE HELPS

In this neck of the woods, which is pretty much a deep fringe area, years of experience have taught me where there are likely to be reasonable signals, where to forget about the idea altogether, and which are the areas of considerable doubt.

This story concerns the Burrill Lake area, south of Ulladulla, which I normally place in the "forget it" category. Granted, the particular site involved was well up on the northern side of a hill and, therefore, nominally looking towards the Sydney channels. The snag was that it looks into a high ridge, about 5km to the north.

So, when the customer broached the subject of an antenna system for the Sydney channels, I told him my experience around that area. I certainly could not guarantee results and, with something like $300 at stake, I advised him not to risk his money.

But the customer was adamant. He was quite prepared to take the risk if I would simply do the best I could. So, on that clear understanding, I agreed to go ahead.

The installation was fairly conventional for this area; a multi-channel phased array and mast-head amplifier on a reasonably tall mast. And I had to admit that the results were far better than I had expected. The picture wasn't perfect, to be sure, but I had seen a lot worse, and hoped that the customer might find it acceptable. In fact he was delighted and reckoned it was money well spent.

What was more to the point, it wasn't long before his next-door neighbour commissioned me to put in a similar system,and this performed every bit as well. On the basis of this experience I felt I now knew the area better; well enough to respond confidently when a third householder in the area approached me.

I was even more confident when I saw the exact site. Whereas my previous installations had been about 20 metres down the side of the hill, this site was right on top of the hill. To the south, to the west, and out to sea was completely unobstructed; only to the north was the view still obstructed by the previously mentioned ridge.

"There's more money in it than servicing the darned thing!"

Nevertheless, I reasoned that if my previous system had worked well, one on this site would have to work better. And, as a further bonus, the house was a two storey one, meaning that I could conveniently score just that much more height for the antenna.

The customer's existing antenna was a simple 4/5A Yagi, very popular in this area, mounted on a short mast attached to the barge board on the rear of the house and looking over the roof towards the local transmitters to the north. For those channels it was giving perfect results.

MORE OF THE SAME

For the new installation I repeated the previous set-ups; a high gain phased array and mast-head amplifier on top of a fairly tall mast. Standing high above the house, on such an elevated site, it looked as though it would bring in the world.

Alas for my hopes; it was a dismal failure. The worst shock was the results on 4 and 5A. Previously perfect, they were now marred by very substantial ghosts. From Sydney, channel 7 was reasonable, though marginally poorer than from the previous two installations, but channels 9 and 10 were both hopeless.

The failure of channel 9 was really quite normal, and I had warned the customer on this point. It is subject, in this area, to co-channel interference from 5A's channel 9 translator at Bateman's Bay. In fact, the translator was putting a snow-free picture into the back of the phased array.

But what was gumming up channel 10? Switching to channel 11 provided the clue. Channel 4's translator, on channel 11, was also putting a walloping signal into the back of the phased array; strong enough to cause adjacent channel interference to the Sydney channel 10 signal.

So there it was, a right proper mess. Why was it happening and, more important, what could I do about it? On reflection, there seemed to be a couple of major factors involved. One was that this phased array, while having substantially higher gain, has a poorer back-to-front ratio than the simple 4/5A Yagi it had replaced.

And this was aggravated by the site; it was too good. Whereas the previous installations had been well shielded to the south and south-west by the hill behind them, this site was wide open and I suspected that several mountain ridges some eight to 12km away to the west and south-west were the source of the 4 and 5A ghosts.

So what could be done about it? If the worst came to the worst, it seemed that I might have to revert to the simple Yagi for the local 4 and 5A channels, with suitable switching to accommodate a more suitable antenna for the Sydney channels, such as a high gain Yagi with a better back-to-front ratio.

TRIAL AND ERROR

But that would be a last resort. First it was logical to try to find a better site for the existing antenna system, though I must confess I wasn't particularly hopeful. To this end I pulled the antenna down and, holding it on a short length of mast, tried a number of locations on either side of the block. The improvement was negligible.

Then I had another idea. If the ghosting was coming from where I suspected, would it be possible to use the house as shield? To try the idea I set up the antenna on a short length of mast, just above ground level, in front of the house. And at last I seemed to be getting somewhere. The ghosts on 4 and 5A had vanished, and the translator signals were much reduced.

The only snag was that the Sydney signals were too weak to be usable. The only hope was to find a compromise site. As I mentioned earlier, it was a two storey house. And on the first floor was a balcony, facing north.

And it worked. I found a spot where 4 and 5A signals were still completely ghost-free (one of my main worries) while signals from channel 7 and channel 10 were now quite reasonable. Clearly, the house was attenuating the signals from the channel 11 translator to the point where they were no longer intruding on channel 10.

And so it all ended happily – more or less! While, to my critical eye, the Sydney signals were marginally down on what I had expected, based on the other two installations, the customer was satisfied. On the debit side was the time it had all taken; far more than I could reasonably charge to the customer, so I had to carry that loss.

Still, that's the name of the game with antenna installations; win some, lose some, with hopefully, more successes than failures.

The story from my own bench is against a quite different background. It started out with a routine call to service a modern colour TV set, and finished up as a restoration job for what is very nearly a museum piece.

More precisely, it was a Kriesler "Multisonic" radiogram; the kind of thing that was popular 15 or more years ago and which was valued as much as a piece of furniture as it was as an entertainment unit. Using valve technology and fitted with a conventional record changer, they were nevertheless capable of quite reasonable reproduction, even if not equal to today's standards.

This particular model boasted a more impressive than usual cabinet, and must have cost a lot of money when new. It occupied a prominent place in the lounge room and I couldn't help noticing it when I walked in. I mentally registered that I hoped nothing would go wrong with it, because valves and other replacement parts are becoming increasingly difficult to obtain.

Unfortunately, it was already in trouble. No sooner had I pronounced the TV set back in operation than the customer pointed to the radiogram. "I wonder if you'd listen to this and tell me what you think. It failed in one channel some months ago and I got a bloke in to fix it, but I'm sure it isn't right. Tell me what you think."

So saying he switched it on, selected a record, and set it spinning on the turntable. I listened for a few seconds and then swung the balance control through its full range. Then I knew the customer was right; the right hand channel sounded horrible. There was no bass response and what signals there were, were noticeably distorted.

When I confirmed the owner's suspicions he immediately wanted to know if I would have a look at it. I said I would, but I first raised the matter of the previous serviceman. Shouldn't he be given a chance to put things right? It transpired that he'd been given his chance already, several times, but had never put in an appearance.

A CIRCUIT HELPS!

I removed the back of the cabinet and was gratified to find a circuit diagram pasted to the inside of it. The circuit was fairly conventional for that vintage. Each amplifier consisted of a 12AX7 preamplifier, plus a couple of 6GW8 triode/pentodes. One triode section functioned as a second amplifier, the other triode as a phase splitter, and the two pentodes as output stages.

The pentodes worked into a 7000 ohm per side speaker transformer, with a 15Ω secondary feeding a low-range, mid-range, and high-range speaker system.

The next thing was to get the chassis out; a rather complicated procedure involving the removal of sundry knobs, escutcheons, screws, bolts, panels, etc, but it was eventually accomplished. And the first thing I noticed was that one of the speaker transformers had obviously been replaced, being smaller and of a different make to its mate in the other channel.

But that was only the beginning. Closer examination revealed that it was only a single-ended transformer and I was intrigued as to what clever trick my predecessor had pulled to enable a single-ended transformer to be used in a push-pull circuit.

In fact, the explanation was amazingly simple; he had wired the transformer into the plate circuit of one of the output valves and left the other valve to its fate — including an open plate circuit and a red hot screen! Small wonder that it sounded horrible. (Fortunately for the valve concerned, the set had not been used after the owner's brief trial run following the repair.)

In fact, I would nominate that gentleman for the OSA — Order of the Striped (butcher's) Apron.

More to the point, what was I going to do about replacing the bodgie transformer? I had little doubt as to why it had been fitted; the right one was obviously no longer available, at least from the normal sources.

I explained the situation to the customer, including the possibility that it might take several weeks to find a suitable replacement. He was quite resigned to the delay, but he emphasised that he was very keen to get the set working. Quite apart from not wanting to throw out a nice piece of furniture, he and his wife genuinely enjoyed its sound and had built up a collection of cherished records.

NEW TRANSFORMER?

And so the search began. I didn't even bother to ring the makers, reasoning that they would long since have written off this particular model. Instead I tried a couple of my regular suppliers of bits and pieces, who are pretty good at finding hard-to-get bits. Unfortunately, neither was able to help in this case.

So then I did try the makers. The result has its amusing side in retrospect, though it didn't seem funny at the time. The storeman I contacted was only a young bloke and he literally didn't know what I was talking about when I mentioned a transformer for push-pull valves. The truth is, he was probably still in primary school when this set was made.

To give him his due he did check with someone higher up — and presumably older — and finally came back with the answer I expected, no stocks.

So where did I go from there? One avenue was via my amateur friend. He had a well stocked junk box, as did most of his on-air friends. Surely one of them had such a transformer tucked away somewhere. In fact, two of them did come good with partial solutions. Neither was the correct impedance ratio, and both were physically much too large to fit on the chassis. They would have to be mounted outboard.

I decided to treat these as a last resort in the event that all my other efforts failed. At least I now knew that I had a chance of fixing the set, one way or another. More weeks went by, and I had almost given up when an advertisement appeared in this magazine by a warehouse that was clearing out a lot of old stock.

And amongst it were some 7000 ohm per side speaker transformers which, from the illustration, looked exactly like the one I wanted. A phone call confirmed the availability, but revealed one nasty fact that no one had bothered to mention; the ratio was 7000 per side to two ohms, not 15 ohms.

WORTH A TRIAL

Disappointing though this was, I decided to take a punt. The cost involved was not very great and, in spite of the serious mismatch, I thought it was worth a try. If it proved totally unsuitable I would be only slightly worse off and could still fall back on one of the outboard arrangements.

So it was that I fronted up to the customer again and set about fitting the new transformer. Physically, there were no problems; it was an exact match for the original unit.

I wired it in temporarily at first. For one thing the feedback voltage was taken from the secondary and it was a fifty-fifty chance whether I would get the phase right the first time. By Murphy's Law, of course, the odds were a lot worse and, at switch-on, the speaker gave forth a fearful howl.

That was quickly corrected and then came the crucial test; what did it sound like? To be honest it was far better than I had hoped, and was certainly a far cry from the horrible performance of the previous bodgie set-up. More exactly, I could not pick any difference between this channel and its stereo mate. And I need hardly add that the customer was delighted.

I tidied everything up, fitted the chassis back in the cabinet, collected my fee, and left a happy customer to drool over his restored unit.

'I'll be back, Doc. I'm afraid it's going to take four or five adjustments!' (From "PF Reporter")

But how had I been able to get away with such a gross mismatch? Or had I really been guilty of the same kind of butchery for which I had condemned my predecessor, though perhaps in a more subtle way?

Judging on results alone, I don't think I need apologise. The previous effort had produced distortion that was obvious even to a non-critical ear, while my effort had produced a result which was acceptable to my own ear, which I regard as fairly experienced. What's more, I had given the customer plenty of opportunity to assess that performance before accepting it.

As for getting away with such a gross mismatch, I must confess to being agreeably surprised. The truth is that a pentode is a fairly critical device in the matter of load. Variation either way from the optimum results in both reduced power output and increased distortion.

Granted, a speaker load is not constant at all frequencies anyway, but this doesn't alter the fact that the theoretically correct load is the best place to start from, before introducing the inevitable variables.

In this case there appear to be a number of factors which worked in my favour. One is that these systems were, in a way, considerably over designed. The push-pull pentodes were capable of delivering between eight and 10 watts in this configuration, and were feeding highly sensitive speakers.

Because of this speaker sensitivity it is unlikely that they would ever be asked to deliver more than a fraction of this in a typical lounge room situation; probably a few hundred milliwatts average, peaking to a watt or so. In these circumstances the inherent distortion would be low anyway.

BUT IT WORKED!

The other important factor is the negative feedback system; something which can correct a multitude of faults. Granted the amount of feedback would be down somewhat, but even a small amount of feedback can still be very effective. In addition, the reduced feedback would tend to offset the loss of sensitivity caused by the mismatch, and help to keep the two channels equal. In fact, there was no noticeable imbalance between the channels.

So there it is, my effort at keeping "old faithful" going for a few more years. Hopefully, the owner will get a lot of pleasure out of it. But the really interesting thing about both these stories is that neither worked out as might have been expected. The antenna site which should have been a good one gave poor results because it was too good, and the output transformer gave good results where one had every reason to fear that they might be poor.

everyone can learn electronics . . . the effective Heathkit® way!

There's never been a better, faster, lower cost way to learn electronics than these Heathkit Programs! Learning electronics could very well be the most important step you'll ever take, so, naturally, there are many factors to consider in choosing your method of learning. If you're like most people, you don't have the time for conventional learning institutions. The Heathkit Continuing Education Series was conceived to make learning electronics more convenient and affordable for everyone. Thousands of people just like you are finding out what makes Heathkit learning programs so tremendously successful. Simple, easy-to-use and EFFECTIVE!

Among the many reasons for the wide acceptance of these programs is their simplicity. Each learning program is simply and logically arranged for easy, step-by-step 'programmed' learning. Progressing at your own established pace, you learn in an unhurried environment free from pressure. No facet of the material is omitted and nothing is assumed. Each program includes everything you need for a high degree of understanding. Audio records (or optional cassettes) reinforce the text material and an optional final examination lets you test your overall comprehension.

The Continuing Education Programs are economical too. The first four programs use the same trainer so you can get a complete education in fundamental electronics at substantial savings. The advanced programs, Digital Techniques and Microprocessors, require separate trainers, but they still cost less than competitive courses.

Get 'Hands-on' experience for a better understanding of electronics. Learning electronics and being able to apply what you've learned are, of course, the goals you seek to achieve with the Heathkit Continuing Education Series. For that reason, we have spared no effort in assuring your complete comprehension. Our optional Electronic Trainers, designed for use with each program, perfectly illustrate the Heath approach to learning. These trainers give you actual 'hands-on' experience with electronic components and circuitry. It's an acknowledged fact that you learn best by doing and the trainers let you do exactly that. You get a better grasp of circuit concepts and perform the program projects quicker and easier as well. Solderless connectors on the trainer panel make hookup of the components supplied with the program quick and neat. Built-in power supplies and signal sources provide convenient operation. The trainers are available in both kit and assembled form.

When you've finished the program, the trainer still serves as the ideal device for breadboarding circuits of your own design. We highly recommend these trainers as supplements to the Heathkit Individual Learning Programs. A record (or cassette) player is needed to play the audio portion of the material. A VOM for measuring voltages is also needed, and an oscilloscope is required for some of the experiments in the Electronic Circuits and Digital Techniques Programs.

---

to find out more send for your FREE CATALOG today!

Recommended Order
The Heathkit Self-Instruction Programs are Designed to let you Progress from DC Electronics to AC Electronics to Semiconductor Devices to Electronic Circuits. These are the Four Basic Programs. For Optional Advanced Study, The Digital Techniques Program Provides the Background for the Microprocessor Program.

There are many courses in the HEATHKIT Continuing Education Program designed to effectively expand your electronic horizons including:—

EE 3101	DC Electronics	$89.00
EE 3102	AC Electronics	$92.00
EE 3103	Semiconductors	$92.00
EE 3104	Electronic Circuits	$109.00
EE 3201	Digital Techniques	$127.00
EE 3401	Microprocessor Program	$168.00
ET 3100	Experimenter/Trainer	$150.00
ET 3200	Electronic Trainer	$166.00
ET 3400	Computer Trainer	$412.00

ORDER BY COUPON NOW OR COME TO OUR SHOWROOM

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

Name ....

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

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

☐ EE 3101
☐ EE 3102
☐ EE 3103
☐ EE 3104
☐ EE 3201
☐ EE 3401
☐ ET 3100
☐ ET 3200
☐ ET 3400

☐ Please rush me my Free catalog containing full details on the complete range of Heathkit Learning Programs.

Bankcard
Credit Card No:
Expiry Date __________ Signature __________

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.

Versatile Nicad Battery Charger

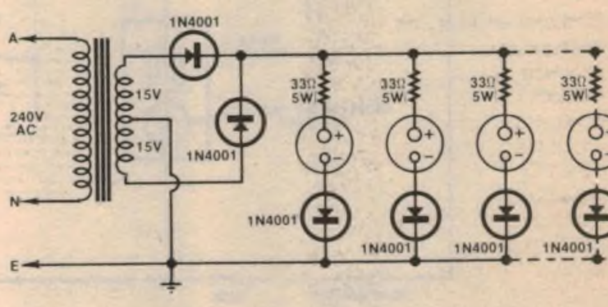
This unit has been designed to permit the charging of two or more sets of nickel-cadmium batteries at the one time. Separate polarised output sockets are provided, with the number being dependant upon the current ratings of the power transformer and rectifier diodes actually used.

Blocking diodes are wired in series with each socket to prevent discharge from one battery to another when the power supply is switched off.

It is suggested that a set of proprietary battery holders be procured to cover the range of batteries it is desired to charge. Wire each holder's battery contacts to polarised plugs (mating with the supply's sockets), via suitable resistors.

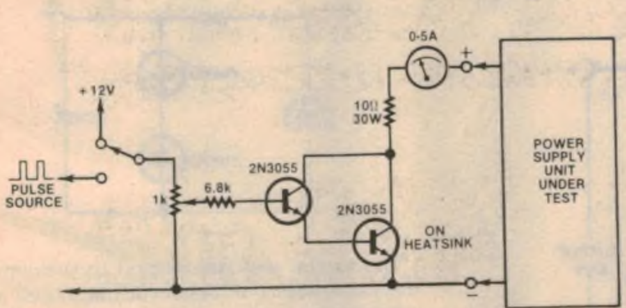
Select the resistor value to give the desired charging current when the battery is near the fully-charged state. Recommended charging current for AA-size cells is 45mA, for C-size cells is 180mA and for D cells is 400mA. Note that power resistors may be required when charging the larger cells. Charging currents for other cell sizes may be obtained from your local battery distributor.

Note that separate series resistors must be mounted in each battery holder.



B. Hunt,
Heathmont, Vic.

Active DC load



Choose an ammeter with full scale deflection a little larger than the desired load current.

When designing and testing DC power supplies, suitable high power resistors and rheostats to serve as test loads are often unavailable. To overcome this problem a simple circuit comprising two low-cost transistors, a low power potentiometer and a couple of resistors may be brought into service. Additionally, the set-up may be used for investigating the transient performance of the supply – a facility not possible with passive loads.

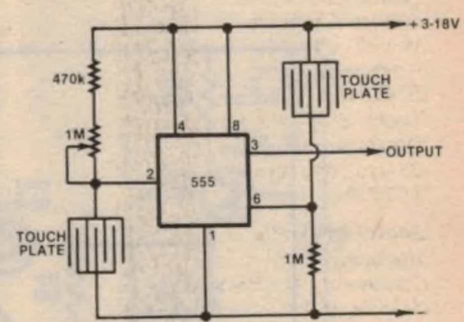
Referring to the accompanying diagram, it will be seen that a 1kΩ potentiometer is connected across a 12-volt source. The moving arm is wired via a 6.8kΩ series resistor to a two-stage current amplifier, connected as a Darlington pair. The output of the power supply is coupled to the collector of the second stage via an ammeter and a 10Ω 30 watt resistor. This resistor limits the peak current through the transistor.

The 2N3055 transistors used in the prototype each had an Hfe of approximately 40. Thus to pass a current of, say, 2 amps through the second transistor an input current of approximately 1.25mA was required. Not only can a power supply be "loaded" with ease, but also, a pulse generator may be substituted for the 12 volt source, enabling transient tests to be conducted. Use an oscilloscope to observe the resultant transient response.

Note that it is necessary to mount the second transistor on a substantial heatsink to dissipate the power.

Tagore J. John,
Meerut,
India.

Inexpensive Touch Switch



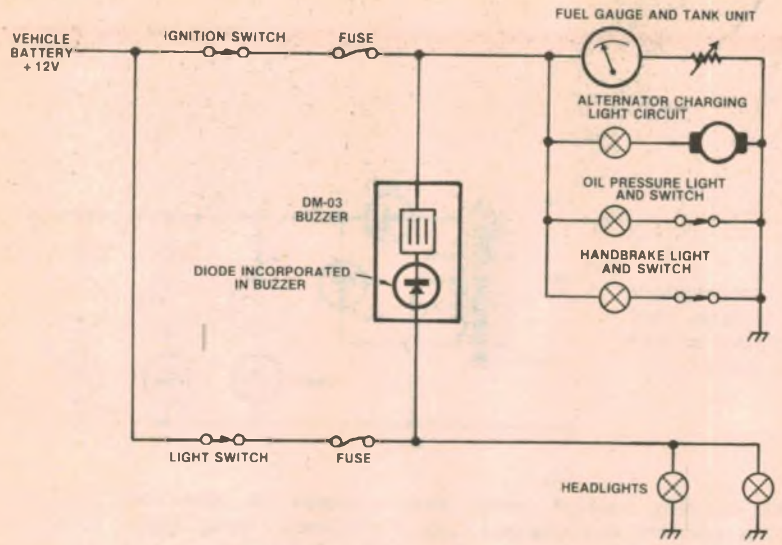
The two internal comparators of a 555 timer IC are used to detect voltage changes when the leakage across a "touchplate" is varied by the application of a "finger". When the resistance across the touchplate connected to pin 2 is reduced, the output (pin 3) will go high, and may be used to activate other circuitry.

If it is desired to obtain a "low" output, use the touchplate connected to pin 6. The 1MΩ trimpot is used for setting the quiescent state of the 555, according to which output mode is required.

A suitable touchplate could be made by etching a small piece of printed circuit card in some sort of maze arrangement as shown. Remember to keep the touchplates clean and dry.

M. Samerski,
Sutherland, NSW.

Simple Headlight Reminder Alarm



On some motor vehicles it is possible to use a simpler circuit – for a headlight reminder alarm – than that described in the May, 1980 issue of "Electronics Australia". To be able to use this scheme it is necessary that the vehicle be equipped with warning lamps which are energised when the ignition is switched on. Some cars without warning lights may be unsuited to its application.

The only component required is a DM-03 (or similar) buzzer, whose positive terminal is connected to the "output" of the headlight switch; whilst its negative terminal goes to the "buss" feeding the warning lamps circuit.

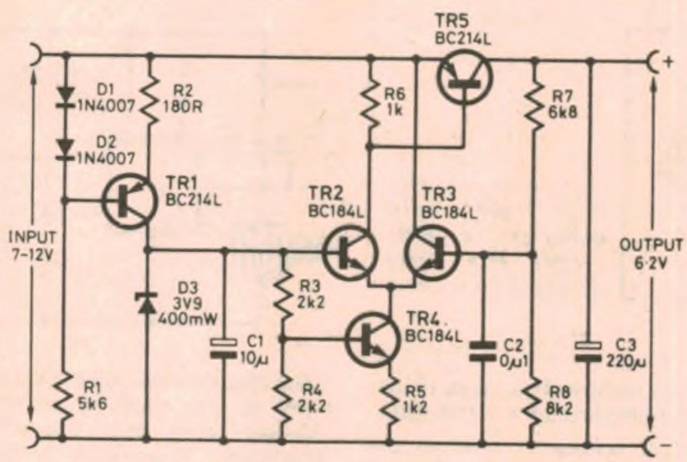
If the lights are left on with the ignition switched off, the buzzer circuit is completed to ground via the (warning) lamps globes. As the impedance of the buzzer is considerably higher than the "cold" resistance of the globes, the buzzer sounds (with no illumination of the warning lamps), drawing attention to the abnormal situation.

With headlights and ignition both on (night driving), there is no potential differences across the buzzer, so it is effectively "off". During daylight running the potential across the buzzer is reversed, but current cannot flow, being blocked by the internal series-connected diode.

As previously indicated, it is doubtful if this idea will work satisfactorily in vehicles without warning lights, as the resistance of the fuel gauge circuit may be too high – preventing adequate current flow through the buzzer.

D. M. Skea,
Fairlight, NSW.

Regulator with Low Dropout Voltage



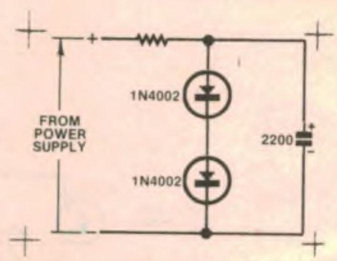
Unlike common 3-terminal voltage regulators, which generally exhibit a dropout voltage of the order of 2 volts, this circuit can operate with an input/output differential of 500mV or less. Basis of the design is the use of the "series" pass transistor in a collector follower ("grounded" emitter) configuration, such that the required base to emitter voltage is arranged to be effectively in shunt with the supply, instead of in series with the pass transistor.

Whilst this particular circuit is designed to provide 50mA output at 6.2V, it could be adapted to produce other output voltages and/or currents.

Operation of the circuit is as follows: Tr1 and associated components feed a constant current to the zener, D1. The zener voltage is applied to one side of an error amplifier consisting of Tr2 and Tr3, current fed by Tr4. The other side of the error amplifier is fed by the potential divider R7 and R8 from the regulated voltage (output), so that, at balance, the potential across R8 must equal the zener voltage. Comparator output is applied to Tr5, the series regulator, completing the loop. Capacitor C2 is included to prevent HF instability, and C3 provides output decoupling.

From "Practical Electronics," January, 1981.

Simulate a Nicad cell



This circuit was developed to simulate the presence of a nickel-cadmium cell in a piece of equipment. It is run from a DC power supply via a suitable high value resistor. The two diodes limit the "cell" voltage to approximately the same value as a fully charged nicad cell while the 2200μF capacitor ensures a low output impedance. The voltage rating of the capacitor is unimportant.

Select the value of the series resistor to "bleed" approximately 10 to 50% of the anticipated load current through the diodes. For intermittent load applications, both bleed and load currents will flow through the diodes. If the intermittent load exceeds (say) 600mA, use larger diodes.

L. David,
Collaroy Plateau, NSW.

PSSST! Got any neat circuit ideas? Why not send 'em in to us? We pay between $5 and $20 per item, depending on how much work we have to do to publish it.

Vented Speaker Systems — Pt 2

Using the theory to design practical enclosures

This is the second and concluding article on vented speaker systems by Brian Davies. It deals with the questions of practical realisation of a given system including the design of an enclosure, the measurement of woofer parameters and measurements on the completed system to check that it conforms with the design requirements.

BRIAN DAVIES*

When Thiele first published his papers there was some concern about the use of vented systems in practice because of possible variation of woofer parameters from one unit to another. A number of papers were written on the subject, but they were inconclusive. The crucial observation was made by P. J. Snyder of Speakerlab Inc who wrote: "While measuring the properties of woofers that our company produces, I observed that while there was considerable unit-to-unit variation in the parameters of woofers of the same model, these variations had little effect on the acoustic performance of the systems in which they were used. This suggested to me that the performance of loudspeaker systems is actually determined by one or more relatively invariant properties of the woofers, while commonly measured parameters . . . are unduly influenced by some varying factor that really has little effect on performance".

In order to understand what these "invariant properties" are, consider once again the ideal sealed box. Assuming that the principal design criterion is that Q_o is equal to one, equation (4) from last month gives the cut-off frequency as

$$f_S/Q_T \qquad (13)$$

This equation may now be used with equation (3) to determine the box size necessary to make $Q_o = 1$. A little algebra shows that the formula is

$$V_B = V_{AS}Q_T^2/(1-Q_T^2) \qquad (14)$$

For most high quality woofers, Q_T is between 0.2 and 0.4, so in this case the required box volume is of the order $V_{AS}Q_T^2$.

Clearly, the parameters f_S/Q_T and $V_{AS}Q_T^2$ are important for designing a sealed box. What Snyder observed is that both of them are independent of the stiffness of the speaker suspension, depending only on the mass of the cone and the effectiveness of the magnet assembly. During manufacture, these two quantities are under much closer control than the woofer suspension stiffness, and it is these two which dominate the performance for an ideal sealed box. Snyder went on to show, through a large number of calculations, that it is these two "invariant properties" which determine the performance of vented systems. Snyder's calculations are an indirect way of tackling the problem in that he first calculates the response of a large number of possible systems and then observes that the curves are all very similar when expressed in terms of the invariant parameters. I have carried out more direct calculations as follows. For a given woofer, it is only possible to choose V_B and f_B. One method of making the choice is to require that the acoustic response at the cross-over frequency f_H is 0dB and that the response at the box frequency is between 0 and −6 dB. These responses are determined from equations (11) and (12), which may now be solved (on a programmable calculator) for V_B and f_B. The curious fact is that the box frequency is almost totally insensitive to the prescribed response $G(f_B)$. In fact, for values of Q_T up to 0.5, the result of all these calculations may be written as

$$f_B = 0.38 f_S/Q_T \pm 2\% \qquad (15)$$

This is the key to the utilisation of Thiele's theories. It gives a recipe for the box frequency which depends on only one invariant property of the woofer, and not at all on the box volume. This frequency may now be employed in equation (11) to show that

$$G(f_B) \simeq V_B/7V_{AS}Q_T^2 \qquad (16)$$

EFFECT OF BOX DAMPING

The principles of operation which have been explained in part I may be condensed as follows: "A speaker system has one (sealed box) or two (vented box) resonant frequencies and the Q of each resonance should be made close to unity". The small Q_T value of good quality woofers is related to questions of efficiency and power handling, and so the enclosure is crucial in increasing Q to the desired level. Once this fact is recognised it is obvious that box damping will be unhelpful in a properly designed system. (I am not referring here to the use of Innerbond to dampen internal reflection at higher frequencies.) Once again, the effect of damping is most readily understood for the sealed system. Here the total damping Q at the cut off frequency is given by

$$1/Q = 1/Q_o + 1/Q_B \qquad (17)$$

A measurement of Q_B is not easily carried out by the home experimenter, but results are available from the literature. The concensus[2] is that for a box of average construction which is lined (but not filled) with innerbond or similar material, Q_B is of the order of 10. Thus a box which has a Q_o value of 1 0 will have a total Q of about 0.9, which will lead to a satisfactory performance. The total Q could be increased by using a smaller box so that Q_o is about 1.1, but this will increase the cut-off frequency above f_S/Q_T.

For a vented box the situation is similar. The response function still has the same form as equation (9) although the details are changed. As with the ideal box, there is still an "optimally flat alignment", but the optimum Q_T value is

Dr Davies is Reader in Theoretical Physics at the Australian National University, Canberra.

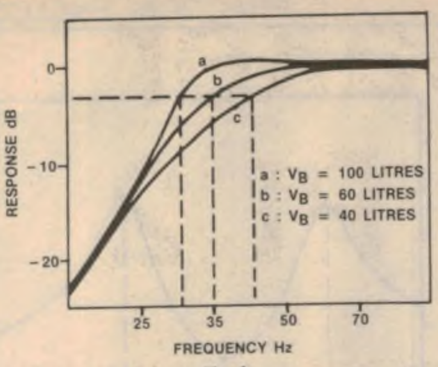


Fig. 4

Fig. 4: Predicted response curves for Magnavox 8MV Mk2 with three different box sizes. Box frequency is 34Hz in each case.

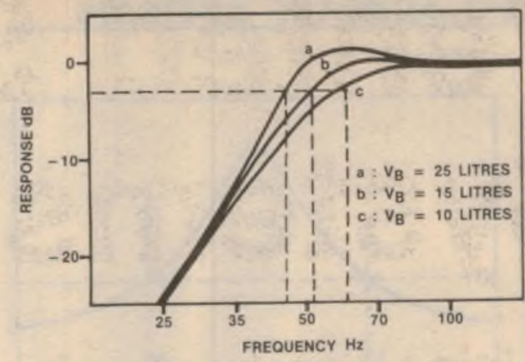


Fig. 5

Fig. 5: Predicted response curves for Magnavox 6MV Mk2 with three different box sizes. Box frequency is 52Hz in each case.

greater than 0.383 since the box is now providing some of the damping. Again it is not easy to measure Q_B, which now includes damping from the resistive effect of the vent, but there is a concensus value of about 7 for a lined box with an unobstructed vent. Filling the box or vent with damping material will reduce Q_B to well below this figure, making the design more difficult. For the assumed value of $Q_B = 7$, which is the value adopted by Snyder in all of his calculations, the optimally flat alignment is

$$Q_T = 0.45$$
$$f_B = f_S$$
$$V_B = 0.942\ V_{AS}$$
$$F_c = f_S$$

Comparison with the Thiele optimally flat alignment (see part I) shows that in order to achieve an optimally flat alignment in a damped box a 33% increase in box volume is needed to offset the effect of having Q_B as low as 7. This makes it clear that performance will not be improved by deliberately introducing extra damping.

For a given woofer, a calculation may be made of the appropriate values of V_B and f_B which will achieve the same design objectives as for the ideal vented box. The same essential simplifications occur as were found in writing down equations (15) and (16), only this time f_B turns out as

$$f_B = 0.4\ f_S/Q_T \pm 2\% \qquad (18)$$

whilst the response at the box frequency is given by the approximate formula

$$G(f_B) = 1/(6.25 V_{AS} Q_T^2/V_B + 0.36) \qquad (19)$$

As an illustration of the use of this formula, the response at f_B for three different box sizes are:

$$V_B = 9.7\ V_{AS}Q_T^2 : G(f_B) = 0\ \text{dB}$$
$$5.9\ V_{AS}Q_T^2 : G(f_B) = -3\ \text{dB}$$
$$3.8\ V_{AS}Q_T^2 : G(f_B) = -6\ \text{dB}$$

This shows that boxes whose volumes exceed 10 $V_{AS}Q_T^2$ are likely to be "boom boxes" for any choice of f_B, and particularly so if f_B is also chosen incorrectly.

DESIGN OF A PRACTICAL SYSTEM

For a given woofer with known parameters f_S, Q_T and V_{AS}, the immediate problem is to design a vented enclosure. At this point it is necessary to take account of a further factor: the electrical component of the woofer damping acts via currents which flow through the connecting wires and these will generally have significant resistance because they include the crossover network which is between the amplifier and the woofer. It is not difficult to take account of these factors, but they should not be neglected in a careful design. For some drivers the manufacturers specify three Q values: mechanical (Q_m), electrical (Q_e) and total (Q_t). The latter figure is in fact obtained from the simple formula:

$$1/Q_t = 1/Q_m + 1/Q_e \qquad (20)$$

Now the effect of external resistance on the electrical Q is to increase it by the factor

$$1 + R/R_S \qquad (21)$$

where R_S is the DC resistance of the voice coil and R is the external series resistance. With the help of the last two formulas and a knowledge of R_S and R, the Q_T value is easily calculated as

$$1/Q_T = 1/Q_m + R_S/(R + R_S)Q_e \qquad (22)$$

If Q_m and Q_e are not known separately then an estimate may be made by using the rule of thumb that $Q_m = 5Q_t$ (approx) and $Q_e = 1.25Q_t$ (approx). In any event it should be noted that the effect of external resistance is to increase the value of $V_{AS}Q_T^2$, which makes a given box "look" smaller and raises the cut off frequency. In most circumstances this indicates that external resistance should be kept to a minimum. In addition, Q_T should not be greater than 0.6, and preferably smaller than 0.5.

Armed with the two invariant parameters f_S/Q_T and $V_{AS}Q_T^2$ it is easy to select the correct box frequency from equation (18). In the Thiele method of alignment the box size is also predetermined from the woofer parameters. Snyder's approach differs from this: the box frequency is selected from equation (18), which is very close to the equivalent Thiele value, but the box size is chosen by trading off size against bass extension. Normally a suitable range for the volume is from $2V_{AS}Q_T^2$ to $10V_{AS}Q_T^2$ although the upper limit is not a fixed rule. In order to choose it is necessary to know the point at which the response falls below −3dB, and this frequency is denoted f_3. Snyder quotes an approximate relationship between f_3 and V; it is

$$f_3 = 0.84 f_S\ (V_{AS}/V_B)^{1/2} \qquad (23)$$

For an optimally flat sealed enclosure with $Q_B = 10$, the 3dB frequency is $0.76 f_S/Q_T$ with a box volume of the order $2V_{AS}Q_T^2$. For a vented enclosure, the same of f_3 is obtained by using a box of about the same size. However, this is the maximum useful size for the sealed box, and in fact a better choice is probably to use a smaller box so as to bring Q_o closer to one. For the vented box the situation is the opposite. By making the box larger it is possible to gain extra bass response. The limit is to gain more than an extra octave of bass by using a box of about $10V_{AS}Q_T^2$: beyond this point it is no longer possible to avoid significant peaks in the response curve.

The more careful designer will want to check the response function and possibly investigate the effect of making small changes to f_B. I consider that this is desirable in any case, and essential for a woofer with a Q_T value of 0.5 or greater. The formula for the response function is

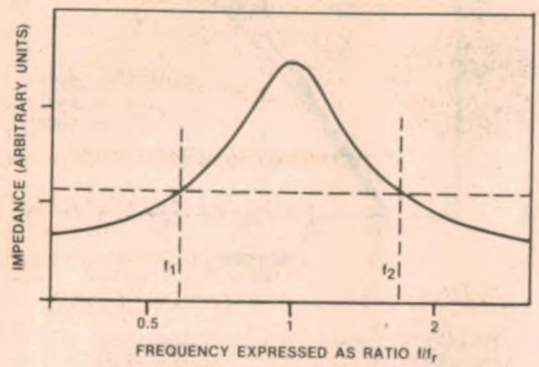


Fig. 6

Fig. 6: Impedance of voice coil for woofer in a sealed box or on an infinite baffle (schematic).

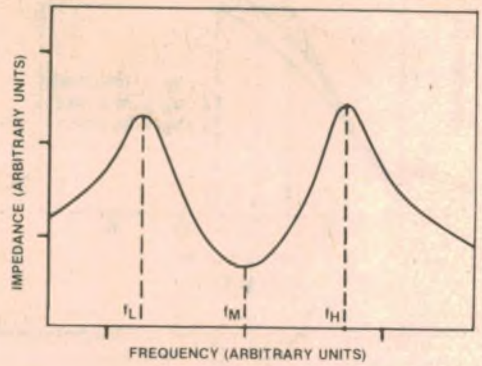


Fig. 7

Fig. 7: Impedance of voice coil for woofer in a vented enclosure (schematic).

$$G(f) = [(1 - A/f^2 + B/f^4)^2 + (C/f - D/f^3)^2]^{-1/2} \quad (24)$$

where the constants A, B, C and D are given by

$$A = f_S^2(V_B + V_{AS})/V_B + f_B^2 + f_S f_B/Q_T Q_B$$
$$B = f_S^2 f_B^2$$
$$C = f_S/Q_T + f_B/Q_B \quad (25)$$
$$D = f_B^2 f_S/Q_T = f_S^2 f_B/Q_B.$$

These constants should be calculated first, and then the response calculated at a number of different frequencies. For this purpose a programmable calculator is useful although not essential.

As an example of the foregoing I will quote some figures for a locally made woofer, the Magnavox 8MV Mk2. Its parameters are [3]

$$f_S = 35\text{Hz}$$
$$Q_m = 2.03$$
$$Q_e = 0.49$$
$$Q_t = 0.39$$
$$V_{AS} = 67 \text{ litres}$$
$$R_S = 7.5\Omega$$

Assuming that the total external resistance is 0.5Ω, equation (22) gives the Q_T value as 0.42, so that the invariant parameters are

$$f_S/Q_T = 84\text{Hz}$$
$$V_{AS}Q_T^2 = 11.6 \text{ litres}$$

From equation (18), a suitable box frequency is seen to be

$$f_B = 34\text{Hz}$$

and the box size may range up to 120 litres without introducing undue peakiness. If aesthetic considerations do not allow a large box, then it is probably better to look for a different woofer. For example, the Magnavox 6MV Mk2 has the invariant parameters (allowing for 0.5Ω external resistance)

$$f_S/Q_T = 126\text{Hz}$$
$$V_{AS}Q_T^2 = 2.5 \text{ litres}$$

In an enclosure of 25 litres, equation (23) gives the following values of f_3:

8MV Mk2: $f_3 = 56$Hz approx.
6MV Mk2: $f_3 = 47$Hz approx.

It is the smaller value of $V_{AS}Q_T^2$ which makes the smaller woofer a clear winner on this score. However, it is less efficient and has a somewhat smaller power handling capacity. Some curves of the theoretically predicted response are shown in Fig. 4 and 5 for these two woofers.

VENT SIZE

In most cases the vent will be a circular tube which is flush with the front baffle of the speaker system and which intrudes into the enclosure. There is a simple formula which determines the length of such a vent, which is said to be flanged at one end. If the diameter of the vent is d, then the length should be

$$\ell = 2350\, d^2/V_B f_B^2 - 0.73d \quad (26)$$

where V_B is measured in litres and dimensions are in millimetres. In using this formula, a number of points need to be kept in mind. The first is that because the vent has a smaller diameter than the woofer cone, the air will have to move more rapidly in order that the vent acoustic output below crossover should match the woofer acoustic output above. This makes it imperative to choose the largest possible vent diameter: I would recommend that it be not less than one-third the nominal diameter of the woofer. The final arbiter in this regard is whether or not distortion and turbulence are audible at the desired listening levels for the total system. The second point is that the larger the vent diameter the longer it will need to be. This places a conflicting requirement since the vent should not be obstructed either by having its rear end too close to the cabinet back or by having sharp bends on it. In practice the distance between the cabinet back and the end of the vent should be at least equal to the vent diameter. Fortunately it is not difficult to check the tuning after the system is assembled, and the effect of having too small a distance is to lower the box frequency, which can be cured by shortening the vent slightly to compensate for the extra obstruction. For a vent of any shape other than a straight circular tube, some experimentation will be necessary. In this regard, a useful substitute for equation (26) is

$$\ell = 2990\, A/V_B f_B - 0.82\, A^{1/2} \quad (27)$$

where A is the area of the vent in square millimetres.

MEASUREMENT OF PARAMETERS

The system parameters may be measured with sufficient accuracy by measuring the impedence of the woofer at various frequencies. This is because the plot of impedance versus frequency has a number of easily identifiable features, and they depend on the same parameters as the acoustic response. I will not reproduce the formulas for the impedence functions in this article but simply illustrate what are the general features. For a woofer mounted on an infinite baffle or in a sealed box the typical plot is shown in Fig. 6. The obvious feature is that there is a maximum at the resonant frequency.

In order to make the measurements, the minimum of equipment is a sine-wave generator, a small amplifier and an AC multimeter. Since impedance is the ratio of voltage to current, two meters, one a voltmeter and the other a current meter, will make life easier. If their calibration is not considered to be sufficiently accurate, then the measurements should be performed both on the woofer and on a known resistance of about 10Ω. In this regard, I have used three 1% 22Ω resistors connected in parallel on occasion. The woofer is

KITS KITS KITS KITS KITS KITS KITS KITS

Engine Analyser Kit

$48.50

Bidirectional Interface (Short Form Kit)

$60.00

Analogue and Digital Storage CRO Kit

$169.00

POOLS/LOTTO SELECTOR

RRP $25

"Electrochune"

$65.50

a 23-note organ with special effects

MUSICOLOUR IV

$95.00

Digital Storage CRO Kit

$78.00

THIS MONTH'S KIT

DIGITAL CLOCK AND THERMOMETER

$80.00

KITS KITS KITS KITS KITS KITS KITS

TV PATTERN GENERATOR
Kit of parts as featured in EA June 1980. Dot, Greyscale, Crosshatch, Raster, Check

COMPLETE KIT (incl Scotchcal front panel)	$48.49
KIT WITHOUT BOX	$36.90

EPROM PROGRAMMER KIT
Kit of parts as featured in EA July 1980 Programs 2708, 2716 & 2532 Use with TRS 80, Sorcerer & Compucolour Kit does not include connector from the programmer to computer

COMPLETE KIT (inc Scotchcal Front panel)	$72.49
KIT WITHOUT CASE	$59.99

DIGITAL PANEL CAPACITANCE METER
Kit of parts as featured in EA MARCH 1980
Four Digits. Extremely popular

COMPLETE KIT (inc Scotchcal Front Panel)	$52.49
KIT WITHOUT CASE	$39.99

TV CRO ADAPTOR KIT (EA MAY 1980)

COMPLETE KIT (Inc Scotchcal Front Panel) (without power adaptor)	$29.00
POWER ADAPTORS TO SUIT	
1. 240V to 6/7.5/9V	$9.50
2. 240V to 9V	$5.95

2 channel infrared remote control

$65.00

LE GONG

Fantastic doorbell using the new Siemens SAB 0600 chip.
Kit of parts $15

INCREDIBLE!!!

E/A has really done it this time. Display your Hi/Fi response on your colour TV. It will really impress your friends. Kit of parts $99

KITS

ETI SERIES 4000 60W STEREO AMP KIT

Complete Kit Rack Mounting Case	$199.00
Woodgrain Sided Case	$189.00

PARTS AVAILABLE SEPARATELY

Front Panel	$10.90
Rack Mounting Case	$55.00
Wooden Sided Case	$49.00
ETI 471 PREAMP KIT of parts	$45.00
ETI 472 PS KIT of parts	$47.00
(without transformer)	$24.00
ETI 470 60W Kit pf parts	$26.50
(without heatsink)	$23.00
ETI 480 50W KIT of parts	$17.50
ETI 480 100W KIT of parts	$22.50
ETI 084 Car Alarm KIT	$11.50
EA TV CRO ADAPTER KIT	$29.00
EA 300W POWER AMP MODULE	$63.50
ETI 466 300W PA MODULE	$63.50
EA DIGITAL CAPACITANCE METER KIT (EA March 1980)	$52.99
AUTOCHIME KIT	$29.75
MK3 Drill Speed Control	$13.50
CAPACITOR DISCHARGE IGNITION	$32.50
MUSICOLOR MK3 KIT	$69.50
DISCO STROBE KIT	$34.50
LEDS & LADDERS (EA August)	$15.75
ETI 149 Two Tone Generator	$34.90
ETI 563 Nicad Fast Charger	$54.90
DREAM 6802 KIT	$109.00
Power Supply TO Suit	$29.50
Hex Keypad	$24.90
ETI 568 Sound or Light Operated Flash Trigger	$25.90
ETI 147 ELECTRONIC DUMMY LOAD KIT	$99.00
SERIES 3000 "MINI" STEREO AMP KIT	$79.90
ETI 561 Metal DETECTOR KIT	$32.50
PLAYMASTER 40+40 AMP KIT	$129.00
PLAYMASTER AM/FM TUNER KIT	$129.00
PLAYMASTER GRAPHIC EQUAL	$99.50
PLAYMASTER GRAPH ANALY KIT	$99.50
EA 79SF9 Sound Flash Trigger	$15.00
ETI 585H Ultra Sonic RX	$15.95
ETI 585T Ultra Sonic TX	$8.95
ETI 576 ELECTROMYOGRAM KIT	$89.00

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

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

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

Bankcard Mail Orders Welcome

Please debit my Bankcard
Bankcard No ....
Expiry Date ....
Name ....
Signature .... EA 9/81

Post & Pack $2.50 small kits, heavier kits add extra postage

**Prices subject to change without notice. Send 60c and SAE for free catalogues.
MAIL ORDERS: PO Box 135, Northcote, Vic 3070. Minimum pack and post $1.00.
Phone (03) 489 8131.**

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS

connected to the amplifier, and arrangements made for the current and voltage to be measured at various frequencies. The resonant frequency is now located by slowly sweeping the frequency while observing the current. Having located the resonant frequency f_S, the impedance at resonance, Z_S, should be determined, as well as the DC resistance R_S of the voice coil. To find the Q_T value, proceed as follows. First calculate the ratio

$$r_S = Z_S/R_S \qquad (28)$$

and then find, by experimentation, the two frequencies f_1 and f_2 (shown on Fig. 6) where the impedance is equal to $Z_S/r_S^{1/2}$ Then the following formulas give Q_m, Q_e and Q_t:

$$Q_m = f_s(r_s)^{1/2}/(f_2 - f_1)$$
$$Q_e = Q_m/(r_s - 1)$$
$$Q_t = Q_m/r_s \qquad (29)$$

To find V_{AS} requires that the woofer be mounted in a box. The easiest method is for this to be the actual vented enclosure, but it is difficult to build it before its size has been determined! Since the volume of the enclosure is not as critical as the tuning, it is probably best to proceed as follows. First mount the woofer in a sealed box, whose volume is known, which really is airtight, and measure the new resonant frequency. Then V_{AS} is given, very approximately, as

$$V_{AS} = (f_0^2/f_S^2 - 1)V_B \qquad (30)$$

This information should be sufficient to enable a sensible choice to be made for the actual size of the vented enclosure. The box should now be constructed; the vent can be chosen now because the choice of f_B is independent $V_{AS}Q_T^2$. The only matter which remains after this step is to make measurements for the purpose of checking, and possibly of adjusting, the vent.

The impedance of a typical vented system as a function of frequency is shown in Fig. 7. Detailed calaculations can be made on the basis of really accurate measurements, and this is described at length in the papers of Small[4]. Three quantities which can – and should – be determined are the positions of the two maxima f_L and f_H and the minimum f_M. The latter is more difficult to locate as the minimum is not as sharp as either of the two maxima. To a reasonably good approximation, the box frequency is the same as f_M. Making this assumption the frequency f_{SB}, which is the resonant frequency of the woofer for the air-load mass presented by the enclosure, is given by the formula.

$$f_{SB} = f_L f_H/f_B \qquad (31)$$

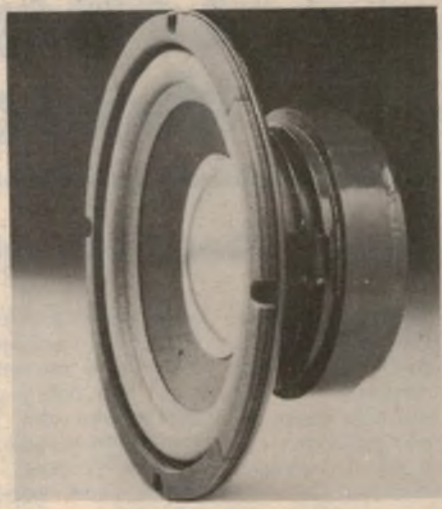
This will generally be a little lower than f_S, but this does not matter since the tuning of the system depends only on the invariant parameter f_S/Q_T. The second quantity which may be calculated from a knowledge of f_L, f_M and f_H is V_{AS}: it is given by

$$V_{AS} = V_B(f_H + f_B)(f_H - f_B)(f_B + f_L)(f_B - f_L)(f_H^2 f_L^2)^{-1} \qquad (32)$$

Generally speaking this is a much more reliable value than that given by equation (30). This completes the measurements which may be made using only simple equipment. All that remains may be a recalculation of the response function and possibly slight adjustments to the vent.

CONCLUDING COMMENTS

Will it really work? I can only say that I have built several different systems with completely satisfactory results in each case. Compared with the labour involved in building a properly finished cabinet, the time spent to design it properly is small. Regarding the process of design, I hope that these articles will enable the less mathematically equipped experimenter to take full advantage of the theory without too much pain. The design process is certainly quite simple if a woofer is used whose parameters are known from the manufacturer. In this case, the final check of the system depends only on locating three frequencies, which is quite easy.



Magnavox 6MV Mk2 15cm woofer. V_{AS} = 25 litres; f_S = 40Hz; and Q_t = 0.3.

One of the criticisms which is sometimes levelled at the vented system is that it is not "sufficiently fast". In this regard, it should be remembered that for frequencies below the cross-over point, the acoustic output begins its life at the rear of the woofer, and must therefore be half a cycle delayed. The problem, however, is not unique to the vented system. It is one of the fundamental laws of linear systems that if their output depends only on previous input – that is, if they cannot see into the future – then the phase response is completely determined by the amplitude response. Applied to the woofer, this means that if a sealed box is chosen and its input electronically equalised so as to extend the bass response, then the gain in amplitude bandwidth will be at the expense of extra phase shifts according to the same inexorable laws of nature. The only perfect solution is to design a system with a resonant frequency of about 20-25Hz with a total Q of about unity – and this depends on buying woofers which are not available, or on mounting a woofer in a very large box, so as not to bring its resonance up too high, and using sufficient series resistance to bring up the total Q. For most people, connecting 10-20 ohms in series with their woofers is not a practical idea.

As a parting remark I would remind the reader that a chain is only as strong as the weakest link. I have been concerned with only one aspect of speaker design, the bass response. It is an important aspect, but only one of many. High quality low distortion midrange reproduction, together with smooth extended high frequency response, must be combined with good bass to achieve a total system which is able to give a reasonable illusion of having the performers in the listening room. Such an illusion is possible and achieving it can be a rewarding experience.

REFERENCES

1. P. J. Snyder, "Simple formulas and graphs for design of vented loudspeaker systems", *Proceedings of the 58th convention of the Audio Engineering Society*, November 1977. (1307-03-part I).
2. R. H. Small, "Closed box loudspeaker systems", *J. Audio Eng. Soc.*
   Part I: vol 20, pp 798-808, 1972.
   Part II: vol 21, pp 11-18, 1973.
3. "Magnavox High Fidelity Loudspeakers": booklet published by Magnavox Australia Pty Ltd.
4. R. H. Small, "Vented box loudspeaker systems", *J. Audio Eng. Soc.*
   Part I: vol 21, pp 363-372, 1973.
   Part II: vol 21, pp 438-444, 1973.
   Part III: vol 21, pp 549-554, 1973.
   Part IV: vol 21, pp 635-639, 1973.

Letters to the editor

Video copyright & the public interest

The article in your June issue on the audio/visual copyright problem interested me but it seemed to completely ignore the public interest in the copyright field. This was best illustrated by your cover picture of a policeman catching someone in the act of copying a 42-year-old Hollywood movie.

As I understand the law, the basic principle of both copyright and patent law is that, in exchange for a copy of the work or details of a patent, the applicant is given exclusive right to copy the work or market the patent for a limited number of years and at the end of that time the copyright or patent lapses and becomes freely available to all.

This procedure appears to be fairly settled as far as printed works are concerned. For example, the copyright of Henry Lawson's works lapsed in 1972 and we may confidently look forward to all of Banjo Patterson's works being freely available at the end of 1991.

What however is the position concerning records and movies? Under the Act, copyright in a photograph lapses in 50 years. Does this mean that the major Hollywood movies of the thirties will enter the public domain this decade? Should not the "all rights reserved" notices on records end with "prohibited prior to the year . . ." Or have the large movie and recording interests so manipulated the copyright laws that their products will never enter the public domain while they remain commercially valuable? After all, the Victualling list for Sydney Cove in 1788 that was published in the Sydney Morning Herald last year had printed underneath "Copyright British Public Record Office". I am sure that your readers would be interested in any answers you can give.

W. Woods,
Beecroft, NSW.

COMMENT: About the best we can do is to publicise the arguments. In the ultimate, the answers have to come from the courts, in the way they interpret the law.

FM difficulties in South Australia

"The Official Line" in the June issue of EA was of particular interest to me in that it considerably added to my appreciation of the difficulties that the Department of Communications is facing in clearing the VHF FM spectrum. It concerns me, however, that there was not a note of greater urgency or even positiveness about the Department's approach to the problem, which after all it has known about for some years now.

The issue is of particular concern to this station which, as you can see from the letterhead, operates on 93.7MHz. Our allocated frequency however is 103.3MHz, and when we first came on air in December '79, that was our operating frequency. At the same time a fellow public broadcaster, 5EBI came on air on 102.3MHz. (Note the 1MHz spacing). Not long after our debut, viewers of the then WSC Cricket Series on Channel 5 in the Port Lincoln area started to complain about interference to their pictures.

For those not familiar with the topography, our transmitters are on Mt Lofty overlooking Adelaide. To reach Port Lincoln, the signals crossed St Vincent's Gulf (60km), Yorke Peninsula (35km) and Spencer Gulf (145km), a total of at least 240 to 250kms. Whilst our transmitting locality is quite high, our transmitters are operating at about only 2.5kW ERP.

Quite clearly, this problem was not forseen by the Department, and it had to ask us to shift frequencies, until Channel 5 can be shifted (12 months plus was mentioned a year ago). With many hassles this shift was completed: a new shared antenna and 5EBI and 5MMM are now on 92.9 and 93.7 respectively.

You may well ask what the problem is. For FM broadcasting in Sth Australia there are real difficulties: with ABC FM on 92.1, and SSA FM on 107.5 (fractionally inside Ch 5 sound) there are no further FM channels available for Adelaide, and possibly other locations, such as Port Pirie (what happened to the ABC transmitter to be set up there as one of the very first regional ABC FM outlets?). The Ch 3 segment is not usable because of ABC TV at Loxton (230km east); Ch 4 TV transmitters exist at Pt Pirie (north) and Keith (sth east). There are at least two other public type organisations looking for FM licences in Adelaide, not to mention a future second commercial station, and FM channels for regional commercial stations.

For 5MMM, and probably also still 5EBI, we're "on a promise" to return to our allocated frequencies. Five Triple M does not want to be "stuck" at the low end of the FM band, which looks like developing into ABC etc at the low end, and commercial FM at the high end. Our allocated mid band 103.3 frequency is in just the right spot on the dial.

Secondly, and just as important to us and 5EBI, is the present minimum 0.8MHz spacing. With three stations squeezed between 92.1 and 93.7, it is difficult for the new FM listener to get used to finding us, and tuning slowly, when he is used to much larger spacings on AM. I know the situation in Sydney is worse, but that's no reason for saying that it's acceptable to have all FM stations in the one city at 0.8MHz spacing. Our original frequencies gave us two mid-band channels at a slightly better 1MHz spacing. Maybe your readers in Sydney and Melbourne have views on the acceptability/long term necessity for minimal spacings, which I accept are sufficient for the selectivity of most FM radios.

Suffice to say I would have been far happier if Mr Lansdown's third paragraph said "will be necessary" with a deadline date mentioned, instead of saying "would be necessary". It may be my public sector background which makes me sensitive to such tentative or indefinite phrasing, but the question of who is going to pay for the costs of relocating TV channels, and informing the generally regional population of the need for this must be prickly problems indeed.

Jerome van der Linden,
5MMM-FM, Norwood, SA.

Home-made ion generator

In reference to your article on Ion Generators (May '81) I have reason to wonder about the commercially available units.

Recently I purchased an ion generator for best part of $100. Curious, I decided to take a peek and see what made it tick. My heart nearly jumped out of my mouth when I realised how few parts there were in it.

The parts comprised a handful of ceramic capacitors, diodes, resistors, a neon light and a few copper "pins" (plus an AC plug and case).

Total cost of the bits, including case — around $10. Total cost of a home-made equivalent (using my own case) — $5.

Luckily, I had bought the unit on account! I just wonder how many other people have so subsidised the incredible ion generator fad.

Incidentally my $5 special does work.

P.G.,
Manningham, SA.

Join the people who have made the Air Force their life

"I've seen a lot of Australia. Now I'm looking forward to being posted overseas."

"I enjoy being a member of the team that keeps our F111's fully operational."

"You're trained to work on some of the most advanced equipment in the world."

"The opportunities for promotion with more pay and responsibility are there."

"You don't mind working hard if it's for a specific purpose like the country's security."

"At 23 I found myself promoted to Section Head. That kept me on my toes."

"It isn't all work. I have time to relax and play my favourite sport."

"The training has set me up with a career for life — it's really professional."

The satisfaction and rewards are immense.

A new lifestyle. New friends. New interests. New qualifications. New places visited.

And you start on full adult pay too! After training we'll pay you even more! Then there's four weeks annual leave and the opportunity to continue studying for higher qualifications. So if you want to reach a higher rank, it's up to you.

It's not an easy life.

Success demands application. A disciplined approach to your work. What's more, you'll be part of a special team that's proud to wear the Air Force uniform.

Normally you'll work a five day week. But at times we expect you to do extra duties.

You must be prepared to join us for a minimum of six years and be prepared to live and work on any one of our bases.

Your future.

Is it in Flight Systems, Propulsion Systems, Air Frames, Telecommunications, Engineering, Administration, Weaponry, Supply or Motor Transport?

The choice is vast. The scope unrivalled.

So if you're aged between 17 and 34 years (17 and 43 years if no trade training is required), an Australian citizen or meet our nationality requirements, we would like to meet you. (People with civilian qualifications and experience are most welcome to apply.) Enquiries are also invited for Apprenticeships.

Today, walk into the Air Force Recruiting Office nearest you and have a chat with a Careers Adviser. The address is in the phone book. It could be your first important step to an exciting new career.

Alternatively send the coupon or phone for the facts:

Brisbane: 226 2626	Townsville: 71 3191	Sydney: 212 1011
Wollongong: 28 6294	Parramatta: 635 1511	Canberra: 82 2333
Hobart: 34 7077	Adelaide: 212 1455	Perth: 325 6222
Melbourne: 61 3731	Newcastle: 2 5476	

To:
RAAF CAREERS ADVISER, G.P.O. Box XYZ
in the capital city nearest you
Yes! I am interested in an RAAF career. Please send me full details.

Name

Mr/Miss ....

Address ....

State .... Postcode ....

Date of Birth: ..../......../........

RG.416.FP.11EA

You're somebody in Today's Air Force

Authorised by Director-General Recruiting Dept. Defence

RG.416.FP.11EA

HURRY! STOCKS ALMOST GONE GET THEM WHILE THEY LAST

HUGE SCOOP PURCHASE

OF THE FEATURE PACKED YAESU FT207R VHF TRANSCEIVER

AUTOSCAN
Up or down scanning of full band, with 3-way setting — clear, busy or manual.

DIGITAL DISPLAY
Large easy to read LED readout. Auto turn-off for power saving too!

Specifications:
- 144-148MHz band coverage in 800 channels
- High and low power (400mW-2.5W)
- .32uV sensitivity — 7.5kHz selectivity
- NiCad battery pack and charger included in price
- External antenna, ear, microphone socket.
- Compact size — 180 x 65 x 55mm
- Rubber Duck antenna included

Normally ~~$358~~

~~August only at~~ Extended to September by public demand!

$295

Cat. D-2888 P&P $5.50

19 key easy to use keypad. For frequency input, memory recall, scanning etc.

800 CHANNELS (4 memory channels)
Instant recall of your 4 favourite repeaters or simplex frequencies. (Easy to read program)

High power Mobile

That's The FT7B

Simple to operate for mobile use!

Cat. D-2868 P&P $5.50

was $599

$549

save $50!!

This particular unit ideally suited for novice! All current HF bands available with continuous variable power output up to 50 watts. You have the option of AM, CW or SSB with a choice of VFO or crystal locked channel. Base or mobile — whatever you application, the FT7B will give excellent results! Call into one of our stores and see the specs. for yourself

ALL NEW Yaesu FL 2050 50W/All mode Linear amp

Add to hand held above for real mobile power. Also suitable for SSB, CW AM etc. Operates from 13.6V DC up to 15W input for maximum power. Includes 12dB receiver, pre-amp. with automatic transmit receive control.

(above hand held may not drive to full power)

Cat. D-2547

$235

P&P $5.50

EXCLUSIVE: Receiver pre-amp built-in

DRIVE TO MAX LEGAL POWER

All-Band linear amp FL2100Z

Want REAL power: the FL2100Z is rated at a whopping 1.2kW — so at our maximum legal power it's just coasting. Tubes last much longer — everything is way under ratings. Built-in SWR/Power meters, suitable for all HF bands.

was ~~$580!~~

$559

Cat. D-2548 P&P $5.50

REMEMBER: We will match or beat any advertised offer!

DICK SMITH Electronics

- AUBURN 648 0558
- BLAKEHURST 546 7744
- BROADWAY 211 3777
- BROOKVALE 93 0441
- CHULLORA 642 8922
- GORE HILL 439 5311
- PARRAMATTA 683 1133
- SYDNEY 290 3377
- NEWCASTLE 61 1896
- WOLLONGONG 28 3800
- CANBERRA 80 4944
- BURANDA 391 6233
- CHERMSIDE 59 6255
- ADELAIDE 212 1962
- MELBOURNE 67 9834
- RICHMOND 428 1614
- SPRINGVALE 547 0522
- COBURG 383 4455
- PERTH 328 6944
- CANNINGTON 451 8666

MAIL ORDER CENTRE: P.O. Box 321 North Ryde. NSW. 2113. Ph. (02) 888 3200

AMATEUR RADIO

by Pierce Healy, VK2APQ

New government encourages amateur radio!

For many "newly independent" nations, Government policy, at best, is to tolerate amateur radio, while many ignore it, and some actively discourage it. It is a pleasant change, therefore, to find that the Espirito Santo Government has actively encouraged the island's amateur radio group with very practical assistance.

Wide press and TV coverage was given in Australia to the establishment, in 1980, of the Independent Republic of Vanuatu, formerly the New Hebrides. It is now pleasing to learn that amateur radio has received a tangible boost from the new administration.

In March 1981, a disused building on the waterfront, about 200 metres from the main wharf at Santo, the chief port on the island, was made available to the Santo Amateur Radio Society by the Maritime Services authority.

Enterprising members of SARS, with the aid of bulldozers, cleared an area of tropical vegetation from around the building. Repairs and refurbishing work was also carried out to the building, which now houses the society's station and is the centre of club activities. These include tutorial classes for the amateur licence.

The equipment for the station was donated by the Department of Telecommunication. It consists of a Yaesu FT101ZD transceiver, and ancillary matching units, feeding a beam antenna.

On May 1, 1981, the SARS club house and station (call sign YJ8ES) was officially opened by the Prime Minister of the Independent Republic of Vanuatu, Fr. Walter Lini.

The president of SARS, James Hige, YJ8JI and members demonstrated to the Prime Minister how the station equipment worked, showing how amateur radio would be an asset to a remote Pacific Ocean community.

Other members of SARS include Augustin Cheung, YJ8TT; David Squires, YJ8DS, and Shigeaki Wachi, YJ8YS. YJ8TT is particularly active on radio teletype and maintains regular contacts with Bill Storer, VK2EG and Syd Molen, VK2SG in Sydney.

It is understood that the requirements for an amateur licence in Vanuatu are similar to those in Australia. Classes conducted by SARS will mean that more YJ8 call signs will appear on the air. Already SARS station YJ8ES is a much sought after DX contact.

The initiative of its members and the outlook of the Vanuatu government towards amateur radio is worthy of high commendation by the amateur service.

(Acknowledgement is given to Bill Storer, VK2EG, and Syd Molen, VK2SG, two leading Sydney RTTY operators, for obtaining photographs and information from SARS.)

Mr James Hige, President of the Santo Amateur Radio Society, shows Vanuatu Prime Minister Fr Walter Lini the FT101ZD transceiver donated by the Department of Telecommunication.

FROM THE DEPARTMENT OF COMMUNICATIONS

The Wireless Institute of Australia federal executive, Melbourne, provided a copy of a Department of Communication letter, reference RB4/4/4, dated July 1, 1981. The letter relates to the linking of amateur repeaters:

"Following a recent submission by the WIA to one of our state offices, in which approval was sought to establish a system of VHF/UHF repeater linking, the Department has considered the implications of this proposal as an Australia-wide issue and appropriate policy guidelines have now been issued within the Department.

"I am pleased to advise that, subject to the conditions set out below, the Department raises no objection to the linking of VHF/UHF amateur repeaters, for the purpose of improving remote area coverage during:

(i) Recognised WIA Divisional news broadcasts or rebroadcasts, for a period or periods which in total, do not exceed one hour per week; and

(ii) Departmentally approved WICEN exercises or operations.

"The relevant conditions are as follows:

(a) Repeater linking is to be minimised, and should be employed only for the duration of approved exercises or broadcasts and only when necessary during WICEN operations. One reason for this condition is to ensure that the disruption to normal operation is limited and does not unfairly restrict non-participating amateur stations in the area.

AMATEUR RADIO

"In the event of a non-WIA repeater group seeking approval to participate in linking operations during WIA broadcasts, the applicant group is required to provide the Department with evidence of co-ordination with the appropriate WIA state repeater committee. Provided this evidence is received, the application will be processed in the same way as one from the WIA.

"It should be clearly understood that any approvals to permit repeater linking are issued on the basis that such operation be confined strictly within the enunciated guidelines.

"Applications which are in accordance with the principles outlined above should be referred to the State Manager, Regulatory and Licensing, in the applicant group's state."

RADIO CLUB NEWS

TAMWORTH AMATEUR RADIO CLUB: The club announces that the second Noel Taylor Memorial Field Day will be held on September 12 and 13, 1981.

Activities will commence with registration at the West Tamworth Scout Hall at 10am Saturday. Field events will begin at 2pm with a barbeque tea at 6pm.

On Sunday the venue will be Duri Hall, Duri. Field events will commence at 9.30am and conclude with presentation of prizes at 3.45pm.

For more information contact: TARC, PO Box W107, West Tamworth, NSW, 2340, or telephone Trent Sampson (AH) (067) 65 9969 or Daron Brooke (AH) (067) 65 8070.

MID SOUTH COAST AMATEUR RADIO CLUB: The quarterly newsletter of the MSCARC, The Lyrebird, is considered by many to be the ultimate in radio club newsletters. It can be readily recognised by the distinctive front sheet of lyrebird sketches and radio logograms. There is plenty of reading in its 16 pages.

The contents include not only technical articles but those of genuine popular interest from newspapers, local and overseas magazines, and other club newsletters. There is also general information of activities within the club, plus humorous sketches and Confucius-like snippets and schoolboy howlers.

The Lyrebird newsletter could be referred to as a radio amateur's digest.

If you wish to obtain a copy write to PO Box 113, Milton NSW 2538 for MSCARC membership details.

John Telfer, VK2BTQ is editor of The Lyrebird.

BRISBANE VHF GROUP: This group maintains the following VHF/UHF beacon and repeater installations:

VHF repeater VK4RBN, location Mt Glorious, Brisbane. Frequency input 146.400MHz, output 147.000MHz.

VHF beacon VK4RTT, location Mt Mowbullan, Bunya Mts. Frequency 144.400MHz, ident AFSK, power 10 watts at feed point, antenna a pair of stacked turnstiles, 1000 metres ASL.

UHF repeater VK4RBC, Brisbane. Frequency input 433.525MHz output 438.525MHz. UHF beacon VK4RBB, location Brisbane. Frequency 432.440MHz, ident AFSK, power 4 watts at feed point, antenna a single turnstile 70 metres ASL.

For UHF/VHF enthusiasts the group has available two-metre amplifier kits and two-metre and 70cm antenna kits.

Meetings are held at the Newmarket State High School, Banks Street, Newmarket, on the fourth Wednesday of each month at 7.30pm.

Postal address is PO Box 911, Fortitude Valley, Brisbane Qld 4006.

EASTERN AND MOUNTAIN DISTRICT RADIO CLUB: As at May 1981 the total licensed membership of EMDRC was 399, as shown in their 1981 call book. Club president is John Hutchinson, VK3JH, and secretary is Harry Kraehenbuehl, VK3NKI.

The club now meets every Friday night. The main meeting is on the first Friday of the month in the Willis Room, Nunawading Civic Centre, Maroondah Highway, Nunawading. On the remaining Friday evenings it is in the coffee shop at the same venue.

The club runs three nets each week; VK3BNW on 28.475MHz on Sunday mornings at 9.30am, VK3ER on 3.620MHz at 7pm, and an RTTY net on channel 52FM on Tuesday evenings (VK3ER) at 7pm.

All enquiries should be made to the Secretary, PO Box 87 Mitcham Vic 3132.

ST GEORGE AMATEUR RADIO SOCIETY: The executive committee decided recently to change the format of the club newsletter, Dragnet. It is now a quarterly publication with increased size and expanded scope. However, a newsletter, Dragnette, described as a diminutive or sub-harmonic of Dragnet, will be available at each monthly meeting of the society. It will contain up-to-the-minute information on the society's activities.

For details about SGARS join their nets on 14.110MHz at 7.30pm or 28.520MHz at 8pm on Tuesday evenings, on 3555kHz Sunday at 8pm, or on the VHF channel 6800 (4) repeater at 8pm Thursday. Postal address is PO Box 77, Penshurst NSW 2222.

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.

BITS AND PIECES

QRP means to reduce power and QRO means to increase power. Power is no substitute for skill. QPR operation offers several advantages, plus a high degree of personal satisfaction to operators who experience good on-the-air results while running low power. Interference between stations in the same service is greatly reduced by using low power. This reduced interference increases the communications effectiveness of the amateur bands and lessens the possibility of creating bad feeling.

Spurious radiations, such as harmonics and parasitics, are minimised at low power, significantly reducing any possibility of interfering with other radio services such as AM, FM and TV broadcasts. In-house interference to audio amplifiers, garage door remote controls, telephones and other similar devices is either reduced or eliminated by operating QRP instead of high power.

These are some points worth considering, according to "CQ", May 1981, page 80.

COAXIAL CABLE ANTENNA TRAPS can be made from a single piece of coaxial cable which serves as both the coil and capacitor. This type of trap offers several electrical advantages and is easy for the home builder to construct. That is the claim made in an article complete with details and data by Robert H. Johns, W3JIP in "QST", May 1981, page 15.

Constructional information is also given for a five-band dipole, a three-band vertical, and a triband beam antenna.

TECHNICAL TOPICS by Pat Hawker, G3VA, in the RSGB publication, Radio Communication March 1981 discusses the current situation relating to price, reliability, and other aspects of amateur equipment.

A point is made on the possibility of equipment rental becoming common. Reliability in service or above average performance are other factors related to good production engineering also mentioned.

Interesting food for thought and consideration.

The Australian CB SCENE

Olbis Industries competition results

Bernie Bischa, proprietor of Olbis Industries

By the time you read this, the two prize winners in the Australian CB Scene/Olbis Industries competition will be making good use of their prizes: a PSC 301 18-channel AM/SSB mobile rig with helical antenna system, and a Ferguson SSB regulated power supply.

When the day came to pick the two winners, I was glad I didn't have to do it alone. I went out to Olbis Industries at Oxley (Brisbane) armed with the entries so that Bernie Bischa, the owner of Olbis Industries and the sponsor of the competition could help decide who was to receive what and why. Unfortunately, Bernie was away, so the task fell to Bernie's brother Peter.

It took well over an hour and a half of reading and re-reading the entries before the final decision was arrived at. Both of us would have liked to have been able to give away extra prizes, but that of course, was impossible. Both the sponsor and I would like to thank you all for sharing in the competition. The standard was excellent.

Peter did ask, however, that I make mention to the fact that the competition guidelines clearly stated that the entries were to be of 250 words or less. However, some of the entries exceeded this and, while we did not reject them completely on this account, we could not allow their extra content to operate to the disadvantage of other entrants who had conformed more closely to the guidelines.

The winning entry, which gained for its author the Contact PSC 301 SSB/AM mobile rig complete with 5′ helical with base and lead came from Ms Angelike (Angie) Mow of Moorabbin in Victoria. Angie's entry is as follows:

WINNING ENTRY

"I purchased my CB radio in October 1979. I was 14 then, and had saved all my pocket money for months. I bought a small Hy-Gain AM set. Being the only girl in my family, and being the 'middle' child, I was very lonely. My shyness provided me with few friends. Lack of closeness with my parents meant that CB was the only thing I had with which to communicate with others.

"I made many acquaintances (including some 'rubbishers') and I was very happy.

"I joined the Southside Radio Club in June, 1980, and was forever borrowing a sideband set to see what it was like 'up there'. I am now saving up for a sideband set to keep in contact with my new friends. Sometimes I would monitor the Emergency Channel in the evenings. I often called tow trucks and ambulances to car accidents in the local area. I was really happy to be able to help others in times of emergencies.

"Nearly two years have passed now, and I am still content with my CB radio. CB to me is a world made up of lonely people, companionships, communications, gasbaggers, girl (and guy) chasers, technical smarties, trouble makers, truckies as well as CB hobbyists. To me CB has not changed at all.

"If CB were to become illegal again, I would lose many friendships and would be forced to return to my shy, lonely little world."

Once again, Angie, congratulations. I hope that your new Contact will help you keep in contact with all your friends!

The runner-up, and therefore the recipient of the Ferguson power supply was Mr Mark Roberts, of Traralgon, again in Victoria. Believe me, Mark, it was not an easy choice. Congratulations to you also. I hope you get many hours of enjoyment from your prize also.

Once again, I must thank the sponsors of the competition, OLBIS INDUSTRIES, 2164 Ipswich Road, OXLEY, 4075. Don't forget that the fellas there also handle mail orders and will be only too pleased to send you a current price on anything you might require. Believe me, they WILL look after you. Besides CB gear, they also deal in all types of car accessories and speed equipment. Or you may prefer to ring them on (07) 379 1087 and ask for any of the Bischa brothers: Bernie, Peter or George.

REACT, AUSTRALIA: A few issues back, I asked if it were true that General Motors in the USA had the last word in the operation of REACT in Australia. The question arose from a report sent in by Ken Upton of a meeting between the Omega Club and the representatives of the REACT team in Sydney. I have received an informative letter from Mr Peter Herman, the National President of

REACT Australia. Space does not permit me to reproduce Peter's letter in full but, he answers the question thus: "REACT was owned by General Motors America but, after 1979, REACT went its own way and GMA now has no say in its running."

REACT has also been active in the public relations area. Over the Easter weekend they helped Channel 10 with its telethon. Sydney CREST also pitched in and helped, and that is great to hear. Peter has given me a whole list of people he would like to see acknowledged for their efforts, but once again, space is against me. They all worked for over 30 hours, and are a fine example of CB operators at their best.

Since the telethon, REACT have provided communications for the Amateur Athletics Association of NSW at Liverpool and more recently, at Holsworthy. Their future planning includes a 48-hour fun weekend at Leichhardt Bowl to raise money for the Manly-Warringah School for Crippled Children and, after that, a 165-hour marathon on air to close off the Year of the Disabled in support of the same school.

REACT is also expanding, which is good to hear. On June 1, 1981, REACT became REACT Australia and now includes the separate teams of Sydney, Shoalhaven, Newcastle, Tamworth, Adelaide, Perth, and hopefully a new team in Mount Isa. As with all emergency monitoring teams, REACT Australia is on the lookout for new members and areas. If you would like to obtain more information about REACT, write to Peter Herman, National President, REACT Australia, PO Box 2169, North Parramatta, NSW, 2151.

POLICE AGAIN: Terry Watkin, the National Director of the NCRA, recently received the unwelcome attention of Qld police. Cited for a slightly noisy exhaust, the ensuing check-out ended up with the CB gear. Terry had to up-date the officers on current departmental regs!

THE ONE AND ONLY: At the time of writing, "Australian CB Scene" is the only (to my knowledge) CB orientated column being published. We were all sad to see CB Action fold, and there is little doubt that the hesitation by the Department in announcing the expected expansion of the HF channels is at least partly to blame. But the fact remains that the column which you are reading is the only opportunity which CBers have to get their message across. Tell all your friends about it and perhaps we can see something come out of this magazine. Write to the Editor and ask for more space. We need a platform for our views. Our major organisations eg that NCRA and CREMC must have the means to keep you all informed of the latest happening. It is in your hands.

So, cheerio, till next month — Jan Christensen. (The Australian CB Scene, PO Box 406, Fortitude Valley, Qld, 4006.)

SHORTWAVE SCENE

by Arthur Cushen, MBE

South Pacific Association of Radio Clubs

Four radio clubs in Australia and New Zealand recently founded the South Pacific Association of Radio Clubs to promote radio listening in the area. Many thousands of radio listeners do not belong to a particular club and there is much that the Association can do to increase the enjoyment of these listeners.

In Europe, the European DX Council and in North America the Association of North American Radio Clubs were formed some years ago to provide an umbrella type of organisation to aid the promotion of radio listening generally rather than on a club basis. It is felt that this is also needed in Australia and New Zealand.

There are thousands of people interested in radio listening and most of them do not belong to Clubs. They purchase a copy of the World Radio & Television Handbook and feel that is all that is required, but the four groups feel that there is much to be passed on to the new listener. This is even more evident in Papua New Guinea and the South Pacific. Many listeners are now turning to shortwave listening and though they may not be DX listeners as such, writing reception reports and seeking verifications, they have an intense interest in receiving radio programs which enable them to keep in touch with the world around them.

The founding members of the South Pacific Association of Radio Clubs are the Southern Cross DX Club of Adelaide, the Down Under DX Circle of Melbourne, the New Zealand DX Radio Association of Dunedin, and the New Zealand Radio DX League in Invercargill. The SPARC is to seek affiliation with the European DX Council and the Association of North American Radio Clubs and will publish a newsletter keeping the various groups in Australia and New Zealand informed of what is happening worldwide in radio listening circles.

The standardisation of rules for competitions, contents, counting countries and the like is also to be taken up by the SPARC Committee, and competitions held between member clubs in the area will be judged under those rules. At the present time the New Zealand Radio DX League, PO Box 1313, Invercargill, NZ is acting as the liason between the other three clubs and providing the necessary secretariat to get the new association into operation.

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.

NEW AUSTRALIAN FEATURE

Radio Australia's new feature for the shortwave listener has been retitled "Spectrum" and is broadcast on the first Sunday of each month in transmissions beamed to the Pacific, Asia, Europe, Africa and North America. The program is compered by Dick Speekman, former compere of DX Jukebox on Radio Nederland. The new feature runs for 16 minutes and the next program is Sunday, September 6.

The session will be broadcast at 0612UTC and repeated at 0810, 1612, 2112 and on Monday at 0112 UTC. The best transmissions in the South Pacific are at 0612UTC on 15160, 15240 and 17795kHz and at 0810 UTC on 6045, 9570, 11740 and 15115kHz.

INDIAN DX CORNER

The relatively new program from All India Radio, titled "DX Corner", is now broadcast on the second and fourth Monday of the month immediately after the Mailbag program at 1040UTC, 1435, 1830, 2030 and 2130 and then repeated on the following Tuesdays at 0040 in the General Overseas Service. The frequencies used at 1040UTC to broadcast to Australia are 15205, 15285 and 17875kHz.

Alok das Gupta of Calcutta advises that the 2130UTC broadcast is on 9912, 11755 and 15110kHz. Between 2045-2230 daily, the transmission on 9912kHz is synchronised with two transmitters each of 100kW. One transmitter on 9912kHz is beamed to Australia and New Zealand, the other to Western Europe.

The Director, Frequency Assignment, All India Radio, Broadcasting House, New Delhi 110 001, is keen to receive reports on the 9912kHz synchronised transmission.

NEW BRAZILIAN FREQUENCY

A strong signal from Brazil has recently been noted on 6020kHz after 0800UTC when the Voice of America leaves this channel. The station has been identified as Radio Universo, broadcasting from Curitiba. The program included a devotional service up to 0810UTC and then plenty of announcements and popular Brazilian music. The station faded out around 0930 and at that time Radio Netherland began transmitting from Bonaire with a transmission in Dutch.

Radio Universo has operated for some years on 9545kHz using 7.5kW and the new frequency of 6020kHz indicates that an additional transmitter has been installed. The address for reports is: Radio Universo, CP7133 Curitiba 80000 PR Brazil.

ISRAEL DEFENCE FORCES

Broadcasts of programs of the Israel Defence Forces station, Radio Galei Zahal have been observed on 14728kHz from as early as 0300 to past 0600UTC. The transmission is a relay of the medium-wave service and at times news in Hebrew is carried from the Israel Broadcasting Authority. News has been noted at 0300 and 0500UTC, while at 0400 a trumpet call and identification was noted by John Mainland of Wellington, NZ.

The station sometimes broadcasts on single sideband and at other times with normal AM transmission, and seems to be used to relay program material to the various medium-wave stations throughout Israel. The Israel Forces station operates 24 hours a day and so it would be possible to hear this shortwave frequency at times other than those reported.

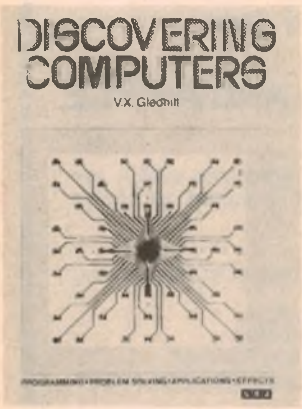
MOSCOW USING SSB

Radio Moscow has been transmitting programs to relay stations on single sideband for some years, but recently has moved to the international shortwave bands with signals being observed in the 19-metre band. The BBC Monitoring Service reports that an Independent sideband (ISB) transmission carrying Radio Moscow's Mayak program on lower sideband (LSB) and Radio Orbita-4 on upper sideband (USB) was heard at 2330UTC on 15225kHz. Another ISB transmission with the Mayak program on LSB and First Program on USB was observed at 1530UTC on 15270kHz.

Books & Literature

An educational look at computers

DISCOVERING COMPUTERS, V. X. Gledhill. Soft covers, 234 pages, 203 x 280mm, photographs, diagrams, flowcharts and cartoons. Published by Science Research Associates, 1981, Australia. Price $10.95.



The "man in the street" is becoming increasingly aware of computers, in fact they are involved in almost every facet of modern life from booking an airline flight to paying the telephone bill. We will also be getting a lot more personally involved with computers in the future with such schemes as "automatic tellers", PRESTEL and electronic telephone directories. Unfortunately most people are still ignorant of just how a computer works.

Clearly it is important to educate the public about computers, so the release of this book, Discovering Computers, is welcome.

Chapter 1 is a "hands on" session with the computer and introduces the keyboard, screen, using actual diagrams of the keyboard and the resulting screen display.

The discussion is in a very clear unambiguous style with plenty of diagrams – even the keys to be pressed are drawn out, and in the later part of the chapter a simple BASIC program allows the student to interact by typing in his or her name and various numbers and sentences which the computer uses to demonstrate just what it can do.

To get the full benefit of this chapter, a computer is necessary and any of the personal computers with BASIC would be suitable. The actual demonstration program is listed at the back of the book and can be typed in beforehand.

The next chapter covers problem solving, and as the book rightly states "computers cannot solve problems – people solve problems". So this chapter sets out how to define the problem by breaking a complex problem into more manageable simpler problems. This chapter like all the others is very generously illustrated and includes quite a few puzzles like making four triangles from nine matches, the nine dot problem etc. It also includes exercises throughout plus a summary and further exercises at the end of each chapter.

Flowcharting is covered in chapter 3 with the concept of sequential tasks described. Chapter 4 is "how a computer works", firstly the functional components such as video terminals, card readers, A-to-D converters, line printers, memory chips, magnetic discs and the CPU with plenty of interesting photographs.

Programming starts in chapter 5 which discusses how to convert a flowchart to a program and chapter 6 introduces BASIC programming including sample problems and BASIC program solutions. A short history of computing with numerous colour photographs completes section 1 of the book. Photos include the Abacus, Pascal's mechanical adding machine, the first valve computer and early tape drives, discs, core storage and VLSI chips.

Section 2 of the book is not in the same instructional vein as section 1 but merely presents a wide range of information about computers in general, their history, the development of computer languages, careers in computing, what computers are used for, computers and society. A glossary of computer terms is presented at the end of the book.

All in all the book is very well presented in a clear and interesting style with loads of diagrams, photographs and cartoons to illustrate the points covered and keep younger readers interested. We can recommend "Discovering Computers" to the hobbyist or beginner and in particular as a school text.

Our review copy came from Science Research Associates Pty Ltd, 82-84 Waterloo Rd, North Ryde, NSW, 2113, phone (02) 888 7833. (R.deJ.).

Computers for engineers

WHAT EVERY ENGINEER SHOULD KNOW ABOUT MICROCOMPUTERS Hardware/Software design, by William S. Bennet and Carl F. Evert. First Edition, Hardcovers, 175 pages, 158 x 236mm, diagrams and flowcharts. Published by Marcel Dekker 1980.

As the price of microprocessors, memory chips, etc falls, micros are going beyond the personal and business computer field and entering dedicated applications such as elevators, washing machines, heat controllers etc, in the near future we may even see microprocessor controlled toasters! Clearly engineers and technicians will have to be reasonably acquainted with micros and this book provides quite a good introductory discussion. Very little technical knowledge is assumed so it should also prove invaluable to hobbyists and non technical people who want to know what a micro can do and how it does it.

Essentially the book is written around one particular microprocessor application; the measurement of the number of gallons of liquid in an oddly-shaped storage tank. The solution to this design problem is gradually developed with various facts about micros introduced as they are required along with diagrams flowcharts.

The authors start off by defining how the job could be done and some of the features of micro, mini and main frame computers. Concepts such as registers, logic levels, memory, ROMs, data bus, and data latches are covered plus the basic hardware to interface the computer. Chapter 6 introduces the Motorola MC6800 and from this point on specific assembler code is given for the various functions to be performed.

We should emphasise that only a very elementary discussion of micros is given and it is certainly not for someone intending to do micro design work. It does however explain the principles of microprocessors in a "down to earth" fashion and we can recommend it to interested beginners.

Our review copy came from Soanar Electronics, 30 Lexton Rd, Box Hill, Vic.

Digital counters

DIGITAL COUNTER HANDBOOK: by Louis E. Frenzel Jr. Published 1981 by Howard Sams & Co Inc. Soft covers, 135mm x 215mm, 264 pages. Illustrated with photographs and diagrams. Price: $14.75.

The term "digital counter" can be used to describe a variety of ifferent electronic circuits and equipment, from a circuit made up of cascaded flipflops to specialised instruments for industrial measurement and control and test instruments used for design and troubleshooting. This book covers all three types of digital counters, but the emphasis is on digital counters as test instruments.

Digital counters are still a poor third in terms of popularity behind the common multimeter and the oscilloscope as test instruments, despite their ease of use and ready availability. The main purpose of this book is to explain how digital counters work and how they are used, providing a wealth of information on the operation, specification and application of digital counters in nine lengthy chapters.

"Digital Counter Handbook" is written for engineers, technicians, hobbyists and servicemen and is a practical working guide. The treatment of the subject is detailed without being bogged down by overly-theoretical concerns, and the virtues and vices of many commercially available instruments are discussed in detail. All in all this is a very useful book, sure to find a place on the shelves of many electronics enthusiasts.

Our review copy came from the Technical Book and Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne, Vic, 3000. (P.V.)

Aeroplane modelling

BASIC AEROMODELLING by R. H. Warring. Published 1980 by Argus Books Ltd, England. Stiff paper covers, 176 pages 210mm x 147mm, freely illustrated. Price in Australia $12.95.

When this book turned up for review, I assumed that it would cover radio-controlled models. It doesn't and it doesn't really qualify for review in this magazine.

Except that it grabbed my attention, as a one-time modeller who never followed through, and who never built the kind of model that was worthy of radio control!

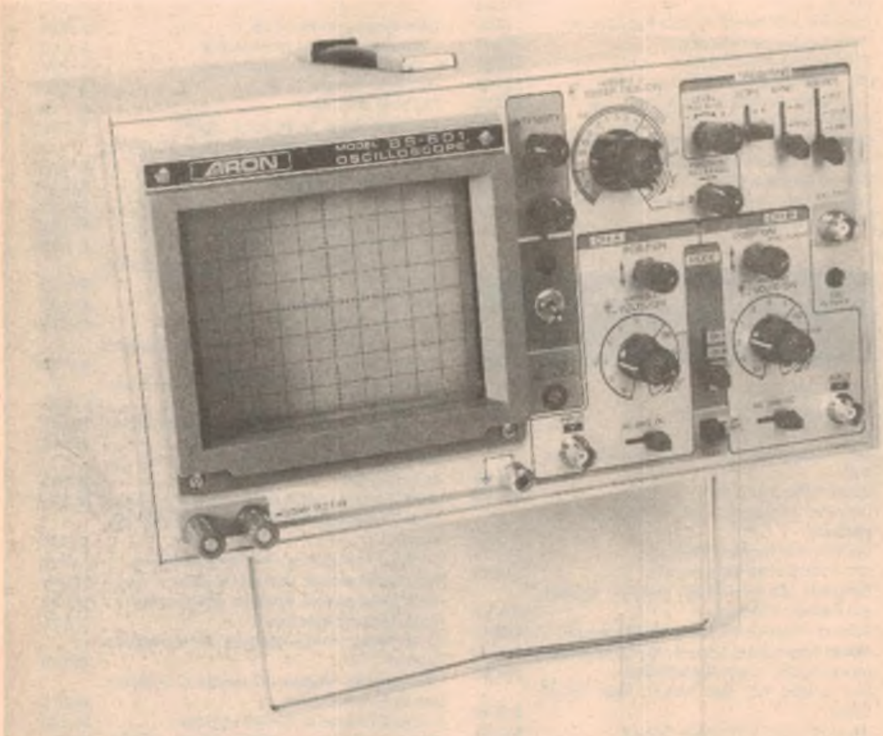
But author R. H. Warring does seem to have all the answers in a book, which is really the compilation of a long series of articles in "Aero Modeller" magazine.

If you know something about radio control but nothing about model making and scaled down aerodynamics, you won't begrudge the price of this tantalising (gorn, 'ave a go) book. It came from Australia and New Zealand Book Co Ltd, 10 Aquatic Drive, Frenchs Forest, NSW, 2086. Phone (02) 452 4411. (W.N.W.)

New Products

Aaron Model BS-601 dual trace oscilloscope

Just released in Australia, the Aaron Model BS-601 should appeal to hobbyists and professional users alike. It competes head-on in the medium-priced market and features dual trace operation, a large rectangular CRT, 20MHz bandwidth, 5mV/div sensitivity and a ×5 sweep magnifier.



In appearance the Model BS-601 is similar to most other medium-range CROs. The front panel features a large rectangular 150mm diameter green phosphor tube with an internal graticule in the standard 8 × 5 1cm divisions. Internal graticules are becoming almost a standard feature on new CROs and have the advantage of eliminating "parallax" error, so that the signal on the screen can be accurately compared against the graticule from any viewing position.

Overall dimensions of the Model BS-601 are approximately 170 x 294 x 400mm (H x W x D) including knobs, feet and rear projections. Mass is around 7kg. The top panel is fitted with a carrying handle, while a separate tilting bail allows the unit to be set to a convenient viewing angle.

All of the usual features expected in medium-range CROs are provided. Input attenuators for both channels are located to the right of the screen along with the vertical position controls and AC/GND/DC coupling switches. Calibration is in the usual 1-2-5 sequence from 5mV to 10V per division and each attenuator features a concentric variable gain control.

We checked the accuracy of the attenuators, measuring a 1.4% error on the 5V scale and no more than 2% error on the remaining scales. These figures are well within the quoted accuracy of ±3%.

Bandwidth of the Model BS-601 was measured as 20MHz, while vertical amplifier input impedance was 1MΩ shunted with 25pF. Both figures are as quoted in the specifications. Inputs to both channels are via standard BNC connectors and maximum input voltage is 600V p-p.

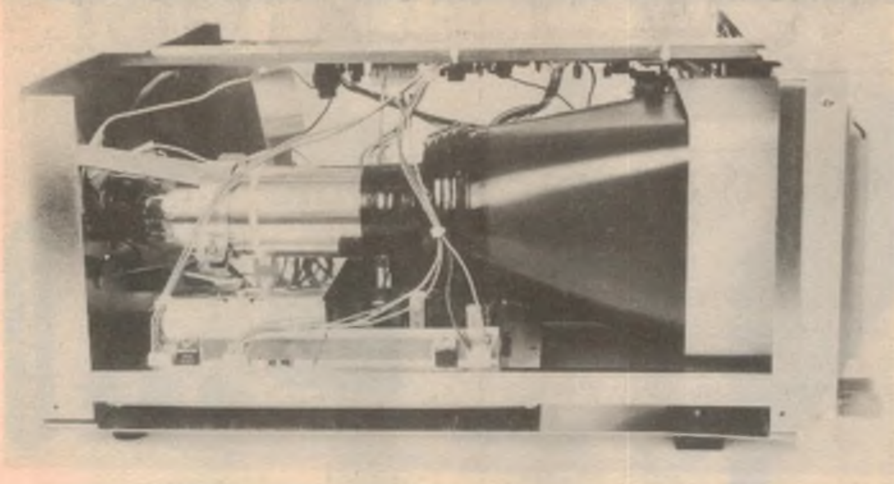
The timebase controls are located at the top right of the front panel and include calibrated timebase, trigger level, trigger slope, AC/HF$_{rej}$/TV sync filter, trigger source and horizontal position. Timebase calibration is in 19 steps in 1-2-5 sequence from 0.5μs to 0.5s with a concentric variable sweep speed control that can be switched to the calibrate position.

Using a DFM, we measured the timebase error as no more than 1.5% which is well within the quoted figure of 3%. No accuracy is stated for the ×5 sweep magnifier but we measured an error of 10%. In practice, we found the triggering to be quite effective and there was no difficulty syncing to TV video signals using the TV sync position.

Four display modes are available via the mode selector: Channel A, Channel B, Dual and ADD. Channel B can also be inverted via the position control to differential mode. The latter can be very useful when working with floating circuitry, eg "hot chassis" colour TVs and other mains equipment.

Switching the timebase control to the "CH B" position puts the CRO into the X-Y display mode where channel A goes to the X amplifier and channel B to the Y amplifier. This is an important feature and one that is often used in logic analysers and for generating Lissajous figures to compare frequencies etc. It can also be used for phase measurements in audio systems but of course the relative phase shift of the CRO's input amplifiers should be small. The Model BS-601 exhibited very little phase shift up to 10kHz and gave a phase error of about 2°.

Additional front panel controls include the usual intensity and focus controls plus a screwdriver adjustment for electronic trace rotation. Electronic trace rotation is a necessity with internal graticule CRTs and can be used to compensate for any inclination of the trace caused by external magnetic fields.



View inside the Model BS-601 shows its uncluttered layout.

Actual trace rotation is performed by a small coil on axis with the tube.

One handy feature included on the Model BS-601 and not found on many competing instruments is the component test facility. This facility allows the user to connect a component to two terminals located on the left side of the front panel and, by pressing the COMPONENT TEST button, to display the current/voltage characteristics of the device. Resistors, capacitors, inductors, diodes and zeners all have their own distinctive patterns so it is easy to spot a faulty component.

Just to put some icing on the cake the BS-601 also features a TTL-level Z-modulation input, a 0.5V calibration output, and 10% and 90% lines on the graticule to enable rapid measurement of rise and fall times. The rise time of the unit itself is quite good at 17ns and so is the overshoot figure which we measured as about 2%.

Internally, the Model BS-601 is nicely laid out with most of the components mounted on three separate PC boards — one each for the power supply, input amplifiers and timebase circuitry. The transformer is mounted on a bracket on the rear panel and is fitted with a copper strap to reduce its hum field. In addition, the CRT is fitted with a magnetic shield around the deflection area.

Front panel finish is also of a high standard and all controls work smoothly and precisely. Our only criticism is that some of the controls are a little close together, although this presents no real difficulties in practice. One worthwhile feature is the provision of slots on the plastic CRT surround to accept an optional polaroid camera attachment.

A comprehensive user's manual is supplied with the unit and describes the various controls, measurement techniques and maintenance procedures. A number of standard patterns are provided for the component test operation and show the user what to expect. Also included is a complete circuit diagram.

In summary, our reaction to the Aaron Model BS-601 is highly favourable. The unit is well made, performs as expected and, at $550 (plus sales tax where applicable), offers good value for money. Probes are not included in this but can be purchased for $30 each (plus sales tax).

Our review sample came from Radio Despatch Service, 869 George St, Sydney, 2000. Telephone (02) 211 0816. (R.deJ).

Total Electronics range

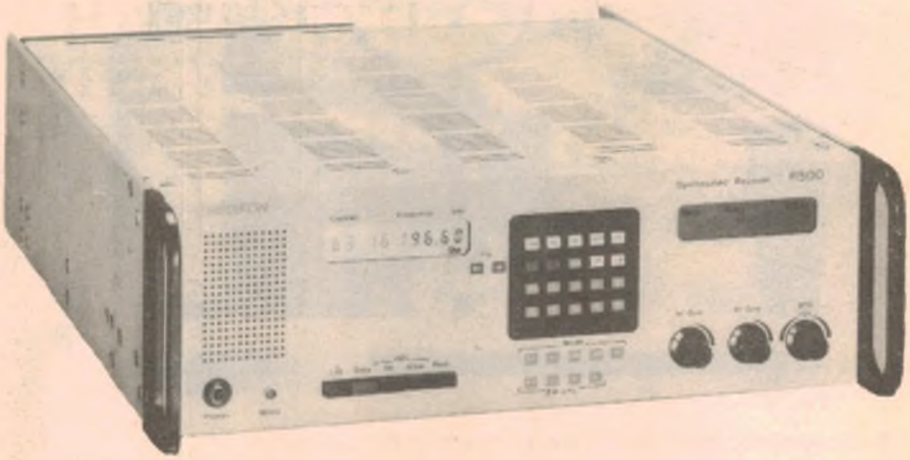
Total Electronics has been appointed the Australian representative for Robinson-Nugent of the USA. Robinson is a leading manufacturer of dual-in-line sockets and flat cable connectors. Mal Carlson, Marketing Manager of Total Electronics says "Total's association with Robinson-Nugent will mean ready availability in Australia of a top quality range of interconnection products and is the forerunner of major product additions to the Total line up of products".

Total Electronics already handle a wide range of products for the electronic industry. One of the latest additions to their range is a new optocoupler from TRW Optron. The 6-pin optically coupled isolator contains a GaAs infrared emitter coupled to a monolithic integrated circuit which includes a photodiode, a linear amplifier and a Schmitt trigger. The output of the isolator is TTL compatible, and capable of driving up to 8 standard TTL loads directly.

For more information on the Total range of products, contact Total Electronics, GPO Box 1286K, Melbourne, Vic.

New Products

Communications equipment from Vicom International



Vicom International Pty Ltd distribute a range of communication equipment including television translators, advanced remote controlled communications receivers and avionic test gear.

Particularly interesting is the new Rediffusion (Redifon) communications receiver R1007 and its associated remote control unit, RC100. The combination is capable of controlling up to 96 separate receivers and is extensively used overseas for surveillance and monitoring applications. Redifon has also produced an R500 version of the receiver with a drive unit for a transmitter, the DU500. Both of these units can be remotely controlled.

Vicom represents the Giga company in Australia, and can supply microwave pulse generators and other products from this company which are designed for the testing and evaluation of satellite systems.

In the broadcasting field, Vicom represent the Austrian company of Hirschmann, who make a range of television transmitters and translators with power outputs from 1W to 200W. Solid state units for both VHF and UHF operation can be supplied.

Vicom is well able to provide the necessary after sales service that is expected in this specialised field. Repair and calibration of all equipment is done in-house, and the company regularly exchanges engineers with overseas suppliers to ensure the best support for customers.

For further information contact Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne, Vic, 3205.

Second generation Powerscope from BWD

The Powerscope from BWD Instruments Pty Ltd is a specialised portable oscilloscope capable of measuring direct in-line power voltages from 100mV to 2KV at phase angles from 0-359° on four completely independent channels which provide separate display traces.

The instrument is already widely used in industry and research establishments for power engineering measurements, providing a safe way of measuring and displaying high voltage waveforms. Now BWD have come up with a second generation version, incorporating new technology.

One enhancement is the addition of a single outlet socket on each amplifier channel, together with a multiple socket, enabling almost any storage oscilloscope, distortion analyser, pen recorder or tape recorder to be connected to the Powerscope to provide processing or storage of waveforms measured in high voltage AC and DC power lines. Circuit improvements have also been made, further increasing the common mode rejection ratio and the stability of the instrument.

Power consumption is low and the Powerscope can be operated from AC, a DC power source or rechargeable batteries. Various accessories are available including 1:1 and 10:1 probes with 3kV peak operating voltages, a storage cover and a carrying case. Also available is a camera designed for taking photographs of the screen of the Powerscope.

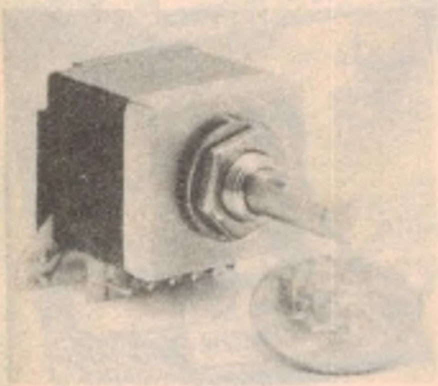
For further information on the improved Powerscope and other BWD products contact BWD Instruments Pty Ltd, Miles St, Mulgrave, Vic, 3170.

New Products Continued ►

New Products

A rugged rotary switch

Digitran has released a new coded rotary switch, the series 55000, designed to meet military specifications standards. The switch is said to be especially suited for navigation and communications equipment which could receive rough usage. It is a sealed unit, and is available with up to six decks and 12 dial positions.



The 55000 offers optional fixed stops or, as an added feature, optional isolation stops, which prevent the operator from accidentally changing positions from a fixed setting. These isolation stops can be by-passed only by a push-to-turn or pull-to-turn action, whichever is specified by the customer.

The switch is designed for specially severe environments. Its operating temperature range for example is from −5°C to 105°C and its shock resistance is greater than 100Gs.

Additional information is available from British Merchandising Pty Ltd, Shaw House, GPO Box 3456, Sydney, NSW, 2001.

Cannon connectors from Instant Component Service

Instant Component Service, the marketing division of STC-Cannon Components, can provide the full range of ITT-Cannon rack and panel connectors, including RTG18 types with 10, 16, 20, 26 and 39 contacts. Contacts can be removed for keying, and the connectors are available with crimp or solder terminations. Ratings for the connectors are a hefty 6A at 250V.

Also available from ICS are ITT-Cannon printed circuit edge connectors in three series. Connectors can be supplied in seven standard layouts with 15, 18, 22, 30, 36, 44 and 56 contacts. GO5 series connectors are available in any required length up to a maximum of 100 contact positions. Single or double read-out configurations are available, and again contacts can be removed for key coding.

Catalogues covering ITT-Cannon's rack and panel circuit board connectors are available on request, and provide ordering information plus dimensions and full technical data.

Further information is available from Instant Component Service, 248 Wickham Rd, Moorabbin, Vic, 3189.

New instrument monitors the power lines

The FDM-3 Fault Duration Monitor from Datamatic is a fully programmable instrument designed to monitor and record a range of power line disturbances. The "Powerguard", as it is designated, detects power line faults such as voltage errors, transients and frequency errors. It can be programmed via a front panel keyboard to recognise faults that fall outside of pre-determined limits.

Power line disturbances can be detected, stored in memory and printed out on an inbuilt printer. Stored results may be searched and a tabulated printout obtained showing only those events which exceed a selected threshold. A system clock tracks the time that errors occur and status lights indicate the condition of each parameter of the monitoring program.

Applications of the "Powerguard" are in EDP and other environments sensitive to power. In computer installations the monitor can be used to check whether data errors or hardware failures are caused by power supply problems, and can indicate whether expensive uninterruptable power supplies, motor generators or isolation transformers are necessary in an installation.

For further information contact Datamatic Pty Ltd, 60-64 Dickson Ave, Artarmon, NSW 2064.

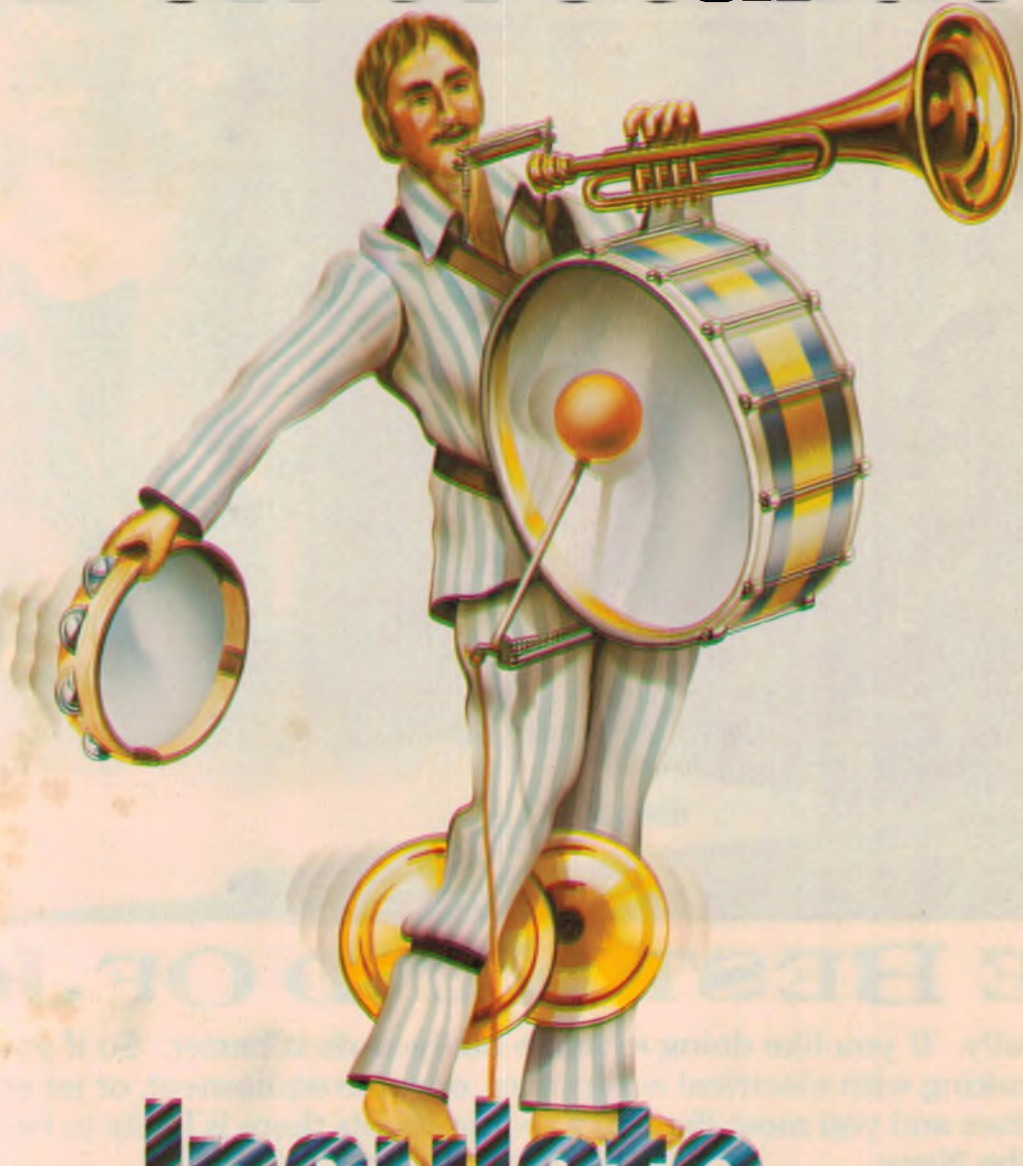
Large-size indicator for easy-to-read displays

Philips Electronic Components and Materials recently introduced a new seven segment indicator tube with a character height of 25mm. The size of the characters make the tube ideal for use in pin-ball machines and industrial equipment where a bright, easy-to-read display is required.

The new tube, the ZM1560, is provided with dual-in-line tinned solder pins for insertion into printed circuit boards. The pins are located on a 2.54mm grid and are positioned so that the display tubes can be mounted side by side without waste of space. The tube has a high light output and is a bright orange colour when used without a filter.

Further details are available from Philips Electronic Components & Materials, 67 Mars Road, Lane Cove NSW 2066.

Don't retaliate



Insulate
with BHAS Lead

When there's no point in complaining about noise, the only thing to do is insulate yourself from it.

BHAS Lead sheeting is the answer. Lead is an efficient, easy to install, economical insulation material. For free booklet on lead installation techniques, mail the coupon or contact Mr. L. I. Goff, Phone (03)658 3945. Just quietly, lead is hard to beat.

LEAD
BHAS
ZINC

CONCORD/BHAS/42

Please send me your free booklet "Noise Isolation with Lead Sheet". EA

Name

Address

Postcode

To: The Broken Hill Associated Smelters Pty Ltd., 55 Collins Street, Melbourne, Australia, 3001.

THE BEST KIND OF JOB I

It's obvious really. If you like doing it you're likely to do it better. So if you feel you'd enjoy working with electrical equipment, or radio equipment, or jet engines or marine engines and you meet the entry requirements there is likely to be a good job for you in the Navy.

If you don't know what you're good at, the Navy might well be able to find out for you. There are many cases where the Navy has discovered great talent in young people. You may have the kind of hidden talent which could lead you on to great things in the Navy.

So if you know that you've got a lot to offer but you're not quite sure what it is. Or there is no opportunity to discover it where you are, a good chat with a

Auth. Director-General Recruiting, Dept. Defence.


AUSTRALIA
S.T. GOSS

Digital IC Probe & Logic Pulser

PRB-1 DIGITAL LOGIC PROBE

Compatible with DTL, TTL CMOS, MOS and Microprocessors using a 4 to 15V power supply. Thresholds automatically programmed. Automatic resetting memory. No adjustment required. Visual indication of logic levels, using LED's to show high, low, bad level or open circuit logic and pulses. Highly sophisticated, shirt pocket portable (protective tip cap and removable coil cord).

- Automatic threshold resetting • DE to > 50 MHZ
- Compatible with all logic families 4-15 VDC • 10 Nsec. pulse response
- Supply O.V.P. to ± 70 VDC • 120 K Ω impedance
- No switches/no calibration • Automatic pulse stretching to 50 Msec.
- Open circuit detection • Automatic resetting memory

Range extended to 15-25 VDC with optional PA-1 adapter

PLS-1 LOGIC PULSER

The PLS-1 logic pulser will superimpose a dynamic pulse train (20 pps) or a single pulse onto the circuit node under test. There is no need to unsolder pins or cut printed-circuit traces even when these nodes are being clamped by digital outputs.

PLS-1 is a multi-mode, high current pulse generator packaged in a hand-held shirt pocket portable instrument. It can source or sink sufficient current to force saturated output transistors in digital circuits into the opposite logic state.

Signal injection is by means of a pushbutton switch near the probe tip. When the button is depressed, a single high-going or low-going pulse of 2μ sec wide is delivered to the circuit node under test. Pulse polarity is automatic: high nodes are pulsed low and low nodes are pulsed high. Holding the button down delivers a series of pulses of 20 pps to the circuit under test.

- High input impedance (off state) 1 meg ohm • Multi mode-single pulses or pulse trains
- Low output impedance (active state) 2 ohms • Automatic polarity sensing
- Output pulse width 2 μsec nominal • Automatic current limiting; 7 amps nominal
- Input over voltage protection +50 volts • Automatically programmed output level
- Finger tip push button actuated • Circuit powered
- Power lead reversal protection • No adjustments required

Multi-family RTL, DTL, TTL, CMOS, MOS and Microprocessors.

PRB 1	DIGITAL LOGIC PROBE	PA 1	HIGH VOLTAGE ADAPTER
PC 1	POWER CORD, Alligator Clips	PT 2	REPLACEMENT PROBE TIP(2)
PC 2	POWER CORD, Micro Hooks	PLS 1	LOGIC PULSER

AMPEC ELECTRONICS PTY. LTD.

1 Wellington St, Rozelle, 2039. PO Box 132, Rozelle 2039. Ph (02) 818-1166.

Available from: **NSW** Sheridan Electronics, 699 5922. Radio Despatch Service, 211 0191. Applied Technology, 487 2711. Jaycar, 264 6688. **VIC** Ellistronics, 602 3282. Ritronics, 489 8131. **QLD** NS Electronics, 36 5061. L.E. Boughen, 36 1277. **SA** Computer Imports, 268 8065. Electronic Components & Equipment, 212 5999. **WA** Reserve Electronics, 275 2377. Taimac, 328 1988. Altronics, 328 1599

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

CBS MASTERWORKS CASSETTES: "effect astounding"

SOME GENERAL REMARKS:

Early in the 1960s, when Philips sent me for review of one of their newly invented musicassette players and recorders, I predicted that, one day, this means of reproducing music would replace the gramophone disc. This, despite the fact that the original model was, by modern standards, a pretty primitive affair. Battery driven (five torch batteries) it didn't play for very long and the background noise produced by the cassettes sounded like escaping steam!

But, having in mind the compactness of the player and the ease with which cassettes could be stored, it seemed inevitable that electronic ingenuity would ultimately up-grade the whole system to full hifi standards.

At this point in time, I have now to admit that cassettes have not superseded discs and, with a new generation of video style, digitally encoded discs in the offering, they probably never will.

However, cassettes have certainly taken their rightful place as an alternative to discs in the mass market while, at audiophile level, premium quality cassettes can certainly stand direct comparison with premium quality discs.

These remarks are prompted by my receipt from CBS' most helpful PR man, Michael Newman, of their first issue of cassettes which have been dubbed at modest speed from a digitally recorded master on to chromium dioxide tape.

I am not exaggerating when I describe their immediate impact as astounding. The first to be played was Richard Strauss' "Also Sprach Zarathrustra" — the same performance as reviewed very favourably on disc in the July issue.

Having in mind the inevitable influence of one's own disc and cassette players, one would be hard put to it to nominate any essential difference between disc and cassette.

The real significance of these new cassettes lies in their all-round superiority over conventional pre-recorded cassettes, which are normally copied at very high speed from conventional master tapes on to ordinary ferric oxide.

I plan to review other cassettes in the new CBS series in the next issue, but here are details of the first one:

"WAY AHEAD . . ."

STRAUSS (Richard) — Also Sprach Zarathustra. Played by the New York Philharmonic Orchestra, conducted by Zubin Mehta. HMT 35888. CBS Masterworks stereo cassette, digital master, CrO2 tape, Dolby noise reduction. HMT-35888.

Just to repeat what I said of the disc in July, the work itself is not one of my favourites. It has little Strauss hasn't said before except the noble "yea-saying" first phrase, now viciously debased by use in TV adverts for soap powder and toilet paper, or some such articles.

Mehta makes it all sound ultra-Straussian. So did Strauss! And his occasional lapse into shocking vulgarity is exemplified by the violin solo in the second half, which is nothing but a thinly disguised Viennese waltz, placed diabolically in exactly the wrong place.

In short, while one would not class the performance as the world's best, it is certainly acceptable.

Technically, it is a different story, as I have already indicated. I have other cassettes of the work — under different performers, it is true — but this one is way ahead of them in the quality of its sound. As in the disc, there is more detail to be heard in the lavishly orchestrated score and a much better balanced bass.

My only real quibble is that the run-off on the first side is so long that too much time is wasted between the turn-over period and the beginning of the next side. Nor is the spot chosen for the break, in my opinion, the best available. However in view of the other perfections this seems a churlish complaint. (J.R.)

☆ ☆ ☆

STRAUSS (Richard) — Don Juan, Till Eulenspiegel's Merry Pranks and Death and Transfiguration. Cleveland Orchestra conducted by Lorin Maazel. CBS Mastersound Audiophile disc, digital master, IM-35826.

I have cut my comments on the new cassettes short in this issue to be able to review some new digital CBS discs that I found very exciting indeed. The first I played had on it three Strauss Tone Poems — Don Juan, Till Eulenspiegel and Death and Transfiguration.

I started with Don Juan in which I found the sharply defined amount of detail quite surprising, especially when combined with Maazel's vigorous opening which closely approaches the impetuous — but without accident. There is plenty of air between the instruments which produce a completely faultless sound. The precision acquired by the Cleveland under George Szell's 25 years of martinet direction has been well preserved by Maazel. The dynamic range is wide but not unwieldy.

While on the subject of dynamic range, Neville Williams' recent remarks show good sense but, to confuse them, I would draw his attention to DGG's new issue of Verdi's Falstaff and invite him to listen to the "Fairies" sequence in the last act in which the almost completely inaudible pianissimos at the beginning call for the help of a hearing-aid and the fortissimos later caused me actual pain in ears and head!

But to return to Don Juan, Maazel in no way neglects the more lyrical passages in the work but never makes the mistake of sentimentalising them. If some of them sound just a little hurried, they do not suffer from that reason.

Maazel begins Till with some beguilingly phrased, tenderly handled introductory bars followed by some remarkably

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.).

accurate, fast horn playing that will make anyone who has ever tried to produce sound from this brass via dolorosa sit up and ask for more.

Maazel's performance is full of well contrasted changes of mood and tempo and his reading never lacks a feeling of mischief behind it. Here and there, you will come across some surprisingly slow bars but these are soon overwhelmed by playing of much freshness and vigour. There are real laughs at the treatment of poor Till at his trial, underlining his feeble, hysterical outbursts against the weight of the law. It all ends with a lovely tender epilogue.

Death and Transfiguration starts, of course, with whispered but quite audible sound of irregular heart beats in a sick room atmosphere and goes on to the sufferer's recollections of childhood, love scenes and other episodes in his life. And Maazel even succeeds in making the unfortunate Resurrection theme sound respectable. My only adverse criticism is that the sleeve notes are more concerned with explaining the new digital techniques than in guiding newcomers through the labyrinths of Straussian tone poem. Full notes on the program will be badly missed, especially in Death and Transfiguration. (J.R.)

"EMPEROR CONCERTO" 45rpm audiophile disc

BEETHOVEN. Concerto No. 5 in E-Flat, Op.73, "Emperor". Artur Rubenstein and the London Philharmonic Orchestra conducted by Daniel Barenboim. RCA Red Seal stereo, 45rpm, ARL1. [From MR Acoustics, PO Box 165, Annerley, Qld, 4103. Phone (07) 48 7598.]

Originally recorded in the Kingsway Hall, London, in March 1975, this performance has found its way on to the Japanese audiophile market through RCA in Japan. Produced in Japan, the pressing carries notes in that language, with only the credits in English. In some respects, that has to be a liability on the Australian market.

On the other hand, the album has been beautifully produced, with a quality of sound that is not shamed by recordings of more recent vintage and more ambitious technology. Importance must be attached to the higher speed — to which RCA has a traditional attachment. Where, as here, the work can be accommodated on one LP, 45rpm can stretch the recorded wavelengths and open up the transients.

For good measure, it has been pressed on "virgin vinyl" — presumably vinyl that has not been sullied by earlier and abortive pressing operations.

As for the music itself, who but a person with a prodigious memory could position it in the countless performances of the "Emperor"? All that I can say is that I enjoyed this one by Rubenstein and Barenboim. I enjoyed the performance, the quality of the sound — especially the piano itself — and I appreciated the lack of background noise.

I guess that adds up to a definite recommendation! (W.N.W.)

QUALITY EXCERPTS

AT HIS BEST — a new series comprising movements of symphonies, shorter pieces and other works by Chopin, Mozart, Brahms, Handel, Bach, Liszt, Beethoven, Rossini and Tchaikovsky. One disc is devoted to each composer. All available separately. CBS Stereo Discs Nos. 001-009.

This is another new CBS enterprise. Budget priced, each disc features various works by popular classical and romantic composers. Most of them are easily assimilable at first hearing. All the nine discs that I received are obviously aimed at newcomers to the opportunity to hear serious, but not too serious, music or even to those exploring this field to see whether or not they have a taste for it.

I hasten to add that these are not a throw-out job lot. They are admirably produced; all are played by reputable performers and soloists, instrumental and vocal. All are well recorded in stereo and each sleeve has notes on the composer and his works.

I might add that the choice of pieces has been made by an expert or experts in this field. This is an exercise well worthy of support in view of the growing audiences in Australia for the better class of music. Many newcomers will find pleasure in exploring these highways for the first time especially those tiring of the manic repetitiveness of pop music or the unmusical inadequateness of the avant garde school. It is to be hoped that the byways will come later.

I shall cite the Beethoven contents as a general example of what you might expect to find on all the others. "Ode to Joy" from 9th Symphony. First movement 5th Symphony. First movement "Moonlight Sonata" — and more. The last phrase I quote from the sleeve. The performers are Bernstein and the New York Philharmonic, Eugene Ormandy and the Philadelphia, Philippe Entremont (piano) and the Morman Tabernacle Choir. All are of course reissues, if they weren't they couldn't be put out at their present price.

☆ ☆ ☆

FAURE — Requiem. Rotterdam Philharmonic Orchestra and Netherlands Radio Chorus with Elly Ameling (soprano) Bernard Kruysen (baritone) and Daniel Chorzempa (organ) conducted by Jean Fournet. Philips Stereo Cassette 7300 407.

This is a difficult work to recommend — or otherwise treat — to its many lovers. It is a real curate's egg, with all that implies. It also faces much stiff competition, especially in my opinion, from Barenboim's recording. It offers many good things and others you may not like as much. Another very real competitor is the performance by the King's College Choir in a true church atmosphere. This is now a bit long in the tooth soundwise and is showing it and has probably been deleted. A pity! Because Robert Chilcott's singing of the solo Piu Jesu was quite unforgettable.

The Faure Requiem, for the most part, is a serene work. There is, for instance, no dramatic Dies Irae — and this might be explained by the fact that, although he had a long association with the church and was for many years a director of one of Paris' most important churches — the Madelaine — Faure himself was a freethinker and this Requiem was composed as a tribute to his beloved father.

In this present recording, I found that much of my enjoyment of Elly Ameling's fresh soprano voice, especially in pianissimo passages, was spoiled because of her recorded closeness to the mike. While Amerling's voice is always quite steady, the same cannot be said of the baritone's, Bernard Kruysen, who has a fast vibrato much of the time.

Barenboim caresses the work delivering it with grateful warmth all through. Fournet is more typically French. He is intent on keeping the orchestra, choir and soloists right up to tempo, except, somewhat astonishingly in the Piu Jesu. Otherwise his reading is orthodox but shows no great distinction anywhere. And after a time the baritone's vibrato develops into a really tiresome flutter. I find it impossible to recommend this work when several of its many competitors are being remembered.

Fournet's absolute steadiness of tempo may not please everyone in his reading of the fill, a Pavane, not to be confused with Ravel's. But I must point

TRANSFORMERS

Made in Australia to Australian standards for 240V, 50Hz mains with secondaries from 1.5V to 115V.

CONVENTIONAL

Rated from 2.5 to 350VA

LOW PROFILE

20, 40 & 60VA ratings with dual secondaries for various output voltage and current combinations. Also multi-tap 20VA version. Compact design.

P.C.B. MOUNTED

Pins located at standard 0.1" PCB grid. Ratings from 2.5 to 15VA with dual secondaries.

MICROPROCESSOR

Specially produced with 8V main secondaries and 12-15V dual auxiliary secondaries. Outputs from 200mA to 10A. Also Computer Line Conditioners.

POWER POINT ADAPTORS

Available in AC and DC versions with outputs to 6VA AC or 4VA raw DC or 3VA filtered.

POWER SUPPLIES

Fixed regulated 13.8V DC supplies, variable 0 35V DC with current limiting. Battery Chargers up to 20A.

ENCLOSED TYPES

Includes step down transformers for 115V equipment, soldering irons, mains isolation etc.

AUSTRALIAN MADE

FERGUSON

Send for data sheets and rating selection guide.

FERGUSON TRANSFORMERS PTY LTD
331 High Street, Chatswood 2067 Tel: (02) 407 0261

DON'T MISS OUT

27 DO-IT-YOURSELF PROJECTS FROM ELECTRONICS AUSTRALIA

If you like building electronic projects in your spare time, this exciting book of popular projects is a must. There's a tacho, a dwell meter and a CDI unit for your car; a Doppler burglar alarm; a digital clock; a loudspeaker protector; a variable power supply; plus much more. Order your copy now!

Use this handy order form

ONLY $3.00*
+ 70c pack & post

To: Electronics Australia, PO Box 163, Beaconsfield 2014.

Please send me .... copies of "PROJECTS & CIRCUITS NO. 2" at $3.70 each. (Price includes packing and postage.)

NAME ....

ADDRESS ....

......................STATE........POSTCODE........

I enclose a cheque/postal order to the value of $ ....

A.C.E. RADIO

136 VICTORIA RD, MARRICKVILLE, NSW 2204
PHONE 51 3845

PROUD TO BE AUSTRALIAN

ELECTRONICS CENTRE

BARGAIN PRICES ● PERSONAL ATTENTION ● SLICK MAIL ORDER SERVICE ● SATISFACTION

MURPHY B41 EX-RAN LONG WAVE COMMUNICATION RECEIVER

Good clean condition. But not air tested. 240 VAC 50 HZ operation. 5 Bands 15 KHZ to 700 KHZ. 2 RF and IF stages. Band Spread. Ideal for variable IF.

$89 Personal Shoppers Only

SANYO NICAD RECHARGEABLE BATTERIES

Size C 1.2V 1.2AH
4 for **$11.95**
P-P **$2.50**, Interstate **$3.50**

CRYSTAL FILTER

HY-Q Type QF10C7 10.7 MHz
$12.95 P-P **90c**

MEMOREX 8-TRACK CARTRIDGE

90 MINUTES. BLISTER PAK
$4.95 EA.
(LIMITED STOCK) **P-P 90c**

8-TRACK HEAD CLEANER
$2.95 EA.
(LIMITED STOCK) **P-P 90c**

BSR

SUPA-DUPA SPECIAL

25% OFF FACTORY PRICE

VERY LATEST MODEL

BELT DRIVE STEREO RECORD PLAYER MODULE

$89.95

P-P NSW $7.50 INTERSTATE $8.50

TRENDY LOW PROFILE CABINET. SATIN SILVER VINYL FINISH. TINTED PERSPEX COVER. ALL THE LATEST FACILITIES. AUTO OR MANUAL OPERATION. 33-45 RPM. CUE LEVER. ADJUSTABLE COUNTER WEIGHT. ANTI SKATE. BIAS CONTROL. BIG PLATTER. ADC MAGNETIC CARTRIDGE. DIAMOND STYLUS. ALL CABLES INCLUDED. ETC. ETC.

GENUINE FACTORY PRICES ETONE 12" SPEAKER SPECIALS

GUARANTEED TOP QUALITY BRAND NEW BARGAINS
Rugged diecast frame. 8 and 15 ohms available
12" Woofer. 30 watts RMS. Reson 65Hz freq 50-8000Hz
$25.50 each **OR** 2 for **$44.00.** P-P for 1 speaker NSW $2.00
12" Twin Cone 30WRMS. Reas 65Hz Freq 50-15,000 Hz. Interstate $3.00
$26.50 each **OR** 2 for **$46.00.**
P-P for 2 speakers NSW $3.00, Interstate $4.00

BULK BUY MONEY SAVERS MINIMUM ORDER $10

IN4006 SIL. Diodes 800 piv 1 AMP, 50 for **$4.95**
BYX48/300 SIL. Diodes 300 piv. 6A. STUD MT, 10 for **$5.00**
UA301 1-C, 10 for **$2.00**
LM3900, LM330IN, 10 for **$5.00**
Transistors, BC327, 546, 547, 549, 556, 558, 559, SE 4010, BC108, 50 mixed for **$4.75**
Stettner Ceramic Trimmer Caps, 4/20 pf. Dia. 10mm, 10 for **$2.90**
Glazed Ceramic Egg Insulators, 10 for **$8.50**
5 Pin Din Sockets, Panel MT, 10 for **$2.75**
BEZELS. Red, Green, White, 15mm. MT hole for STD Screw, 10 for **$3.80**
Screw Terminal Post with 4mm Banana Socket. Red, Black, Blue, Green, Yellow. 10 for **$3.00**
High Quality Amphenol 6 Pin Plug and Panel MT Socket, fully chromed, 2 pair for **$4.75**
A1 Quality Solid Bright Aluminium Knob, 25x17mm, ¼" Shaft, 10 for **$6.95**
Black Plastic Inst. Knob, 22x24mm. Chrome Insert, 5mm Skirt OA dia. 32mm, ¼" Shaft. 10 for **$5.95**
ADD P-P NSW, **$1.25**, INTERSTATE **$1.95**

AKAI SPARES LESS THAN ½ PRICE

PURCHASED FROM THE DISTRIBUTOR — THEY NO LONGER HAVE THE AGENCY ● TO SUIT R TO R CASSETTE MACHINES ● ALL SPARES BRAND NEW ● HEADS ● HEAD ASSEMBLYS ● MOTORS ● HARDWARE ● 240VAC CAPS ● BELTS ● METERS ● TRANSFORMERS ● KNOBS ● SWITCHES ● SERVICE MANUALS ● ETC, ETC, ETC.

AHV

1982 Australian Home Video Convention

Sydney Hilton
February 13/17, 1982

Australia is the world's fastest growing market for home video software and hardware.

Both the general public and the trade are invited to participate in the 1982 Convention which will include extensive display areas featuring the latest in video software and hardware available from Australian and International exhibitors.

The 1982 Convention will feature top Australian and International speakers who will lead workshop sessions on a variety of areas including:

- Copyright law
- Pirating
- Censorship
- Retailing
- Merchandising
- Promotion
- Closed circuit applications
- Software Developments
- Hardware Developments
- Video for education and training
- Video for recreation and pleasure
- Video production
- Video resources

For further information about attending and/or promotional facilities contact the Convention organisers:—

L.D. Graham & Associates Pty. Ltd.
Management Consultants,
155 Drummond Street, CARLTON,
Vic.3053.
Tel. (03) 347 3437 or (03) 347 5076

Name:

Address:

P/Code:

out that the Pavane was originally a dance so that a rigid tempo can be excused more readily in a ballroom than on a concert platform. The sound is good average cassette though not in the race with the recently recorded digital CR02 products of CBS. (J.R.)

☆ ☆ ☆

HAYDN: Il mondo della luna (the world on the moon). Domenico Trimarchi, Luigi Alva, Frederica von Stade, Arleen Auger, Edith Mathis, Lucia Valentini Terrani, Anthony Rolfe Johnson; Lausanne Chamber Orchestra; conducted by Antal Dorati. Philips stereo disc Grandioso series 6570 156.

These excerpts from one of Haydn's many operas really made me wish for more; the opera had its only performance at Esterhaza in 1777 and remained forgotten until 1958 when H. C. Robbins Landon reconstructed it from three large fragments. Haydn used the text of a Coldoni comedy — a lucky choice, since it meant a cast of only seven singers, required no chorus and had, for its period, a fairly simple and comprehensible plot.

Given these favourable pre-conditions, Haydn added a very tuneful score with lots of dramatic colour, some exquisite arias and might not have been too surprised to learn that his comic opera became a 20th-century success — first in Holland, then in France and elsewhere. At last, it seems, Haydn has "arrived" as a composer of operas! Dorati's deftness with Haydn is firmly established and his stylish direction contributes much to one's pleasure. The orchestra, though not a name-band, produces excellent sound and all the singers are first-rate, special mention being due of contralto Terrani, a newcomer as far as I am concerned. I think one should try for the full recording; failing that, these excerpts deserve the highest praise. (P.F.)

☆ ☆ ☆

ALBINONI: Concerto in B flat, op. 7 No. 3 (transcribed for trumpet); HERTEL: Concerto in E flat for trumpet and oboe; HUMMEL: Trumpet Concerto in E flat. Andre Bernard, trumpet; Heinz Holliger, oboe; English Chamber Orchestra; directed, from the harpsichord, by George Malcolm. CBS Masterworks Stereo disc 76862.

First it was Wilbraham, then Maurice Andre, now Andre Bernard: a peal of brilliant trumpeters interested in the rediscovery and popularisation of baroque and rococo music written to challenge their illustrious predecessors. Albinoni's concerto, actually written for the oboe, could not have been performed on the trumpets available in his time; he died in 1750 and Anton Weidlinger's keyed trumpet was not yet invented.

The Albinoni concerto of about nine minutes' duration, and including a seductively beautiful Adagio, immediately establishes Bernard as an outstanding trumpeter and musician. These qualities distinguish the two other works as well. The concerto by Johann Wilhelm Hertel, a North German composer of great distinction who died in 1789, is an attractive and quite imaginative work, treating the two solo-winds in concertante fashion. The only exception is the second movement, a fine Arioso, which omits the trumpet and exploits the oboe's range to great advantage.

The whole of side two is given to Hummel, Haydn's successor at the Esterhazy Court, with the concerto he wrote for the inventor Weidlinger. Incidentally, it was this work that endeared him to Haydn and got him the Esterhazy job. It is quite a remarkable work, brimming over with fine music and brilliant ideas — some lyrical, some cheeky; a work to interest performer and listener alike. The fine soloists apart, there is lovely playing from the ECO, excellent direction by George Malcolm and very good recorded sound which copes with all trumpet's pyrotechnics. (P.F.)

☆ ☆ ☆

HANDEL, FOUR FLUTE SONATAS. World Record Club R 08329.

We have heard so much lately of the brilliance of James Galway playing on modern instruments, that we forget how many changes have taken place in the design over the last few centuries. These sonatas have been played on in-

ORCHESTRAL "SNACKS" IN DIGITAL

DRAKE 400. The Bournemouth Symphony Orchestra, conducted by Ron Goodwin. Digitally mastered stereo, Chandos ABRD 1014. (From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone 02 343 1612.)

If you'd like to acquire a digitally mastered disc but are less than partial to classical orchestral fare, this album could be for you. The orchestra is the Bournemouth Symphony, but the fare is much lighter than you might expect.

The 14-minute title track is an orchestral suite written by Ron Goodwin, well known as a successful composer of film music. "Drake's Drum" commemorates the 400th anniversary of Drake's return to Plymouth — an area that Goodwin knew well in his boyhood.

The remaining tracks are mainly film themes but interspersed with traditional and other items: Love Theme (Beauty and the Beast) — Festival Time — Candleshoe — Amazing Grace — Force 10 From Navarone — Minuet In Blue — The Spaceman and King Arthur — The Girl With The Misty Eyes — Auld Lang Syne.

As often as not film music, heard in isolation, lacks interest, but there is no such problem in this new album. There is a varied mix of mood and sound and the Bournemouth Orchestra seems to have enjoyed every minute of it — even to providing a backdrop for the bagpipes in "Amazing Grace"!

The sound quality is excellent and I can imagine that side 2, in particular, could serve as an excellent demonstration disc for stereo systems — will able to expose orchestral texture, without being musically overpowering. (W.N.W.)

struments of the period, as the composer knew them, and it makes an interesting comparison.

The sonatas are: G minor Op 1 No 2 — C major Op 1 No 7 — A Minor Op 1 No 4 — F major Op 1 No 11. They are played by Hans-Martin Linde on the Blockflute, August Wenzinger, Viola da Gamba and Gustav Leonhardt on the Harpsichord. It is a relaxing record, just the thing to play on a quiet evening at home. (N.J.M.)

☆ ☆ ☆

GREATEST SCIENCE FICTION HITS. Neil Norman and his Cosmic Orchestra. L 25368 Festival Records.

Contains 14 up-tempo orchestrated themes from well known science fiction movies.

The tracks are: Star Wars/Empire Strikes Back — Voyage To The Bottom Of The Sea — Daughter Of The Lesser Moon — Sinbad And The Eye Of The Tiger — The Time Tunnel — Twilight Zone — Star Trek — Buck Rogers In The 25th Century — War Of The Satellites — Vampire Planet — Dr Who — The Adventures Of Superman — Dark Star and March Of The Lizard Men.

This album is entirely instrumental and allows the listener to reminisce on favourite science fiction movies.

Musical arrangements are extremely well co-ordinated and well presented — an excellent collection. (D.H.)

☆ ☆ ☆

THE MAN WITH THE GOLDEN FLUTE. James Galway. Stereo, RCA LRL1 5127. Released through the World Record Club.

The remainder of the title summarises the contents and I simply reproduce it. "Plays music by" J. S. Bach: Minuet and Badinerie. Debussy: Clair de Lune, Syrinx, The Little Shepherd. Paganini: Moto Perpetuo. Vivaldi: Flute Concerto in G Minor, "La Notte". Gluck: Dance Of The Blessed Spirits. Berkeley: Sonatina. Mozart: Andante for Flute and Orchestra in C Major, K.315.

Associated with James Galway in the various tracks are the Festival Strings, Lucerne, conducted by Rudolf Baumgartner; National Philharmonic Orchestra conducted by Charles Gerhardt; Anthony Goldstone, piano.

Jacket notes cover each of the items and they make appropriate reading as you listen. But this is a record that you don't have to work at, in any sense. Whether or not you are familiar with the contents, you can just relax and let the music do the rest. Perhaps I should expect Moto Perpetuo; it made me breathless just to listen to James Galway play it on flute, without perceptibly drawing breath!

The quality is normal. As I said, relaxing and eminently listenable. (W.N.W.)

☆ ☆ ☆

VIVA CHILE. Inti Illimani. World Record Club WRC 08023.

Instead of the usual latin inspired jazz that passes for South American music so often, we have 12 tracks of Chilean music, played mainly on instruments of that country.

The record sleeve carries little information except for the names of the musicians, what they play and the titles of the music. The titles include: Fiesta de San Benito — Cancion Del Poder Popular — La Sugunda Independencia — Tatati — Ramis — Subida — Simon Bolivar.

The quality of the playing and recording is excellent, making for an enjoyable listening experience. (N.J.M.,(

RECORD CLUB DIGITAL

CLASSICAL FAVOURITES IN DIGITAL. Franck Pourcel and the National Philharmonic Orchestra Digital master stereo, EMI, EMC-2712. Released through the World Record Club.

This is the first digitally mastered recording I have received through the World Record Club — made in the EMI studios at Abbey Road, London and recorded on EMI-manufactured digital equipment.

The sound has the open texture that one expects of a modern digitally based recording but the bass end is notably light — perhaps because of the limited dimensions of a studio, as compared with a concert auditorium. Whatever the reason, you will find that this recording needs a fair amount of bass boost, to give it body. Then it sounds fine.

There are ten tracks: The Great Gate

Of Kiev (Moussorgsky) — Gymnopedie No. 1 (Debussy) — Ritual Fire Dance (De Falla) Intermezzo From Cavalleria Rusticana (Mascagni) — Sicilienne (Bach) — Carmen Overture (Bizet) — Norwegian Dance No. 2 (Grieg) — Gymnopedie No. 3 (Debussy).

The selections will have a familiar sound and a ready appeal to those partial to classical snippets, but don't forget the bass boost. (W.N.W.)

CLEO LAINE IN AUSTRALIA with the John Dankworth Quartet. World Record Club stereo R 90070.

What can I say about Cleo Laine which hasn't already been said many times before? Her vocal range is little short of amazing; her vocal agility rivals that of her husband John Dankworth on clarinet and saxaphone and her ability to improvise is the best I have ever heard from any male or female jazz singer. Apart from that, Cleo Laine has a delicious sense of humour and a great deal of empathy with her husband and other members of the quartet. With all that going for her, it is not surprising that Cleo Laine turns in a brilliant performance on this record.

Recorded on a recent tour of Australia by Cleo Laine, this disc shows her at her very best and with the audience loving every minute of it. It goes without saying that I enjoyed it too. Recording quality is good without being outstanding.

There are twelve tracks in all: Fascinating Rhythm — Tell Me The Truth About Love — I'm Gonna Sit Right Down — Aquarius — On A Clear Day — Paddy — Mad About The Boy — Dunsinane Blues — O Mistress Mine — Take All My Loves — Please Don't Talk About Me When I'm Gone — Song Without Words. (L.D.S.)

☆ ☆ ☆

LA4, ZACA. Concord Jazz L37523. Festival Releases.

When you gather together talent such as Laurindo Almeida, Ray Brown, Jeff Hamilton and Bud Shank together on one record, you can expect the best in jazz; and you won't be dissapointed.

There is a strong Latin influence throughout the seven tracks: Zaca — You Can't Go Home Again — A Child Is Born — O Barquinho — Close Enough For Love — Pavanne — Secret Love: It is obvious from the skilful interplay between the musicians that they have been working together as a team for a long time, with Laurindo Almeida on guitar, Ray Brown on bass, Jeff Hamilton on percussion and Bud Shank on alto saxophone and flute.

In all it is a most enjoyable record, and one you will want to play time and time again. (N.J.M.)

☆ ☆ ☆

JOYCE GRENFELL, Second Collection. Mono and stereo, World Record Club WRC-R08061.

I remember the name Joyce Grenfell but that is all. Obviously, I was not a fan, and that still applies. There are 16 tracks, mainly humourous monologues but with a few humourous songs interspersed. Titles include: Nursery School — Hymn — The Wedding Is On Saturday — If Love Were All — Fan — Picnic.

The trouble is that I didn't find them even slightly funny, the more so because, to catch the softer syllables, the loud ones had to be too loud for that kind of voice.

Devotional album

FATHER LIFT ME UP. Expressions for His presence. Produced and conducted by Kurt Kaiser. Stereo, Word, WSB 8844. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

This production from the dedicated hand of Kurt Kaiser is aimed to appeal to a broad cross-section of churchgoers, whether protestant or catholic. All the melodies and lyrics are new, several by Kurt Kaiser himself, but they are all tuneful and eminently listenable.

The theme is worship: Father Lift Me Up — Enter Into His Gates — The Lord Is My Strength And My Song — O Bless The Lord — Grow In Grace — He Careth For You — If Any Man Thirst — Oh, So Wonderful — Give Me Thine Heart — Sing It Out Loud — A Shield About Me — Hallowed By Thy Name.

Believe it or not, the orchestral arrangements by Bill Pursell were recorded in London, while the vocal arrangements by Kurt Kaiser were recorded in Dallas, Texas. A third studio in Santa Ana, California, did the mix-down. Yet the sound is so clean and so well blended that it has all the qualities of a single, tightly conducted performance.

Pleasant, gentle, tuneful Gospel listening. (W.N.W.)

I can only say: strictly for Joyce Grenfell fans, whoever and wherever they are. (W.N.W.)

☆ ☆ ☆

"AINT WE GOT FUN". The Mighty Marenghi Fairground Organ. World Record Club WRC R 06369.

The Age Of Steam is still with us, with incredibly noisy musical monstrosities such as this Marenghi Fairground Organ, with its accompanying traction engine. The history of these amusement machines is that of technology replacing people — a somewhat familiar theme these days, only this happened nearly 100 years ago!

This machine now resides at the National Motor Museum at Beaulies. The mechanism is similar in operation to the player piano, that is enjoying such a revival, in that the notes are operated by a pneumatic keyboard, with perforated cardboard pages instead of a player roll.

The 20 tracks include such numbers as: The Harry Lime Theme — All My Loving — Tritsch Tratsch Polka — A Wonderful Guy — The Blue Danube — Boomps A Daisy — She Loves You — In A Little Spanish Town. (N.J.M.)

☆ ☆ ☆

THE GREAT BRITISH DANCE BANDS play the Music Of Noel Coward. World Record Club WRC 06200.

This is a record for the senior nostalgia buffs among our readers. Some of the original recordings must go back at least 50 years, with names like Jack Hylton, Ambrose, and Ray Noble amongst the band leaders. The music has a sameness about it and you would have to be a Coward fan to appreciate it. (N.J.M.)

Column 80

by JAMIESON ROWE
*Technical Director,
Dick Smith Electronics*

Serial communications and RS-232C ports

Nowadays most small computers are provided with an input-output port designed for serial communication — or if they're not, it can usually be provided as an add-on option. Here's a quick rundown on serial communications, RS-232C ports and what they're used for.

Last month, you may recall, we looked at computer input-output or "I/O" ports in general, and the way they link the computer with its "attachments" or peripherals in the "outside world". We also looked at one of the two main types of I/O port, the Centronics-type parallel printer port. Now let's look at the other main type of port: the serial communications port.

Like a parallel port, a serial port is basically a connection socket and circuitry, provided to allow information to be transferred between the computer and another device. And as before the information is usually transferred in chunks no larger that a "byte" (a group of eight bits). The main difference between the two is that whereas with a parallel port the various bits are handled in parallel or "side by side", in separate circuits, with a serial port they are handled in serial order or "one after the other" on a single circuit.

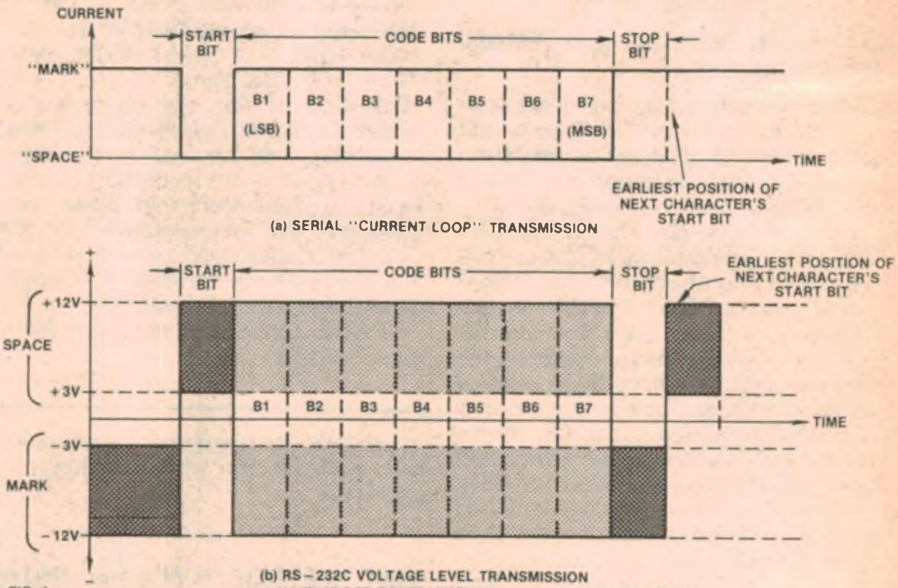
This "serial" method of transmission originated long before computers came on the scene, with simple manual telegraphy using "Morse keys". The dots and dashes making up the code for each letter and number in a message were sent one after the other along the telegraph line, to be "decoded" by the operator at the distant end. This was the only practical way, as it would have been far too costly having a number of parallel circuits.

When teleprinter machines were developed around 1906, they too were designed to use serial transmission along a single circuit, for the same reasons. And the type of serial information transmission developed for teleprinters is basically that still used today, for both "Telex" communications and the serial port of your computer.

The basic idea is that the code bits making up each letter or number of the message are sent along the line one after the other. However, a special "start bit" is tacked onto the front of the code bits for each character, to serve as a warning to the receiving end that the character code is following. This lets the receiving end adjust its timing and "strobe" the code bits in accurately, to avoid errors.

At the end of each character's group of code bits there is also one or more "stop bits", designed to allow the receiving end time to "digest" the received character, and ready itself for the arrival of the start bit of the next character. So the basic format used by serial data transmission is as shown in Fig. 1(a).

One of the big advantages of this type of communication is that it uses only a single circuit — making it ideal for communication over relatively long distances. Another advantage is that it is basically "asynchronous": the receiving end doesn't have to be adjusted to exactly the same speed as the transmitting end. This is because the start and stop bits allow it to lock onto each character code as a separate entity. Providing the speed is sufficiently close to allow it to stay locked for the duration of each character code, there will be no errors. This was particularly important in the days of early mechanical teleprinters, which relied upon crude governors for speed regulation.



(a) SERIAL "CURRENT LOOP" TRANSMISSION

(b) RS-232C VOLTAGE LEVEL TRANSMISSION
NOTE BROAD TOLERANCE FOR MARK AND SPACE LEVELS

FIG. 1

The serial communication used by computers is basically much the same as that used by Telex and other telegraphy, except that it employs the 7-bit ASCII code rather than the much older 5-bit Baudot-Murray code. The other main difference is that it uses voltage-level signalling, rather than on-off current switching.

Generally Telex and other telegraphy uses the presence or absence of a current in the line to represent a digital "1" or a "0". When the current is flowing (called the "mark" state) this is usually taken to represent a "1", and when there is no current (called the "space" state) this is taken to represent a "0".

In contrast, computers tend to use different voltage levels to represent the two digital values. And the convention used is generally that defined in 1969 by the American Electronic Industries Association, in their specification RS-232C — hence the term "RS-232C serial port", often used to describe a port designed to conform to this specification.

Without going into too much detail, the RS-232C system uses a negative voltage to represent "1" or mark, and a positive voltage to represent "0" or space. In each case the voltage at the receiving end can be anywhere between 3V and 12V for correct operation — so anything from −3V to −12V is a "1", and anything from +3V to +12V is a "0". this is illustrated in Fig. 1(b).

Needless to say, the information being

(Continued on p137)

PRINTER SURPRISE:

Fan form paper ● 80/40/132 columns ● 9 x 7 dot matrix bi-directional impact printer.

Unbelievable Performance

125 characters/second or 64 lines per minute ● continuous printing ● many functions such as vertical format unit and more.

Unbelievable Quality

Full 96 characters, upper and lower case ● adjustable sprocket feed, 115 to 240mm wide ● 7-bit parallel interface - Centronics type.

Unbelievable Price

Available NOW at a substantial saving on our normal price ● use cash, Bankcard, or Credit Terms (available to approved personal shoppers only).

AT LAST!

a computer every home can afford

NEW LOW PRICE $695* was $750

the brilliant DICK SMITH System 80 computer

*Monitor and expantion unit not included. Cat. X-4005

Outstanding value for money . . . plus programs especially written for Australia!

Australia's fastest selling computer — and small wonder! Compare the System 80 with its competitors: you'll see why!
And now it's even better: with now features to make your computing even better.
Join the thousands of System 80 users now: turn yourself into a computer expert!

Compare the features – then compare the prices!

PARAMETER	SYSTEM-80	TRS-80 (Level II)
1 CPU type	Z-80	Z-80
2 Speed	1.7MHz	1.7MHz
3 S-100 compatible (with expansion unit)	Yes	No
4 Amount of RAM (basic computer)	16K	16K
5 Built-in cassette recorder	Yes	No
6 Built-in video RF modulator (use with any TV)	Yes	No
7 Capacity of BASIC ROM	12K	12K
8 Cassette recorder ports (basic machine)	2	1
9 Motor control for cassette recorders	Yes (2)	Yes (1)
10 Cost of basic unit with 16K RAM including monitor and cassette recorder	$844.50	$1169

*The basic SYSTEM 80 computer costs only $695. As this computer has an output for direct connection to your TV set a video monitor, as a separate entity, is not required, making the possible savings on Tandy prices even greater . . .

UNLEASH THE FULL POTENTIAL OF YOUR COMPUTER . . .

To get the most from your computer, you need to add peripherals. This expansion unit gives you this capability. Made to world standard S-100 system, so you aren't tied to any one supplier for your add-ons.

S-100 EXPANSION $499

Cat. X-4010

LOOK AT DICK'S PRICE FOR A GREEN PHOSPHOR MONITOR!

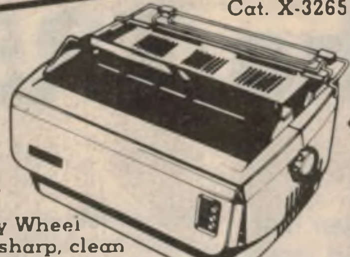
for the professional user — or even the hobbyist who uses his system for long periods, a Green Screen Monitor is a must. Superb definition, with ultra-sharp print that can be looked at for hours longer with less fatigue. Cat. X-1198

NOW WITH IN-BUILT AMPLIFIER FOR PROGRAMS WITH SOUND EFFECTS.

$199

NOW! A WORD PROCESSING QUALITY PRINTER FOR UNDER $2000!

Cat. X-3265



DAISY WHEEL PRINTER

The Dick Smith Daisy Wheel printer delivers ultra sharp, clean copy — it is ideal for those important applications such as word processing. It accepts standard office stationery (letter-heads, etc) — or continuous stationery if required — up to 400mm wide. It can produce proportional printing for that 'professional' look. The Daisy Wheel can use standard Diablo daisywheels and ribbon cartridges — so a wide range of fonts is available. Centronics-type parallel interface — so it is suitable for most of the currently available microcomputers.

For quality and value for money, you can't beat the Dick Smith Daisy Wheel Processor Printer!

only $1995

RUN A PRINTER WITHOUT AN EXPANSION UNIT

The low-cost way to obtain a Centronics-type printer port from your System 80 computer without need for an S-100 Expansion Unit.

Cat. X-4013

$49.50

DISK PRICES TUMBLE!

133mm (5¼in.) minifloppy diskettes. Superb quality.

Hard Sectored (Cat. X-3505)

Soft Sectored (Cat. X-3510)

$4.95 each

TOP VALUE!

TWICE THE STORAGE OF A TANDY DRIVE — AND IT COSTS LESS!

Cat. X-3208

Dick Smith MICROPOLIS™ Disk Drive

The Tandy disk drive with 35 tracks gives 87.5K of storage and costs $699. If you want approx. the same storage as the Micropolis™, you need to spend $1378. The Micropolis™ has 77 tracks with 2.5K per track, a total of 192.5K of storage on one disk drive!

THAT'S TWICE THE STORAGE FOR A LOWER PRICE!

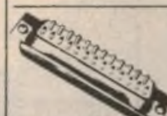
only $649

Look at this incredibly priced printer!

Amazing value! You've seen the price of all the other printers — now look at this one. Unique single hammer system gives unbelievable print quality; takes up to 204mm paper. Ideal for business or hobby computing.

Cat. X-3252

$495



25 PIN D-TYPE CANNON SOCKET

Used in conjunction with P-2690 25 Pin D-Plug and P-2692 Backshell, to suit both the plug and socket. High quality gold contacts.

Cat. P-2691

only $7.95

GREAT NEW SOFTWARE

HIGH QUALITY WORD PROCESSING ON YOUR SYSTEM 80 WITH

WORP-9 PROGRAM

WORP-9 provides a host of features including unlimited text insertion, ability to print mailing labels and merge name and address file with a standard form letter. Complete with easy-to-read User Manual. Requires 32K and at least one disk drive.

Cat. X-3761

$299

I wouldn't be here, if I could have collected sooner

If your're in business, you'll know the importance of monitoring your cash flow. Don't be caught out! This program gives you this information without hours of labour normally associated with such a task. Features include: Five types of transactions, invoices, credit notes, cash receipts, journal debits and credits, General invoices and statements; Automatic end-of-month reset plus many other outstanding features.

Cat. X-3756

ACCOUNTS RECEIVABLE FOR SYSTEM 80/TRS-80.

Introduction to Computer Applications

The best guide to BASIC programming we've seen. 400 pages crammed with information.

Cat. B-2368

only $18.95

SORCERER SOFTWARE

WANT ANIMATED GRAPHICS?

This system creates and displays graphics and effecting animation with BASIC programs. Includes: three demonstration programs, separate character maker program and 28 pages of documentation. Cassette.

Cat. X-3666

$29.95

SAVE PROGRAMMING TIME WITH 'DEBUG'

Machine language debug package, designed to trouble-shoot language programs.

Cat. X-3624

$17.95

Z-80 DISASSEMBLER

Translates back into assembly language. A BASIC program, can be used to examine ROM PAC BASIC interpreter. Cassette.

Cat. X-3622

$17.95

Got a computer problem?

We're only a phone call away. Our Hotline provides a level of service and advice without equal in Australia's small computer industry.

Remember, we're here to help you.

DICK SMITH COMPUTER HOTLINE (02) 888-2002

DICK SMITH Electronics

®

NSW AUBURN 648 0558 ● BLAKEHURST 546 7744 ● BROADWAY 211 3777 ● BROOKVALE 93 0441 ● CHULLORA 642 8922 ● GORE HILL 439 5311 ● NORTH RYDE 888 3200 ● PARRAMATTA 683 1133 ● SYDNEY 290 3377 ● TIGHES HILL 61 1896 ● WOLLONGONG 28 3800 **ACT** FYSHWICK 80 4944 **QLD** BURNADA 391 6233 ● CHERMSIDE 59 6255 **SA** ADELAIDE 212 1962 **VIC** MELBOURNE 67 9834 ● RICHMOND 428 1614 ● SPRINGVALE 547 0522 **WA** CANNINGTON 451 8666 ● PERTH 328 6944

Mail Order Centre: PO Box 321, North Ryde 2113. Phone: (02) 888 3200 DSE/A023/LM

A "Centronics" Printer Interface for the TRS-80

After using your computer for a while, you will probably discover that a printer is essential for conventient listing of programs and files. While printers are becoming cheaper they are still costly and if you have a Tandy TRS-80 you also need a printer interface which is an additional outlay. With that in mind, we have produced this easy-to-build Centronics printer interface to suit the Tandy TRS-80.

by RON DE JONG

Printouts or "hardcopy" are essential for listing long programs and generating program outputs such as accounts, tables of results etc. But most personal computers do not include a printer interface and so a suitable interface has to be purchased either separately or as part of an expansion unit.

Two basic types of printer interface are available, either RS-232C or Centronics. The RS-232C is the more complex of the two and involves transmitting characters in a serial bit stream using suitable circuitry at both ends to perform the parallel-to-serial and then serial-to-parallel conversion. The Centronics parallel interface avoids this complexity by transmitting entirely in parallel.

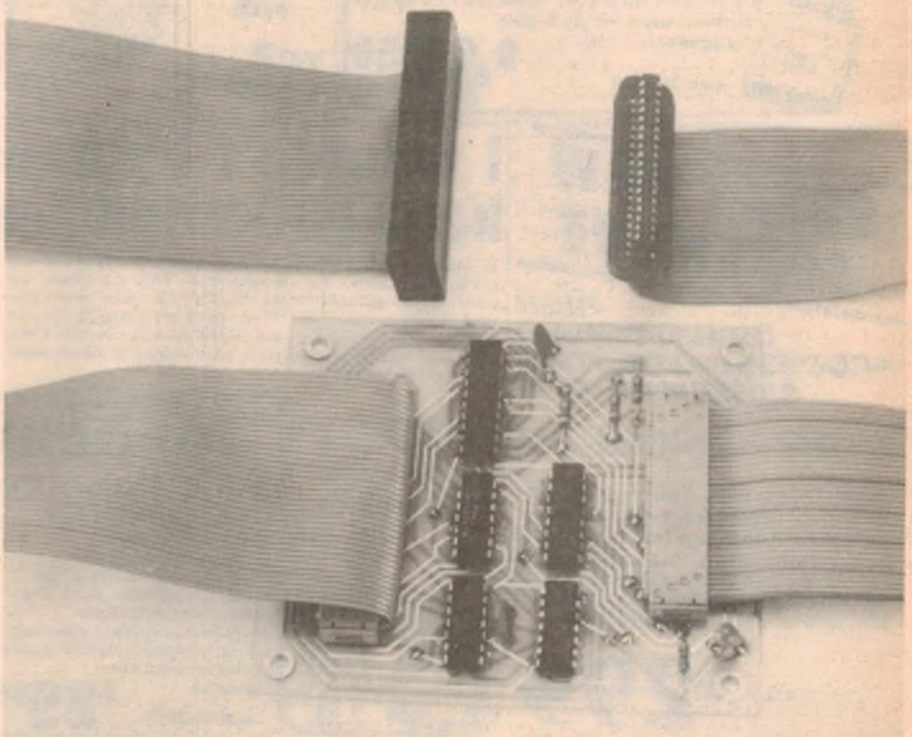
The simplicity of the Centronics interface plus its higher speed is one reason why almost all printers nowadays feature a Centronics interface as standard and an RS-232C as an optional extra. For this reason we opted to do a Centronics interface and to keep the circuit complexity and board size to a minimum we have restricted it to TRS-80 computers only. The circuit could be adapted to other computers though we leave these modifications to the reader.

It is quite a simple matter to use the printer interface on the TRS-80 as line printer commands such as LPRINT and LLIST are standard commands and perform exactly the same function as the PRINT and LIST commands except that they output to the printer instead of the screen. The interface unit itself simply plugs into the expansion port on the back of the TRS-80 and into the Centronics socket on the back of the printer.

Looking at the circuit diagram now, it can be seen that just five ICs are used. The circuit is very simple and consists essentially of an address decoder comprising of IC1, IC2 and IC3 plus an octal latch, IC5. When the computer sends a character to the printer it actually writes the character in to memory, location 37E8. This exact address is decoded by the printer interface which latches the data on the bus into IC5. The outputs of the octal latch then go to the printer.

In more detail, the bit pattern corresponding to the address 37E8 is decoded by IC1 and IC2. Those address bits which must be high go to the three input AND gates IC1a,b,c and those address bits which must be low go to the 3-input NOR gates IC2a,b,c. Assuming that the correct bit pattern or address is present the outputs of the AND gates and the NOR gates will be high. These outputs go to 8-input NAND gate IC3 whose output will therefore go low when the correct address is present.

The low pulse from IC3 is ORed (ie fed through an OR-gate) with the RD and WR signals from the TRS-80 by IC4e and IC4f, both Tri-state buffers. The RD and WR signals are the RD-bar (complement of RD) and WR-bar signals from the Z-80 CPU ORed with the MREQ so the RD signal will go low when the CPU is performing a memory-read operation and the WR signal will go low when it is performing a memory-write operation. By ORing these with the "correct address" pulse from IC3, the output of IC4f gives a low pulse when the CPU reads from location 37E8 and IC4e generates a low pulse when the CPU writes to 37E8.



This photo shows the interface board together with the 40-way card edge connector to the TRS-80 and 34-way connector to the printer.

We have used Tri-state buffers instead of OR-gates in this circuit because these two buffers are actually "spare" gates left over from IC4 which is a hex Tri-state buffer. Four of the buffers have their Tri-state control lines connected together while the remaining two, which we have used here, have their Tri-state control lines connected together and brought out to IC3. When IC3 is high the buffers are Tri-stated, ie the outputs are effectively disconnected and hence they will be pulled high by the 4.7kΩ resistors. With the Tri-state control lines low, the outputs are enabled so the inputs must be low for the output to go low – ie, effectively an OR-gate function.

When a "write" to location 37E8 is performed therefore, the output of IC4e will go low briefly for the period of the WR-signal of the Z-80 CPU. This pulse is used to clock IC5, a 74LS374 octal Tri-state latch which then latches the data on the data bus on the rising edge of the signal, ie the rising edge of WR. This signal from IC4e is also used as the DATA STROBE signal to the printer and it indicates to the printer that data is available.

Well so far we can write data to the printer, latching it in IC5 and presenting it on the Centronics data lines, DB0 to DB7. Because the printer takes a finite time to actually print the character sent we need to know when it is ready to receive the next character. This is accomplished by reading the printer status from the same location, 37E8. This causes a pulse from IC4f timed to the CPU RD-bar signal and it enables the four Tri-state buffers IC4a,b,c,d which buffer the BUSY, OUTPAPER, FAULT and UNIT SELECT signals from the printer onto the CPU data bus to be read.

The BUSY signal from the printer indicates whether it is ready to receive the next character. OUTPAPER indicates there is no paper left in the printer and UNIT SELECT can indicate whether the printer has been deselected, say, via the front panel switch. Usually the printer driver routine in the TRS-80 computer will ignore data bits D0 to D3 and check that bits D4 to D7 are correct; if not the routine halts printing until it is correct.

Unlike some printer interface circuits we have not included a DATA STROBE pulse-extender or an internal BUSY signal. This internal BUSY signal is ORed with the BUSY signal from the printer and in effect generates an immediate busy signal for a short period to allow the printer to respond with its own BUSY signal. Neither of these features is usually required as most printers are fast enough to cope with a short DATA STROBE and respond with a BUSY signal before the CPU can read the interface status.

Power is derived from the printer which provides +5V line on its Centronics input for add-on RS-232C adapters. Decoupling of the supply is performed by two 0.1μF disc ceramic capacitors and a 10μF tantalum capacitor.

Construction of the interface is simplified by two features of the unit. Firstly all the circuitry is mounted on a double-sided PC board (without plated-through holes) and connections to the printer and TRS-80 are made via mass-terminated connectors.

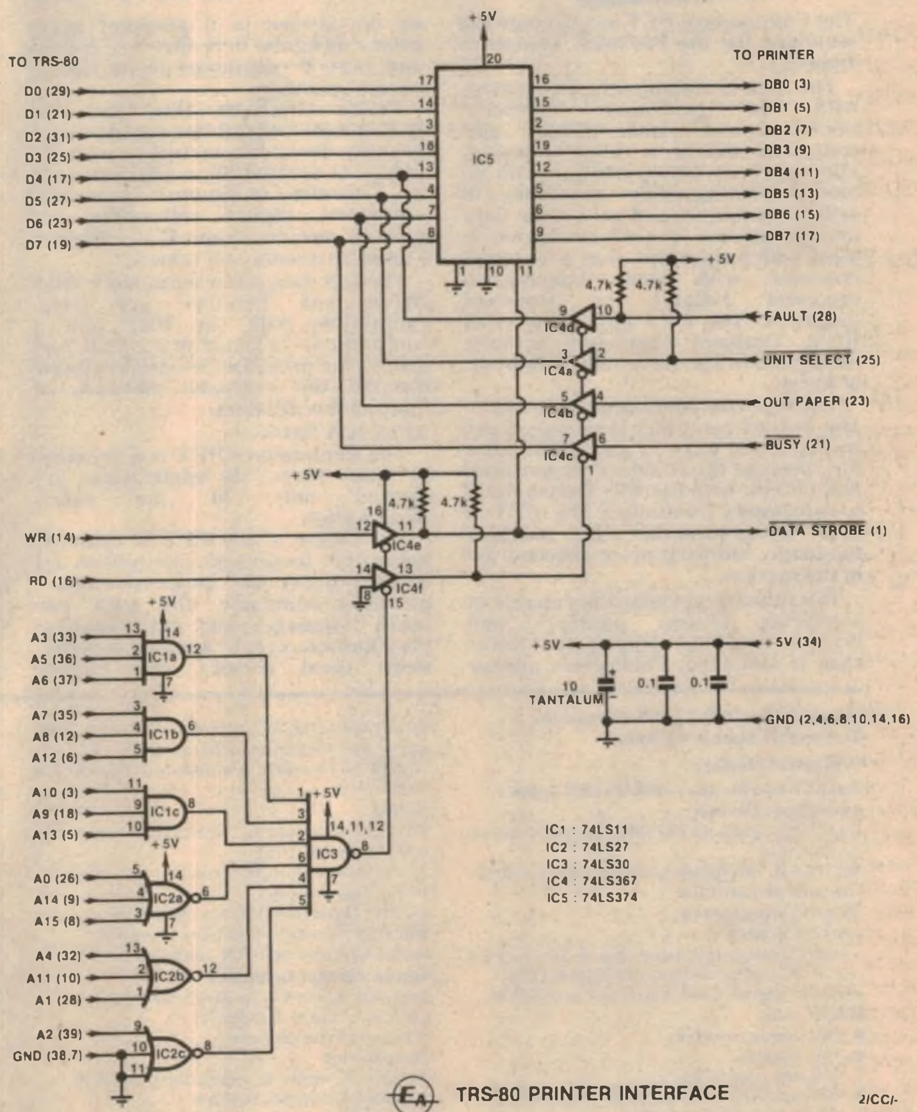
The PC board is coded 81pi9 and measures 85 × 100mm. We opted for a double-sided board because of the large amount of point to point wiring involved in this circuit, particularly because of the mass-terminated connectors.

As mentioned, the board is not "plated through", ie there is no metallisation in the holes connecting one side of the board to the other. This economy measure means that the interface board must be "pinned through" which means that component leads or IC pins act as the through-board connections. Where other pin-throughs are required, short lengths of wire are passed through the holes and soldered to each side, then cropped close to the board for a neat appearance.

The first step then in constructing the unit should be to solder the pin-throughs. These are marked on the component overlay diagram as small

PARTS LIST:

1 double-sided PC board, coded 81pi9, 85 × 100mm
1 Centronics (36-way) solder pin plug
1 40-way mass-terminated card edge connector (0.1-inch pitch)
1 40-way mass-terminated solder transition connector
1 34-way mass-terminated solder transition connector
½ metre 40 way flat cable (Blue-Macs)
1½ metres of 34-way flat cable (Blue-Macs)
1 74LS11 triple three-input AND gate
1 74LS27 triple three-input NOR gate
1 74LS30 8-input NAND gate
1 74LS367 hex Tri-state buffer
1 74LS374 octal latch
4 4.7kΩ ¼W resistors
2 0.1μF disc ceramic capacitors
1 10μF 25VW tantalum capacitor



IC1 and IC2 decode memory address 37E8 and data on the data bus lines D0 to D7 is latched into the printer data lines DB0 to DB7.

In the world of personal computers there is just one that is known as the best: the PET

NOW 16K RAM AT 8K PRICE $999

The Commodore PET has become the standard for the Personal Computer Industry.

The Pet is completely integrated, with the processor, memory, keyboard and visual display unit contained within a robust housing, allowing easy transportation with no interconnecting cables necessary. In order to retrieve and save your data and programs, a storage device is used which operates like a cassette recorder, with your information recorded reliably on standard cassettes. The PET has 16k bytes of RAM. Optional equipment permits expansion to 32k. Also, it has 14k bytes of ROM.

The Pet communicates in BASIC— the easiest computer language. Easy to learn and easy to use, BASIC has now become the standard for personal computers, with literally thousands of programmes available. The PET is also programmable in machine language, allowing more efficient use of the system.

The full-size keyboard is capable of producing letters, numbers and graphic symbols. Upper and lower case is standard. Characters appear on the screen in a pleasant green colour designed to reduce eye fatigue and may be displayed in normal or reverse print.

PET's IEEE-488 Bus- just like H.P.'s mini and full size computers — permits direct connection to over 200 pieces of compatible equipment such as counters, timers, spectrum analysers, digital voltmeters and printer plotters from H.P., Philips, Fluke, Textronix and others.

The full range of Commodore Disk Drives and Printers are plug-compatible with the PET and a comprehensive range of cassette and disk based programmes are available through the extensive network of Commodore Dealers.

APPLICATIONS

The Commodore PET is a creature of many faces. Its applications are limited only by the user's imagination.

The future of the PET is virtually unlimited; its present capabilities are already many and impressive. As a personal computer, the PET can teach languages and mathematics; play games; create graphic designs; store meal recipes and change number of portions; maintain budgets, personal records and checkbooks; operate appliances and temperature controls.

As a management tool, it delivers the information the executive needs, in the form he can use, and available to him alone. Trend analyses charts and graphs can be almost instantly available.

The professional may use the PET for maintaining appointment schedules, recording income and expenditures and filing all the specialized information and forms he may need to make his work more efficient — from medical records for a doctor to income tax computations for an accountant.

The engineer, mathematician, physicist, has a tool far superior to the very best programmable calculators yet developed... at a cost that is comparable...and with almost infinitely greater versatility.

And the businessman has a computer that can maintain inventories, keep payroll records, operate accounts payable and receivables, issue cheques and handle correspondence.

Commodore PET 4016 Computer Technical Specifications.

Computer/Memory

Read/Write Memory (RAM) 16K bytes available to the user

Read Only Memory (ROM) 14K bytes in total, divided into:

8K BASIC interpreter available immediately you turn on your PET.

5K Operating System

1K Test Routine

The 6502 micro-processor chip makes the PET one of the fastest and most flexible BASIC systems. Significant features of Commodore BASIC are:

- 960 simple variables
- 960 integers
- 960 string variables
- 960 multi-dimensional array fields for the above 3 types of variables
- Up to 80 characters per program line with several statements per line
- Upper/Lower case characters and graphics capability
- Built in clock
- 9-digit floating point binary arithmetic
- True random number generator
- Supports multiple languages; machine language accessibility

Keyboard

74-Key professional keyboard.

Separate calculator/numeric pad.

Upper-case alphabetical characters with shift key to give 64 graphics characters.

Can be set for lower case and shifted upper case characters.

Screen

40 characters wide by 25 lines (1000 characters in 8 × 8 dot matrix).

23 cm screen phosphor screen.

Brightness control.

64 ASCII plus 64 graphics characters.

Blinking cursor with full cursor control, including programmable control.

Screen editing capabilities

Full cursor control (up, down, left, right)

Character insert and delete.

Reverse character field

Overstriking.

Return key sends the entire line to the CPU regardless of cursor position.

Input/Output

8 bit parallel input/output port.

IEEE-488 Bus (HP-IB and IEC Bus) allows up to 12 other peripherals to be connected.

Two cassette ports.

Video signals for additional displays.

Serial output port.

Technical Data

Dimensions:Height 355 mm (14"). Width 419 mm (16.5"). Depth 185 mm (18.5"). Shipping Weight 20.9 kg (46 lbs).

Power requirements 240V ± 10%. Frequency 50 Hz. Power 100 Watts.

Commodore BASIC

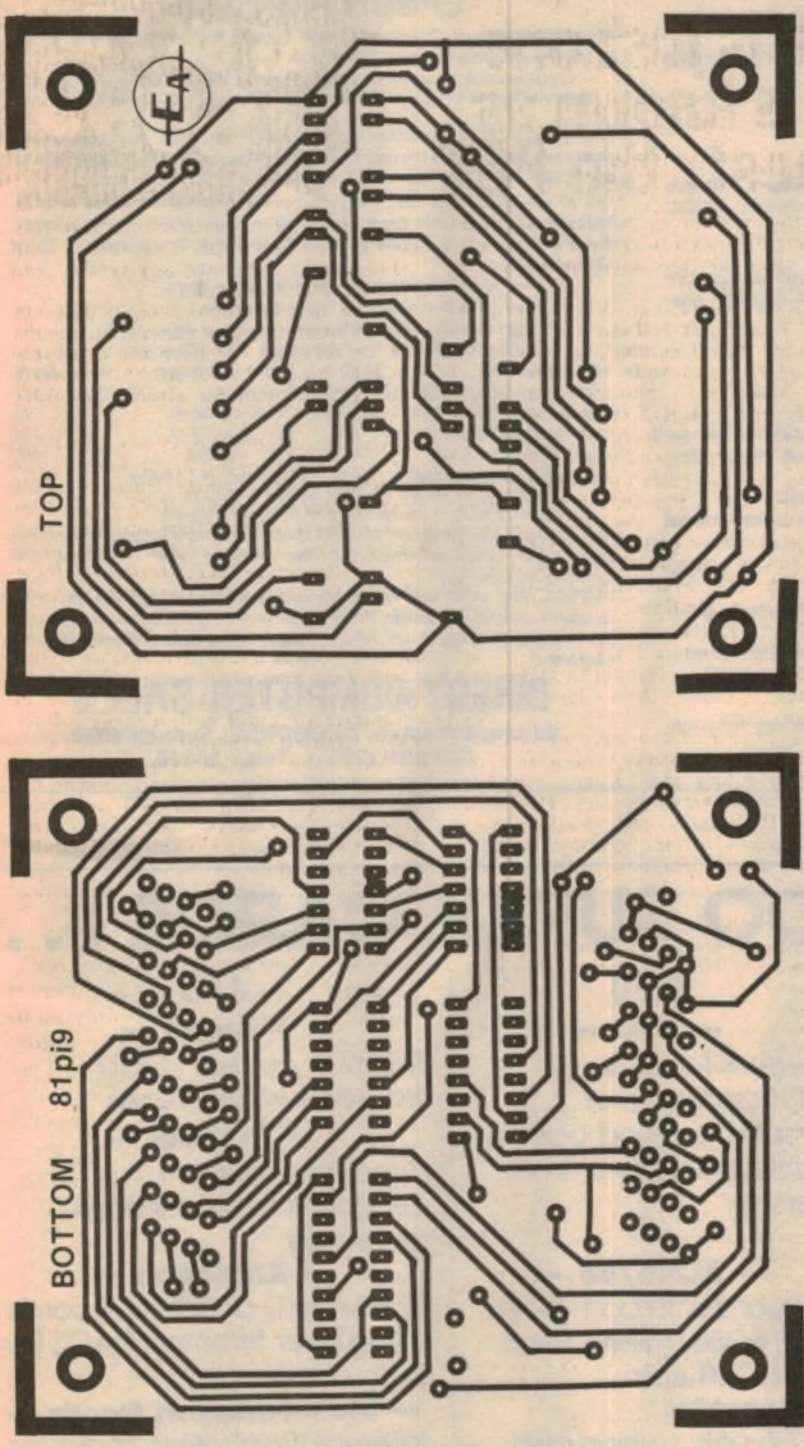
APPEND	GOSUB..RETURN	STOP	SPC
BACKUP	IF..THEN	SYS	LEFT$
CLOSE	INPUT	VERIFY	RIGHT$
CLR	INPUT •	WAIT	MID$
CMD	LET		CHR$
COLLECT	LIST	SGN	ASC
CONCAT	LOAD	INT	LEN
CONT	NEW	ABS	VAL
COPY	ON..GOSUB	SQR	STR$
DATA	OPEN	SIN	TI
	POKE	COS	TI$
DEF/FN	PRWT	TAN	ST
DIM	READ	ATN	DS
DIRECTORY	RECORD	LOG	DS$
DLOAD	REM	EXP	+
DOPEN	RENAME	AND	—
DSAVE	RESTORE	OR	•
END	RUN	NOT	/
FOR/NEXT	SAVE	TAB	↑
GET	SCRATCH	POS	π

commodore microcomputers

For details of your local dealer send to: Commodore Information Centre, Box 336, Artarmon, NSW 2064, Australia. Phone (02) 437 6296

MIvl 469

PRINTER INTERFACE FOR THE TRS-80

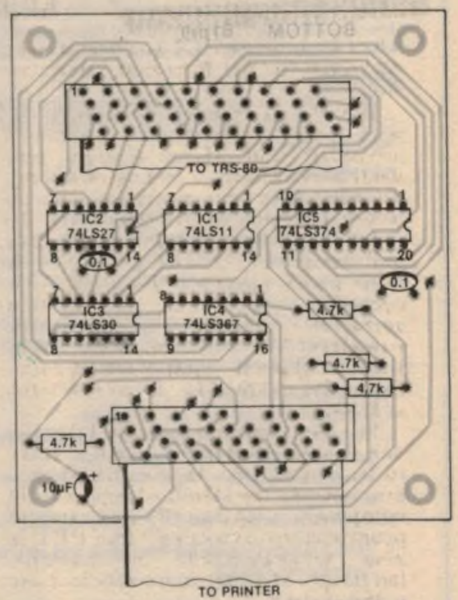


Above are the full-size patterns for the top and bottom of the PC board.

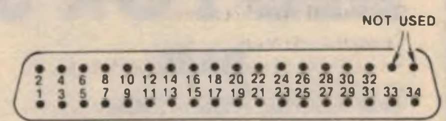
blobs with an oblique stroke. Next solder in the resistors, capacitors and ICs, paying particular attention to the correct orientation of the ICs. Since component leads also act as pin-through connections, if there is a pad on the top of the board the component lead or IC pin must be soldered to it as well as to the corresponding pad on the bottom of the board.

Mass-terminated connections to the printer and TRS-80 really simplify construction. For those unfamiliar with mass-termination it involves using flat cables which are terminated to a connector by placing the cable and connector in a simple press. Specially shaped ends at the back of each connector pin pierce the plastic insulation of the cable and make a reliable connection to the wire. This is certainly a lot easier than soldering a mass of closely-spaced individual wires.

The cable from the TRS-80 to the printer interface consists of a 40-way edge connector mass terminated to a 40-way flat cable which is then mass terminated to a 40-way "solder transition connector" which is soldered directly to the board. To reduce transmission line effects and capacitive loading on the TRS-80 expansion port, this cable should be no longer than about 500mm.



Above is the component overlay for the PC board showing only the bottom PC pattern while below is the wiring order for the 34-way printer connector.



> We estimate that the current cost of parts for this project is about
>
> **$60**
>
> including all the mass terminated connectors and cable.

From the interface to the printer we used a 34-way solder-transition connector on the board mass-terminated to a 34-way cable which is then soldered to a Centronics connector.

An accompanying diagram illustrates the order in which the cable is soldered to the connector.

When specifying the flat cable to be used we would recommend "Blue Macs" rather than rainbow cable as it is a

(Continued on page 137)

Microcomputer News & Products

FORTH — a new language for the Sorcerer

FORTH is a computer language which can best be described as somewhere between machine language and a high level language like Basic. Compared to machine language Forth is much easier to understand and use, but requires more overhead and is slightly slower than machine language. Compared to Basic, Forth programs run faster and can be much shorter.

Forth is built from functions, or "words" which are similar to machine language subroutines. The programmer uses previously defined words to define new words (new functions) until finally he defines one word which includes all the functions required by a particular application. That one word is then the entire program.

Quality Software's version of Forth is based on fig-Forth, a standard version distributed by the Forth Interest Group of California. Quality Software has expanded the fig-Forth model to make it compatible with the special features of the Sorcerer computer. Added enhancements include a screen editor, a serial RS232 driver and tape load and save routines.

Forth normally requires a disk system and runs in 16K of memory. The Quality Software version does not require a disk system, but instead sets up simulated disk space in RAM. Up to 14 "screens" of about 1K bytes each can be held in RAM in a 32K Sorcerer, and 48K systems will allow 30 screens to be stored. Each screen can hold the definitions which make up one program, or a number of screens can be combined to make up larger programs. The simulated disk space can be stored and retrieved from cassette tape.

Forth has several unusual features. Instead of the more familiar algebraic notation used in Basic, Forth uses postfix notation, sometimes called reverse Polish notation or RPN. Arithmetic expressions are entered with the operands first, then the arguments (eg 2 3 +). Postfix notation is more efficient than algebraic notation, particularly when combined with the use of the a stack to pass parameters from one subroutine to another.

The major part of the Forth program is the "dictionary", which consists of a list of "words" and their definitions. New words are defined by the programmer by stringing together the previously defined words and adding them to the dictionary. Groups of words are called "vocabularies", and Forth for the Sorcerer comes with two vocabularies, "Forth" and "Editor". New vocabularies can be created by the user, such as "Graphics" or "Finance" (for example). A graphics vocabulary would be a series of Forth words which perform graphics functions on the Sorcerer. Once defined it could be loaded in and used by any other Forth program.

It is this feature of Forth which makes it so fascinating to use. The language is almost infinitely extendable, and in fact new languages can be written using Forth definitions. Features which are lacking in the original implementation (Forth is an integer language only) can be added by the programmer as required.

Forth is also a strongly structured language. Because each definition can only use words that have been previously defined, programming in Forth requires careful planning and "top down" organisation. Control structures such as "DO . . . . WHILE" and "DO . . . . UNTIL" are supported, but there is no GOTO statement. Data types however are not extensive — only 16 bit integer constants and variables are supported, by the standard vocabularies, although certain Forth words allow the creation of other data types.

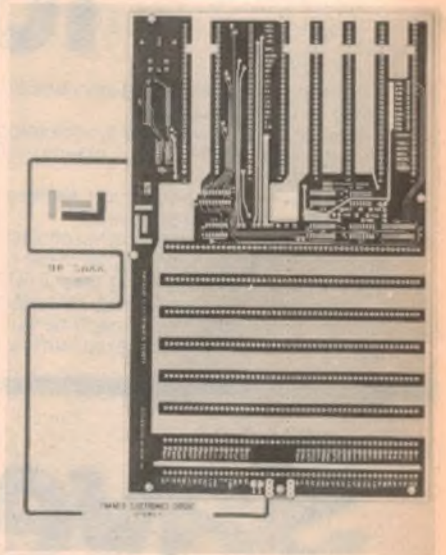
The Quality Software version of Forth comes with 316 words already defined, but these really serve only as the kernel of the user's own language. A comprehensive 126-page manual is included in the purchase price, explaining the structure of Forth and Quality Software's extensions of the language.

Forth for the Sorcerer costs $49.95, and our copy came from CQ Electronics, 95 Regent St, Sydney, 2000.

SS-50 motherboard from Paradio Electronics

Paradio Electronics of Sydney now has available the MB-68XX Mother Board, a universal motherboard for SWTPC and similar SS-50 based systems. The board provides eight slots for full sized SS-50 boards and eight I/0 sized (SS-30) slots for peripheral equipment.

Features of the new board include I/0 addressing which is switch selectable to suit 6800 or 6809 microprocessors, provision for a baud rate generator on the board, space for buffers on all data, address and control lines, and size and mounting compatibility with existing SWTF SWTCP 6800/09 motherboards. The board itself is of heavy duty 2.5mm expoxy board, plated through and solder masked on both sides.



DIP switches on the board control the addresses at which the Input/Output block appears in the memory map, and a configuration guide for SWTPC 6800 and 6809 users is printed beside the switch block. Another DIP switch determines whether each I/O slot appears as four addresses (for 6800 systems) or 16 addresses (for 6809 systems).
systems).

Assembly of the board is simply a matter of installing all the components in the positions marked on the artwork diagram. Tantalum capacitors are used for power line filtering, and a +5V regulator supplies the on-board circuitry. All in all there are nine ICs, nine capacitors and 59 resistors to be installed, in addition to the edge connectors.

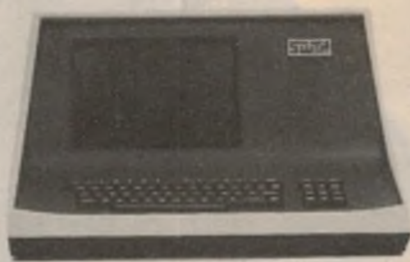
The board comes with a manual and circuit diagram describing assembly and operation. Paradio are offering the board on an "as is" basis, with the provision that the purchaser may return the board for an immediate refund if it is found unsuitable for his purposes. The return privilege is valid for 14 days after the invoicing date.

Micronews continued p 134 ►

DISCOVER THE WORLD OF
6809

SWTPC SYSTEM

6809 COMPUTER

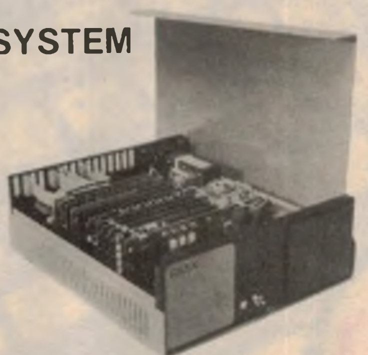


8212 TERMINAL
(ASS. IN AUSTRALIA)

DMF DISCK
SYSTEM 2.5M

D-5 720k
DT-5 1.3M

GIMIX INC. SYSTEM



2MHZ 6809
PLUS 56K SYSTEM

IDEAL FOR SOFTWARE DEVELOPMENT

NEW SOFTWARE

MICROWARE SYSTEMS CORPORATION

OS9 LEVEL I OPERATING SYSTEM
OS9 LEVEL II OPERATING SYSTEM
BASIC 09
STYLOGRAPH WORD PROCESSOR
OS9 MACRO TEXT EDITOR
OS9 INTERACTIVE ASSEMBLER
OS9 INTERACTIVE DEBUGGER

TALBOT MICROSYSTEMS

t FORTH
t FORTH +
FIRMFORTH

UNIVERSAL DATA RESEARCH INC.

DATA BASE MANAGER FOR FLEX
FOR UNIFLEX
PAYROLL, GENERAL LEDGER, MANUFACTURERS INVENTORY, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE.

WASHINGTON COMPUTER SERVICES

RECORD MANAGEMENT SYSTEM
DATA BASE MANAGEMENT

TSC NEW SOFTWARE

PASCAL FOR FLEX OR UNIFLEX AND MANY OTHERS.

PARIS RADIO ELECTRONICS

7a BURTON STREET, DARLINGHURST, NSW 2010
PO BOX 380 DARLINGHURST, NSW, 2010. PHONE (02) 357 5111. TELEX A22579

Reach advanced computer comprehension in a few short hours with the new, mighty

sinclair ZX81

1980 saw a genuine breakthrough — the Sinclair ZX80, world's first complete personal computer for $300, the ZX80 offered a specification unchallenged at the price.

Over 50,000 were sold, and the ZX80 won virtually universal praise from computer professionals.

Now the Sinclair lead is increased: for just $250, the new Sinclair ZX81 means an even bigger saving. At $250 it costs less than the ZX80.

Lower price; High capability

With the ZX81, it's just as simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same microprocessor, but incorporates a new, more powerful 8K BASIC ROM — the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements — the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

Higher specification, lower price — how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

The ZX81 comes complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

New, improved specification

- Z80 a microprocessor — new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function — useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer (not available yet — but coming soon)!
- Advanced 4-chip design, microprocessor, ROM, RAM, plus master chip — unique, custom-built chip replacing 18 ZX80 chips.

If you own a Sinclair ZX80 . . .

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 — including the ability to drive the Sinclair ZX Printer.

16K-byte RAM pack for massive add-on memory

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

Coming soon — the ZX Printer

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics across 32 columns, and highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981.

For your free catalogue on software, send stamped, self-addressed envelope to Sinclair Equipment (Australasia) P/L.

Microcomputer News & Products

With the steadily increasing number of boards available for the SS-50 bus a readily available standard motherboard will be welcomed by both hobbyists and commercial users. The high quality and low cost of the Paradio product make it an especially attractive offering.

The MB 68XX Mother Board is available from Paradio Electronics, 7a Burton St, Darlinghurst, NSW, 2010 and J. H. McGrath, 208 Little Lonsdale St, Melbourne, 3000. The price is $47.50 plus tax.

Computer programs on shortwave radio

On Thursday, September 10 the Media Network program of Radio Netherlands will conduct a unique experiment. A short computer program will be broadcast over the air in three machine-readable formats. Organisers of the experiment hope that listeners will be able to record the computer program off the air onto cassette tape and play it back into their computer. Three cassette formats will be broadcast: for the Apple II, Commodore PET and TRS-80 computers.

According to the producer of the Media Network program, Jonathan Marks, preliminary experiments indicate that the system should work, but the purpose of the September 10 trial is to determine whether atmospheric noise is low enough to allow consistent results. If successful the idea might be repeated on a more regular basis.

In conjunction with the broadcast of the computer program the Media Network transmission for September 10 will cover the subject of home computers and their uses in shortwave listening.

The Media Network program will be broadcast to Australia and the Pacific region at 0747UTC on 9770kHz and 9715kHz and again at 0847UTC on 9715kHz. Readers who hear the broadcast and try out the computer program are asked to write in and report their results to "Computer Experiment", Media Network, Radio Netherlands, PO Box 222, 1200 JG Hilversum, Holland.

National has bubble memories in quantity

National Semiconductor Corporation recently began shipping 1 megabit bubble memories in prototype quantities and expects to begin volume production later this year. National has been making volume shipments of 256 kilobit magnetic bubble memories since November last year, and recently announced a five chip bubble memory support circuit said to be the smallest and most dense memory system currently available.

National and Motorola, which second sources National designs, are the only suppliers of magnetic bubble memory circuits and controllers, able to offer a compatible family of 256 kilobit and one megabit components, kits, boards and subsystems. A 1 megabit system is contained on a 7.5cm square board, and a full one megabyte system will be available on a 28cm square standard Multibus board.

Link to overseas databases with "The Source"

"The Source" is a major computer network based in Virginia, USA, which can be accessed by most microcomputers. It offers an efficient electronic mail service, hundreds of database services and access to Unistox, a service which provides up to date stock and commodity prices from the world's major stock markets.

Seahorse Computers, of Camden, NSW, are offering to connect new subscribers to the system within 24 hours. They have the application forms and operating manuals for The Source and application forms to enable users to link up with Midas, OTC's data link service with the United States. The company can also supply the programs to

Microcomputer News & Products

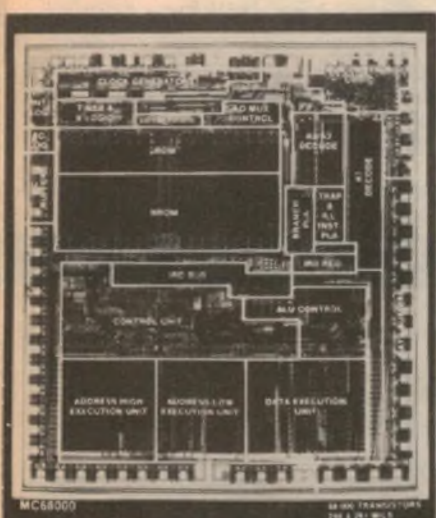
turn your microcomputer into a terminal for communicating with The Source and modems to link your system to OTC (Overseas Telecommunications Commission).

Once you have set up a data link system you have access to a wide range of computer services from your home or office. The Source alone makes available electronic mail services, worldwide share prices, the New York Times News service and the database of United Press International. Other facilities available include processor time and data storage on large mainframe computers as well as a range of programs and games which can be "called up" from a home terminal.

Application forms for membership of The Source, demonstrations of the system and programs to turn your microcomputer into a terminal are available from Seahorse Computers, 10 Mitchell St, Camden, NSW, 2570.

Agreement will expand M68000 production

The Semiconductor Group of Motorola Inc and a team of N.V. Philips and Signetics have jointly announced an agreement for a five-year development plan for Motorola's M68000 microprocessor family. The goal of the plan is an expanded family of integrated circuits, software products and allied development tools.



Philips/Signetics will produce pin-for-pin compatible M68000 family products as well as develop new products which may be manufactured by both participants in the agreement.

Colour graphics software from Cromenco

Informative Systems Pty Ltd has announced the release of a new high resolution colour graphics package from Cromenco. The system, called "Slidemaster", enables users of Cromenco microcomputers to generate images interactively, using Cromenco graphics equipment which can display colour or black and white images with up to 756 x 482 point resolution.

Dr Simon Rosenbaum, Managing Director of Informative Systems, says "The system lends itself to the easy preparation of graphics for visual communication in education, business sales, process control and advertising. It also has a wide range of professional applications such as medical imaging, circuit design, architectural drawings, etc."

The user need not have any prior knowledge of computer programming languages, as the system is designed around a menu of commands selected by use of a pen and a digitising tablet. Graphics and text can be erased, changed, moved, enlarged or manipulated in response to 75 different commands, with the picture being created appearing progressively on a colour video monitor. Images may also be stored and retrieved from disk at a touch of the pen.

Over a period of time the user can build up a library of images and be able to prepare charts, grapho and illustrations simply by retrieving images from the disk file and making changes as required.

Further information is available from Informative Systems Pty Ltd, 337 Moray St, South Melbourne, Vic, 3205.

Micronews continued P137 ►

SPECIALS!!

☆TEXAS Ti59 and PC100C PACKAGE DEAL

ONLY $440 excl. tax
$495 incl. tax

Ti58C

$135 excl. tax
$152 incl. tax

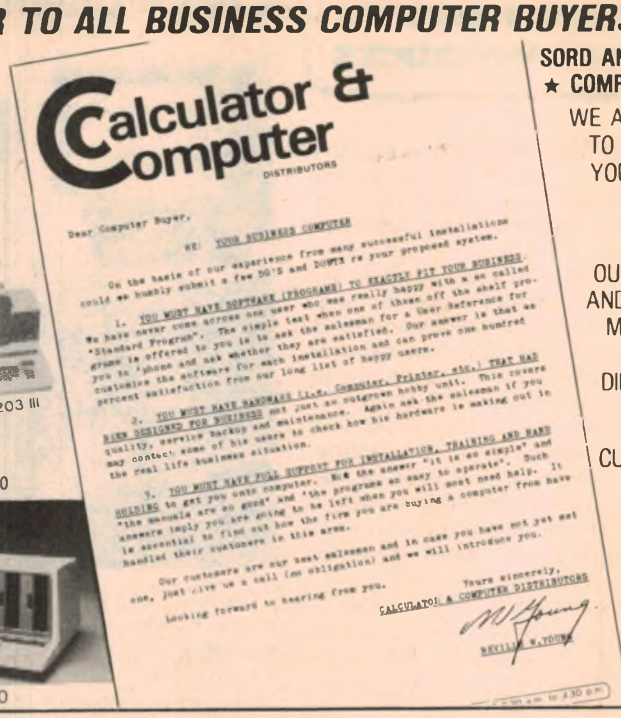
ALL POST FREE ☆

A LETTER TO ALL BUSINESS COMPUTER BUYERS

SORD
MODELS
M 100 ACE
M 203 III
M 223 III
M 223 VI

DIABLO MODELS
3000, 3100 & 3200

DIABLO 3000



Calculator & Computer DISTRIBUTORS

Dear Computer Buyer,

RE: YOUR BUSINESS COMPUTER

On the basis of our experience from many successful installations could we humbly submit a few DO'S and DONTS re your proposed system.

1. YOU MUST HAVE SOFTWARE (PROGRAMS) TO EXACTLY FIT YOUR BUSINESS. We have never come across one user who was really happy with a so called "Standard Program". The simple test when one of these off the shelf programs is offered to you is to ask the salesman for a User Reference for you to 'phone and ask whether they are satisfied. Our answer is that we customise the software for each installation and can prove one hundred percent satisfaction from our long list of happy users.

2. YOU MUST HAVE HARDWARE (i.e. Computer, Printer, etc.) THAT HAS BEEN DESIGNED FOR BUSINESS not just an outgrown hobby unit. This covers quality, service backup and maintenance. Again ask the salesman if you may contact some of his users to check how his hardware is making out in the real life business situation.

3. YOU MUST HAVE FULL SUPPORT FOR INSTALLATION, TRAINING AND HAND HOLDING to get you onto computer. Not the answer "it is so simple" and "the manuals are so good" and "the programs so easy to operate". Such answers imply you are going to be left when you will most need help. It is essential to find out how the firm you are buying a computer from have handled their customers in this area.

Our customers are our best salesmen and in case you have not yet met one, just give us a call (no obligation) and we will introduce you.

Looking forward to hearing from you.

Yours sincerely,
CALCULATOR & COMPUTER DISTRIBUTORS

NEVILLE W. YOUNG

8.30 am to 3.30 pm

SORD AND DIABLO ★ COMPUTERS ★

WE ARE PROUD TO SELL AND YOU WILL BE PROUD TO OWN.

OUR SERVICE AND SUPPORT MAKES ALL THE DIFFERENCE, JUST ASK OUR CUSTOMERS.

Calculator & Computer DISTRIBUTORS

3 Rowley Street,
Seven Hills, N.S.W. 2147
OPEN THURSDAY NIGHTS TILL 8PM

PHONE 8.30am to 3.30pm
(02) 624 8849
624 8400

THE VIC IS HERE!

The new COMMODORE VIC 20 connects to any television set or monitor, provides 5K bytes of memory and has the following features:

DISPLAY: 22 characters by 23 lines. 64 ASCII characters and PET graphics.
COLOUR: 8 character colours, 8 border colours, 16 screen colours.
SOUND: 4 internal amplifiers including 3 tone (music) generators and 1 sound (white noise and sound effects generator). Each amplifier has 3 octaves. The sound is available with the television or separate speaker.
MEMORY: 5K RAM — expandable to 32K RAM.
KEYBOARD: Full typewriter keyboard with special screen editing and function keys.
GRAPHICS: Full PET keystroke graphics.
LANGUAGE: PET BASIC.
FUNCTION KEYS: 4 programmable function keys (8 separate functions).
EXPANSION PORT: For 3K direct plug-in memory expansion and for program cartridges. To expand memory further a separate "motherboard" with slots for memory expansion and programmed cartridges will be available.
ACCESSORIES: Will include a Single Disk Drive, Printer, Tape Cassette, Joysticks, Paddles and Lightpen.
PROGRAMS: Will be available on cassette and "VIC ROM Packs".

The VIC 20 and cassette will be released in Australia September/October, 1981 with other VIC accessories and peripherals being phased in when available. PLACE YOUR ORDER NOW TO SECURE YOUR VIC — THE PRICE APPROX $400.00 — CAN YOU BEAT THAT!

MICROCOMP FOR BOOKS

Osborne McGraw-Hill Publications:

PET/CBM Personal Computer Guide	19.00
APPLE II User Guide	19.00
PET & The IEEE-488 Bus (GPIB)	18.00
Some Common Basic Programs PET/CBM	17.00
6502 Assembly Language Programming	19.00
Z80 Assembly Language Programming	19.00
Z8000 Assembly Language Programming	24.00
6800 Assembly Language Programming	18.00

AND MANY MORE!!! Call for full lists.

Sybex Publications:

Microprocessor Lexicon	6.00
6502 Games	18.00
6502 Applications Book	18.00
Programming the 6502	18.00
The CP/M Handbook (with MP/M)	20.00
Programming the Z80	20.00
Programming the Z8000	21.00
The PASCAL Handbook	20.00

PRINTOUT Magazine — Yearly Subscrip $45.00

bankcard welcome here

MICROCOMP
MICROCOMPUTER SYSTEMS DESIGNERS

B.S. MICROCOMP
4th Floor,
561 Bourke Street,
MELBOURNE, 3000.
Tel: 614-1433/614-1551.

Microcomputer News & Products

PROM programmer

Applied Measurement (Australia) Pty Ltd now has available the Kontron MPP-80s programmer for Programmable Read Only Memories. The programmer is packaged in an attache style case and includes a UV lamp for erasure of EPROMs and space for "personality modules" which make it suitable for checking and re-programming equipment in the field.

The MPP-80s handles EPROMs, bipolar and fusible link PROMs from all major manufacturers, and is manufacturer approved for all popular types.

An RS232 interface, automatic memory self-checking and 32K bytes of internal memory are standard.

Additional information is available from Applied Measurement (Australia) Pty Ltd, PO Box 207, Glen Iris, Vic, 3146.

News from the Clubs

● The Australian ZX80 Users Association (AZUA) has sent us a copy of their introductory newsletter, 13 pages packed full of programs and tips for users of the Sinclair ZX80. Membership of the Association and a subscription to the newsletter costs $10 for 12 months, and the postal address is 19 Godfrey St, Campbell, ACT, 2601.

● An Australian Users' Group is being formed for owners of the MicroAce kit computer. The Group will enable users of the MicroAce to pool their experience, software and resources. Those interested in joining the group should contact Paul Willmott, at 672 Alice St, Lakemba, 2195.

Micro User News is a newsletter produced by Adelaide club members who have a particular interest in TRS-80 and System-80 equipment. An annual subscription to the newsletter costs $5 and the postal address is 36 Sturt St, Adelaide, 5000.

Column 80 . . . from p120

sent in this way can be sent at various speeds. The speed of serial transmission is traditionally measured in "baud", where a baud is roughly the equivalent of one bit per second. And there are a number of accepted "standard" speeds or rates for RS-232C serial communication: 110, 300, 600, 1200, 2400, 4800, 9600 baud and a number of even faster speeds if required.

In many cases, RS-232C serial communication is as simple as this – a flow of coded characters either one way or the other along a single circuit at a designated speed. However there are situations where it is necessary to use some additional "handshaking", along the lines we discussed last month in relation to parallel ports.

For example when a computer's RS-232C serial port is used to interface it to a printer, a "handshaking" line must generally be used so that when the printer's internal buffer is full, the printer can request the computer to stop sending until it has "digested" that buffer-full of text by printing it out. Otherwise, the computer may have to be slowed down until it is only sending the characters at a speed where the printer can always keep up – not a very efficient alternative.

Another situation where handshaking is often required is where the computer's RS-232C port is used to connect it up to a modem unit, for communication over the telephone network. Here the handshaking must generally be used so that the modem can let the computer know when a link has been established with the modem at the other end, so that communication can proceed.

The full RS-232C standard specifies a number of different handshaking signals, which can be used for different purposes. You needn't worry too much about these, except when you are trying to hook up two pieces of RS-232C equipment. Then it will pay you to read the manufacturer's manuals carefully, and make sure that you connect up all of the signal lines they have provided – otherwise they may stubbornly refuse to "talk" to each other!

Hopefully that gives you a basic understanding of serial communication and RS-232C ports. Next month, all going well, we might be able to discuss an allied subject – modems and telephone communication.

Printer interface . . . from p127

uniform blue-grey colour with the first wire coloured dark blue and every fifth wire coloured to enable quick identification of the wire number. Flat cable and mass termination connectors is available from Radio Despatch Service, 869 George St, Sydney 2000, phone (02) 211 0816 or 211 0191. RDS will also perform the mass termination if required, for around 50 cents per connector.

When placing the solder transition connectors on the board make sure that pin 1 on the printer Centronics plug and the card edge connector match with pin 1 on the relevent solder transition connector (see overlay diagram). With the cables finally connected the board is complete and ready to be tested but first make another quick check of the board. Poor solder joints, hairline cracks in the board and solder bridges between tracks are potential problems.

The board can be housed in a suitable plastic case such as a zippy box or for an attractive appearance use a PAC-TEC case. We opted for the cheap approach and simply placed rubber feet on the bottom of the board.

Now connect the printer interface to the printer and computer, then in BASIC enter a simple program and list it out using the LIST command. Then use the LLIST command to obtain a printout of the program on the printer. With some printers the last line of the listing may not come out because the printer has an internal buffer which stores an entire line and only begins printing it when it receives the next line. This can be readily solved by just typing LPRINT which sends one carriage return to the printer, forcing it to dump the last line.

INFORMATION CENTRE

CAPACITOR DISCHARGE IGNITION: I have recently assembled, tested and installed a CDI which was featured in Projects & Circuits – a book published by your magazine. I have experienced none of the dreaded crossfire problems with my car (V8 Holden Kingswood) – but I am keeping my eyes on the spacing of the HT wiring.

I am experiencing considerable difficulty with cold starts however – so much so that I have had to disconnect the CDI. I can reconnect the unit once the engine is warm – everything is then OK.

However, if I try to start the cold engine, the CDI seems to stop singing – due to low voltage presumably? – and it restarts a short time after I release the starter (of its own free will).

My workshop manual states that there is a 1.8Ω ballast resistor built into my ignition wire. Could this be the cause of the voltage drop? I replaced an ageing battery but this produced no improvement.

Have you had any other similar complaints/worries? Do you agree with my explanation for the symptoms? If so, how can I solve the problem?

I look forward to your reply. (R. J. Flynn, ACT.)

● Most vehicles have a ballast resistor built in to the ignition switch wiring, and our CDI circuit (published in July, 1975) was designed to take its supply via this ballast resistor, so this should not be the source of the difficulty. You could try changing the value of resistor R5 in the circuit (made up of 3 × 180Ω1W resistors). A fourth 180Ω resistor connected in parallel with the existing three may cure the problem.

FLUORESCENT METERS: Is it feasible to replace VU meters with fluorescent meters on present equipment?

Would a fluorescent add-on meter with peak hold, and number of times peak has exceeded a selected threshold be possible as a project in the near future? (R.J.B., Burrendah, WA.)

● Yes, it is feasible to replace VU meters with fluorescent meters, provided of course that you can obtain the fluorescent display. We understand that there are also ICs available which are specially designed for driving the display. The readily available LM3915 from National Semiconductor can also be made to drive such a display. We shall consider this idea for future publication.

COLOURFUL ELECTRONICS: Why is it that all integrated chips are black? Why aren't they different colours, say red for voltage regulators, blue for TTL and yellow for CMOS, etc? This would improve them a lot as quite often the writing on them is hard to see. Specially for someone as blind as me. (P.M., Burnie, Tas.)

● Yeah. Why are all the little beggars black? Yours is certainly a good question and one that caused quite a deal of speculation at the EA office. A few years back General Electric had a range of power transistors with colours such as red and blue but apart from blue Triacs the scene is largely devoid of colour.

It is possible that most epoxy resins used for IC encapsulation are loaded with carbon black to give strength to the package, to aid heat dissipation, to make the package and the device insensitive to light, and to reduce the chemical breakdown effects of UV light.

But this is speculation on our part. We really do not know. Perhaps no company has really considered it. After all, around 15 years ago you could have any colour for your telephone as long as it was black.

WIEN BRIDGE OSCILLATOR: I recently constructed a Dick Smith Kit (K-3469), a Wien Bridge oscillator. The instructions state it is an "Electronics Australia" project, but the project number is not given.

Upon testing it, I encountered a couple of problems:

(a) the square mark-space ratio changes with variation of frequency.

(b) there is overshoot present on the leading edge of the output square wave – approximately 15% of the total amplitude.

Any suggestion as to the cause and possible remedies to the above faults would be greatly appreciated. (P.I.T, Roseville, NSW.)

● The Wien Bridge oscillator was published in our June, 1981, issue. Concerning the problems you have encountered, the variation in the mark space ratio might be caused by an overall DC shift in the output of the oscillator, perhaps due to the input bias current of Q1 and Q3 and the 10kΩ pot at the input. Since the resistance of the pot changes as the frequency is adjusted this will cause a DC shift at the input, of worst case 20mV, resulting in a shift in the DC output level of about 60mV.

This shift is too small to really effect the squaring circuit of Q10 and Q11. All of this assumes that the specified input transistors were used but if devices with a much lower Hfe are used then it could be a potential problem.

Another possible reason for the variation could be excessive wiring capacitance on the collector of Q11 which would have the effect of increasing the risetime of the Q11 output thus reducing the mark period. Check that you have kept the wiring to switch S2a to a minimum and that there is no coupling to the wiring connected to S2b.

Regarding the overshoot present on the leading edge of the square wave, this may be just an artefact of your CRO and its input probes or perhaps due to some inductive load in the output of Q12. Note that low inductance resistors are preferred for the 330Ω and 82Ω resistors on the output – carbon composition types being ideal.

PROSPECTOR METAL LOCATOR: In reference to an article in June, 1981, pages 83 and 85, Modified "Prospector Metal Locator", by D. Edwards, Campsie, NSW. I have had very little luck with my detector and I would like to try the modification. The soldering of an extra 4013 on top of the existing IC presents no problems: running flying leads is straightforward and cutting the strips to pins three and five IC3 and 12 IC2. What I am confused about is what lead, that is, number of the pins on the additional IC to the break in the printed circuit.

Pins four, six, seven, eight, 10 and 14 are soldered direct to existing IC. Pins one, two,three, five, nine, 11, 12, 13? Where do these leads go and in what order do you connect to one side of the break in the PCB to pins three and five IC3 and 12 of IC2? (J.H.T., Bilinga, Q.)

● Your confusion concerning the connections to IC4 can be resolved by noting that those pins of IC4 which are soldered to those on IC3 are just power supply connections or ground connections to the Reset and Set lines of the flip flops. The remaining pins on IC4, ie 1, 2, 3, 5, 9, 11, 12, 13 are connected as shown in the circuit diagram. Note also that the track from pin 11 of IC1d to pin three of IC3 and the track from pin 11 to IC2d to pin five of IC3 must be cut to allow the connections to IC4.

FM WIRELESS MIKE: There are on the market many types of FM wireless mikes, some work to a point and others don't. The problem in most cases is that portable off-the-shelf FM radios are too narrow banded causing the frequency to drift as the mike is moved about.

There must be many people about doing PA work like me, who would like to see you design a small portable broadband FM tuner to work with these mikes. It would not have to be too elaborate but it must have squelch as the background noise is very objectionable from the receiver when the mike is turned off. How about it? The little Dick Smith FM mike covered in EA, Dec '80 is an excellent performer. Good range and very stable. (R.W.S., Nanango, Q.)

● Our approach to this problem would be to design a better transmitter, free of the problems of drift that you mention. We shall give consideration to this idea in the near future.

LARGE SCREEN OSCILLOSCOPE: I have recently constructed a large screen oscilloscope for use with TV as in your issue of May, 1980.

I have not been able to get this project to work and have checked for correct positioning and for solder overlaps on the printed circuit board. The unit is connected to the aerial terminals of a Toshiba black and white portable TV with a 250mm wide screen and a 300/75Ω balun as directed.

The only picture I can get so far is a straight line.

Can you please advise if there is a fault finding chart showing voltages at various points around the circuit available or any similar material. (G.L., Boulder, WA.)

● The white line that you obtain on the screen is what should appear with no signal input. If it is in the centre of the screen then the input amplifier is biassed correctly. If no waveform can be seen when an input signal is applied, then there is probably no signal path to or through the input amplifier. Check for correct wiring and component layout of the input amplifier.

Problems with CRO Storage Adapter

DIGITAL STORAGE CRO ADAPTER: I built the Storage CRO Adapter and found that it worked well except for some erratic behaviour at high clocking rates. I also found errors in the description and the schematic on page 55 of the November issue.

I was very pleased, therefore, to see the errata in the January 1981 issue, but unfortunately this corrected only the clocking speed fault and in addition caused more confusion. Having now modified my adapter in line with the modifications described in the errata, I measured various points around the circuit with my oscilloscope and found the following observations:

The Memory Timebase, position 1 is given as 256μs. This should surely be 128μs as this is the minimum time to fill the memory when in the write mode. The clock input to IC7 is 2MHz and there are eight address lines giving 256 pulses to complete, therefore giving 128μs.

The tracer selector position 1, is given as half the memory timebase which is ½ × 256 according the diagram and two pulses per timebase according to the description, whereas IC7 pin 9 marked A0 is the least significant digit and will therefore clock at half the clock rate. In other words an actual period of 1μs and this is doubled by IC12d, for the tracer purposes, to 0.5μs. This means that according to the diagram, position 1 should be 1/256 although of course this should be in fact 1/128.

Upon fitting the 4-bit synchronous counters as described in the errata, the errors have compounded because position 1 of the Tracer Timebase has been connected to A1 where the pulse rate is one quarter the clock speed. Another thing I have noticed is that there is no difference between the 7 and 8 positions of the tracer selector, both showing pulses of 128's interval. (R.P.R., Killarney Heights, NSW.)

● Firstly, you are quite right in observing that position 1 of the Tracer Timebase should be 1/256 Memory Timebase; position 2, 1/128, etc in fact, the reverse to that mentioned on the circuit of page 55 of the November issue. This should be corrected accordingly and the wiring to S4 reversed.

Secondly, there appears to be some confusion as to the actual clocking rate of the memory, IC8. It is correct to say that the maximum clock speed to IC7 or IC13 in the case of the revised version, is 2MHz. However, this is not the clock speed of the memory which is half that clock rate. The 2MHz is divided by two within IC7 or IC13 to give 1MHz at the output of the counter, driving A0 of the memory, IC8. Consequently there are 256's to completely fill the memory.

With regard to the positions 7 and 8 of the Tracer being the same, it would appear that there is a fault in the carry out of IC14 in your circuit. Position 8 should give half as many pulses as position 7. Maybe this fault is causing only half the memory to be filled; the carry out, position 8 of the counter resetting the counter at half the memory count or 128 clock puses, giving you the readings you have observed on your oscilloscope.

GRAPHIC EQUALISER: I have just completed the Playmaster Graphic Equaliser from a Dick Smith kit. On completion I checked the IC voltages. There was nothing wrong with the supply voltages. The voltage at pins 3, 4, 10 and 12 should have each been ± 100mV according to the assembly manual. Unfortunately these are all ± 30mV. Having checked and double checked the circuit board I have not been able to find the problem. (P.H., Mt Waverley, Vic.)

● The ± 30mV you measure at the outputs of the op amps, pins three, four, 10 and 12 are very acceptable voltages. According to the Graphic Equaliser article in Electronics Australia, May 1979 issue, these voltages should be within ± 100mV of 0V. In other words, the voltages should be equal to or smaller than the worst case condition of either positive or negative 100mV.

SPACE INVADERS: Would you please tell me where I could find an Asteroids or Space Invaders' chip please. I have been on the lookout for either of these chips for some time now and to no avail. If you can get me this information I will be most grateful. Could you also get the circuit diagram for the external components needed to operate it on a normal TV set please (B&W). (C.W., Port Macquarie, NSW.)

● It is not possible at the current state of the art to fit all the circuitry required onto one or a few ICs. In fact, a look inside one of the popular video games found in amusement parlours would reveal a number of quite large PC boards with a whole raft of memory chips and other devices. And most popular personal computers have to utilise all available memory to be able to accommodate the higher level Space Invaders' games.

NIPPER'S MATE: I was interested to learn that in the USA, RCA are marketing the Selectavision video disc player under the brandname "His Master's Voice". This seems strange to me, as I was always under the impression that the HMV trademark belonged to EMI, who are reportedly backing the Japanese "VHD" system.

Could you please give a brief history of the HMV name, and state who are "Nipper's" current masters (please pardon the pun)? (M.A.C., Elizabeth Grove, SA.)

● Towards the end of the last century the inventor of the disc (sound) recording process, Emile Berliner (a naturalised US citizen), set up subsidiary companies in Europe. The English company was named the Gramophone and Typewriter Company (G&T) and the one in Germany, the German Gramophone Co (DGG). Another was also located in imperial Russia.

Shortly after its inception G&T purchased Francis Barraud's painting of "Nipper" and the record player. As a point of interest, Barraud's picture originally portrayed the dog listening to an Edison cylinder phonograph; and this had to be changed to a Berliner gramophone prior to purchase.

At the time of purchase G&T were using the "Recording Angel" trademark (still used on Angel recorods today), and did not utilise the Nipper picture. On a visit to England in 1900 Berliner saw the painting and almost immediately started using it as an emblem for his American products. It was not until after 1908 that G&T, DGG and the Russian company did likewise.

Ownership of the American company changed on two occasions; with RCA taking it over about 1930. In this period (to 1930), the European subsidiaries became autonomous in their own right.

During the early 1930s, the Gramophone Co Ltd (successor to G&T) amalgamated with other English record companies, Columbia Graphophone and Parlophone, with the new company naming itself EMI.

Thus, all original Berliner companies were entitled to use the "His Master's Voice" (HMV) emblem; and did so (it always seems quaint to us when we see a DGG record with the "dog"). After the diversification of ownership, it appears as if each company was only entitled to use the trademark within its own boundaries.

As far as we know, this still applies – although only RCA and EMI appear to continue with its use.

When EMI (Australia) Ltd ceased manufacture of consumer electronics equipment several years ago they sold the "His Master's Voice" trademark to Rank Industries Australia Pty Ltd.

FREQUENCY SYNTHESISER: Looking through your magazine, I see that most projects employ ICs to simplify construction and complexity. I wish to build a frequency synthesiser which can oscillate up to 850MHz incorporating ICs. To do this I need a decade multiplier and a decade divider which can operate at this frequency. Could you please tell me of any such ICs and where I can obtain information on how to use them. (M.B., Gladstone Park, Vic.)

● Two divider ICs that may prove suitable for your application are the SAB1534P and SAB1034P, both ECL divide-by-4 counters. The SAB1534P has a maximum input frequency of 1.5GHz while the SAB1034P has a maximum input frequency of 1.05GHz. Using these dividers the 850MHz output of your synthesiser would divide down to about 212MHz, which could then be divided down by an 11C90 decade counter to around 20MHz which is then within the range of standard TTL dividers such as the 74LS90.

The SAB1534 and SAB1034 are Signetics devices, whilst the 11C90 is a Fairchild device. If you are unfamiliar with ECL circuits, then we can recommend the Fairchild ECL Data Book which provides information on the on the 11C90 and also gives a good discussion of ECL circuits.

ELECTRONIC MOSQUITO REPELLER: University tests appeared to indicate that the female mosquito only seeks human blood when pregnant, and will not associate with the male mosquito during this period.

As I recall the frequency of noise emitted by the male was in the order of 24kHz and electronic circuits were suggested with this in mind.

My query is this – as the loudspeakers suggested for use with this circuit are small and probably not capable of more than, say, 3500Hz, it would appear to me that the device cannot produce either the fundamental or harmonics of suitable order to repel the female.

I have used one of this type units manufactured in Hong Kong and I doubt very much its usefulness. My hearing is first class and the sound from this is quite audible, however I have doubt that Mrs Mos hears it correctly? (R.J.B., Burrendah, WA.)

● A small loudspeaker (say 5cm diameter) can produce a quite satisfactory 24kHz signal level. However your repeller unit may not be producing this frequency. The fact that the sound is quite audible to you leads us to suspect that it is in fact at a somewhat lower frequency than 24kHz.

We published an electronic mosquito repeller in our January 1976 issue. This circuit ran at about 22kHz but we are not sure how many mosquitoes read our article and how many were subsequently repelled. We doubt whether the idea works.

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $3 per part where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in these pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value. Seven months and older, if available, $2 (includes storage fee). Post and packing 70c per issue extra.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

MARKETPLACE

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm.
CLASSIFIED RATES $3.60 for 40 letters or part thereof an insertion payable in advance. Minimum 80 letters.
Please use coupon below.
CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Wednesday of each month.

FOR SALE

2114.2 RAMS memory 1C static TTL 1k × 4 Bits fast R/W time $3.50, over 50, $3.00 each. Low power suit ETI Feb 79 16k Ram Project. Contact 699 9297 (H) or 1 Wilson Lane, Redfern 2016.

SPECTRUM ANALYZER Tektronix 5L4N plug-in module. Low frequency (0-100KHz) swept-front-end analyzer operates with any 5000 series mainframes. Linear or log frequency spans and time domain displays. $3000 or near offer. Ph (02) 888 3103. Bus (02) 439 0033 ×233.

EPROMS TO BURN? Our super Eprom Blower teams with your microcomputer to blow all popular Eproms up to 8K bytes. Guaranteed performer. Send SAE for more info. Nutek Sales, PO Box 95, Eastwood NSW. 2122.

RADIOGRAM — Quad Antique Cabinet and Speaker $500 ono 9 Tennyson Cres, Forrest. ACT. Tel (062) 95 3673.

EXIDY SORCERER Mk1 with 16k RAM. Excellent condition. $1050 ono, all offers considered. 1 Wynn Street, Fraser, ACT 2615. (062) 58 6779.

AMIDON FERROMAGNETIC CORES — Large range for all RF receiver and transmitter applications. Closed during November. Send large SASE for data and price list to: R.J. & U.S. Imports, Box 157, Mortdale, NSW. 2223.

1 ONLY SYM-1 COMPUTER plus KTM/2 VDU basic with 16k RAM $300. A. R. Hall, Stirling St, Southbrook 4352.

TEST GEAR. Tek CROs, 545dB. 30MHz, $275. Tek 517A, 50MHz with up to 100MHz TB direct early model, but good cond, $175. Sanders m/wave Gen 4-8GHz, $150. R.F.L. AC/DC calibrator N.A.T.A., orig cost over $3000, $500. Box 437, Gawler, S.A. 5118.

WANTED

WESTERN ELECTRIC 555W with or without horn, also 594A, 713C and LF drivers. I pay top prices. Lachlan Hood, 81 Oleander Dr Ashgrove. 4060 (07) 38 1480.

FOR HIRE

MICRO RENTAL Microcomputer systems of various models and configurations with peripherals, are available for hire from DORF MICROCOMPUTER. Start-up and reference manuals included Sydney 922 1644 or 960 1808 (AH).

POSITION AT E.A.

We have a unique opportunity for someone who is keen to take up a career in technical journalism.
The ideal applicant will already have a broad basic knowledge of electronics theory and will have completed, or be nearing the end of a formal study course. Equivalent knowledge acquired through private study will be favourable considered.
He or she will have a lively interest in the practical side and will have constructed a variety of projects as, for example, from electronics magazines. The wider the interest the better, because — "Electronics Australia" magazine covers the whole range: From the simple to the complex; from R.F. through to hi-fi, video and instrumentation to computing. Under supervision, the successful applicant will have the opportunity to develop skills in the design and construction of projects and the preparation of articles for publication.
A permanent position is envisaged with opportunity for advancement plus full leave, sickness and superannuation provisions. As for salary, that will depend on your present background and experience but let's start talking around $13,500 p.a.
Apply by letter, stating experience and with copies of references to:

The Editor-in-Chief,
ELECTRONICS AUSTRALIA
57 Regent St, Chippendale 2008.

SUPPLIER WANTED

Large equipment manufacturer Email Limited requires reliable supply of High Voltage power supplies.
Typical output:- 13 KV at 2 mA
and 6.5 KV at 100 micro amp
with both Open and Short Circuit protection.
Preferred input 240V 50 Hz
CONTACT:
C. CHRISTOFORIDIS
(02) 644 2641
P.O. BOX 51, REGENTS PARK, 2143

CLASSIFIED ADVERTISERS

To the Advertising Manager, ELECTRONICS Australia, Box 162. Beaconsfield. 2014.
- Please insert the following advertisement in the first available issue.
- Tick the classification required: FOR SALE — WANTED — FOR HIRE — CLUBS — POSITION VACANT — POSITION WANTED — READER SERVICE

Please print in ball-point pen using capital letters only where necessary.

____

____

____

____

____

____

Signed
Address

I enclose Cheque/Money Order for $
being full payment for letters at $3.60 for 40 letters or part thereof (minimum 80 letters).

RESISTORS

150 ohm, 5W	20c
10 ohm 5W	20c
12 ohm 3W	20c
2.5 ohm, 3W	20c
33 ohm, 3W	20c
8 ohm 10W	25c
4000 ohm, 10W	25c
220 ohm 5W	20c
5 ohm, 5W	20c
220 ohm, 10W	25c
950 ohm, 3W	20c
115 ohm, 5W	20c
10 ohm 5W	20c
1k ohm, 5W	20c
5000 ohm 5W	20c
6.8k ohm 3W	20c
3300 ohm 10W	25c
6800 ohm 10W	25c
1500 ohm DUAL 21W	50c
50 ohm 5W	20c
1k ohm, 5W	20c
820 ohm, 5W	20c
12 ohm, 10W	25c
470 ohm, 7W	20c
4700 ohm, 4.5W	20c
5000 ohm, 10W	25c
8.2 ohm	5W
3.3K	7W
27 ohm	5W
10K	7W
2.5 ohm	3W

CAPACITORS

0.56 250V	40c ea
2000 MFD VDcw25	75c ea
0.0039uF, 1500V	20c ea
6N8, 1500V	20c ea
0.0068uF 1500V	20c ea
1200PF 400V	10 for $1
0.068uF 400V	5 for $1
2200PF 630V	10 for $1
0.47uF, 250V	10 for $1
0.10uF, 400V	5 for $1
0.082uF, 160V	10 for $1
26k, 250V	10 for $1
0.041uF, 400V	10 for $1
0.033uF, 250V	5 for $1
0.027uF, 100V	20 for $1
220uF, 10V	10 for $1
1uF-350V	10 for $1
470uF 40V	5 for $1
1000uf 16V	25c
2.2uF 200V	10 for $1
0.047uF, 1500V	50c
47uF, 25V	4 for $1
680uF, 40V	50c
22K, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	50c
680uF, 35V	50c
0.015uF, 250V	25c
1uF, 100V	25c
1000uF, 16V	50c
220uF, 16V	50c
2000uF 63V	$1
0.47uF, 400V	50c
680K, 250V	25c
012, 250V	25c
15NF, 250	10c
120K, 250V	20
10uF, 315V	25c
0.056, 250V	10c
500 MFP 10 VOLT	5 FOR $1

TV Stick Rectifiers 20SC, $1.00

Slide Pots

250K-50K	3 for $1
Dual 500K	3 for $1
1 Meg	3 for $1
2 Meg	3 for $1
Including Fancy Gold Knobs	
25K dual	2 for $1

SPECIAL

100 mixed resistors, all useful	$2
100 mixed capacitors, fresh stock	$2

AUDIO LEADS

3.5m to 3.5m, 7ft	75c
3.5m to 6.5m 7ft	75c
6.5 7ft	50c

MICRO SWITCH

5A, 250v AC — 75c ea

TUNING CAPS

2 and 3 gang	$1 ea
Min 2 gang	50c

FUSES

0.5A, 2A, 3.25	10 for $1
In line fuse holders	30c
RCA jack plugs and sockets	40c pair
1A 10 for	$1

L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

SPECIAL TRANSISTORS

AD 161-162	$2.50 pr
BSC 901A	$1.50 ea
BC 548	10 for $1
AD 149	$3 pr
OC9554	50c
BD202N	50c
BD135	50c
2NC055	$1

ELECTROS

470uF, 25V	5 for $1
400uF, 10V	5 for $1
47uF 63V	5 for $1
350uF 16V	2 for $1
27uF, 160V	5 for $1
25uF, 63V	10 for $1
22uF 160V	10 for $1
47uF, 16V	5 for $1
47uF, 200V	5 for $1
220uF, 10V	10 for $1
68uF 16V	10 for $1
100MFD 350V chassis mount	$1

- Telescopic aerials. $1.50
- 6 inch ferrite rods. 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers
- Line output transformers, 1200 to 3/ohm 5 watt $1
- Power supply units, filtered, 240 to 20 volt, $12

Power leads and sockets 240 volt, suit most tape recorders, radios, etc. $1 each

Speaker Transformers

7,000-15 ohms	$2 each
10,000-15 ohms	$2 each

TV EHT Leads

4'6" in length — 50c each

455KC IF Transformers for valve radios. $1 each. Also OSC coils, 75 cents each.

POTS ROTARY

½ Meg	30c
1 Meg	30c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
7 500	30c
10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/Ohm	50c
½ or 1 Meg Switch	50c
½ 1 meg dual Concentric tapped at 100K	$1
2 meg ganged double pole switch	$1
1.5 meg dual ganged	50c
2 meg ganged log	$1
1 meg dual ganged	$1
½ meg dual ganged LIN	75c
25K, 50K dual ganged Concentric double switch	$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K lin ganged pots	75c

HOR Drive 3021 transformers for colour TV — $2
TV Colour Convergence Units 11270 44 x 6 — $3

PILOT LIGHTS

Screw in 6.3V	10 for $1.50
24V	10 for $1.00
Pilot light holders	10 for $1.00

- Car radio suppressors, 3 for $1
- 3 position slide switch, 50c
- Toggle switches, 25c
- 2 position push button switch 50c
- 6 position push button switch, $1
- 4 position push button switch, 75c
- Transistor ear plugs & leads 3 for $1
- In-line fuse holders, 4 for $1
- 4 pole 2 position rotary switches, 50c

Pick up Cartridges BSR universal type Ceramic Stereo — $5
Diamond stylus stereo magnetic — $12

DIODES

OA 626	4 for $1.00
OA 662	4 for $1.00
EM 410C	4 for $1.00
DS 150A	50c
DSY 130YO	50c
OA 636	50c
HR 15	50c
Diodes BYX 55, 300	30c
BY 188	30c

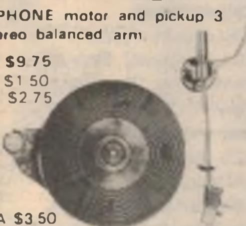
DIODES BAV20 10 for $1

Valve sockets 7 pin	10c
Valve sockets 9 pin	10c
OCTAL	10c
09478	5 for $1.00
BZX79	5 for $1.00

SUPER SPECIAL

GRAMOPHONE motor and pickup 3 speed stereo balanced arm

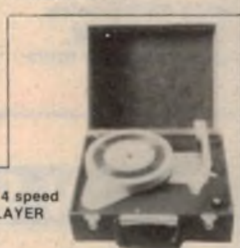
240 volt $9.75
PP NSW $1.50
Interstate $2.75
WA $4



$250 WA $3.50

COLOUR FRONT END COMPLETE PUSH BUTTON TUNER SECTION

TO SUIT PHILIPS, PYE, KRIESLER ETC. **$25**



PORTABLE 4 speed RECORD PLAYER

Power transformers 240V, 117V, 2/25V Tapps 6.3 — $7.00

SPARK GAPS 500 volt 20 cents
THERMISTERS 20 cents

PICK UP ARMS

Mono — $3.50
Inc Ceramic Cartridge & Stylus

TRIMPOTS

200 ohm	10c
5K	10c
100K	10c
47K	10c
10K	10c
470 ohm	10c

Miniature speaker and drive output transformers — $1 pr

Special mixed tag strips — 10 for $1

SPEAKER SYSTEMS

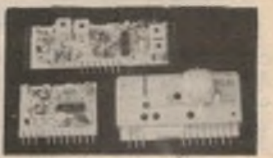
Inc one 6 x 4 speaker, 5W RMS, $4.75 ea. P&P NSW $1.80, Interstate $2.80 WA $4 (For singles or pairs.)

SPEAKER SPECIALS

5 inch in 3.5.8 or 15ohms $3.50
15 ohm 4" — 2 for $2
6x9 15 ohm $5 each
5x7 15 ohm $4 each
8x4 15 ohm $4 each
6x4 15 ohm $3 each
6x4 27 ohm $4.50 each
6x3 27 ohm $3.50 each
5x3 27 ohm $3.50 each
5x3 47 ohm $3.50 each

SUPER SPECIALS

FM STEREO TUNER KITS



Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

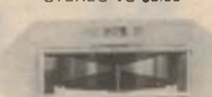
ONLY $22
P&P $1.00

TRANSISTORS

2N3055	$1.20	AC187	50
SE1002	4 for $1	2NC3055	50
BF459	50	2SB407	$1.00
B544 DE6	50	BC549	5 for $1.00
C106 F1	50	25C1548	50
TIP 110	50	OC968	5 for $1.00
608EK	4 for $1	608EK	5 for $1.00
BCS548	10 for $1	DS113AG	75
2SB186	50	BD236	50
2SA101	50	BD139	50
BD263	50	BD135	50
BSB405	50	25A240	75
2SB77	50	BF469	50
2SB303	50	BD235	50

VU & BALANCE METERS

STEREO VU **$3.00**



12Kn 100uA **$2.00**

TV TUNERS

$2.50 + P+P

$2.50

EA Magazine Holders

The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: $5.10 binders, $4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Beaconsfield, NSW 2014.

Prices including postage are:

Holders: $5.40 NSW; $5.50 other states; or six for $28.30 NSW, $30.40 other states, A$32NZ.

Binders: $6.20 NSW; $7.90 other states; or six for $32 NSW, $34 other sates, A$36.60 NZ.

ELECTRONICS AUSTRALIA

PRINTED CIRCUIT BOARDS AND FRONT PANELS

Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

N.S.W.

Dick Smith Electronics,
PO Box 321,
North Ryde, NSW 2113.
Telephone: 888 3200

Electronic Agencies,
115-117 Parramatta Road,
Concord, NSW 2137.
Telephone: 745 3077

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

Radio Despatch Service,
869 George Street,
Sydney, NSW 2000.
Telephone: 211 0816

VIC.

Kalextronics,
4 Burgundy Plaza,
101 Burgundy Street,
Heidelberg, Vic. 3084.
Telephone: 743 1011

Rod Irving Electronics,
425 High Street,
Northcote, Vic. 3070.
Telephone: 489 8131

Sunbury Printed Circuits,
10 Counihan Street,
Sunbury, Vic. 3429.
Telephone: 744 2852.

S.A.

James Phototronics,
522 Grange Road,
Fulham Gardens, 5024.

W.A.

Jemal Products,
8/120 Briggs Street,
Welshpool, WA 6106.

N.Z.

Marday Services,
PO Box 19 189,
Avondale,
Auckland, NZ.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket, NZ.

Printed Circuits Limited,
PO Box 4248,
Christchurch, NZ.

SUBSCRIPTION SERVICE

ELECTRONICS Australia

Subscription Rates

$23.50 per year within Australia
$27.50 per year elsewhere

Make sure you receive every copy of the magazine by ordering it from your newsagent or the publisher. For publisher subscriptions post this coupon, with your remittance to Electronics Australia Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001. Subscription will start with first available issue.

Name ....

Address ....

Postcode .... **Enclosed is** .... **for** .... **years**

ADVERTISING INDEX

PERFECT REPRODUCTION. REPRODUCED PERFECTLY.

To reproduce the true sound of a live performance has been the goal of manufacturers since Edison invented the phonograph.

At JVC, we have gone further than any other maker to achieve this goal.

First we developed the stereo groove, making possible stereophonic recording techniques.

And, more recently, we invented the amplification process known as Super A.

Quite simply, Super A gives you very high output while using very low power.

What you hear is an extremely clean, natural sound, with almost no distortion.

Another recent development is our Quartz Lock turntable.

This turntable offers an accuracy of speed impossible in conventional turntables, because it is regulated by the most accurate measure known to man. The pulse of the atom.

Then, to match the quality of these components, we produced the SEA graphic equaliser system for perfect tone control.

This system has been refined to such a degree it even compensates for the furniture in your room when the sound leaves the speakers.

The end result is the opportunity to appreciate live performance realism, without having to go to a live performance.

If you'd like to know more about the many innovations JVC has brought to Hi-Fi, write to us for a brochure or call into any JVC dealer.

Then you'll see why JVC equipment is recognised as The State of the Art.

JVC

JVC0061EA/FMMH

For further information, write to JVC Advisory Service, Private Bag, Kingsgrove, N.S.W. 2208 or phone (02)750-3777